

APPENDIX E

Greenhouse Gas Inventories and Forecasts for Jurisdictions in Kern County



Greenhouse Gas Emissions Inventory and Forecast for the City of Arvin

Prepared for:

US EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105

June 2025

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LIST OF ABBREVIATIONS

ABAU	legislative-adjusted BAU
AR5	Fifth Assessment Report
BAU	business-as-usual
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CH ₄	methane
CO ₂	carbon dioxide
CVP	Central Valley Project
eGRID	Emissions & Generation Resource Integrated Database
EPA Local GHG Inventory Tool	EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1
EPA	US Environmental Protection Agency
GHG	greenhouse gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
Kern COG	Kern Council of Governments
MRR	Mandatory Greenhouse Gas Reporting Regulation
MSW	municipal solid waste
MTCO _{2e}	metric tons of carbon dioxide equivalent
N ₂ O	nitrous oxide
PG&E	Pacific Gas and Electric Company
RPS	Renewables Portfolio Standard
SB	Senate Bill
SWP	State Water Project
VMT	vehicle miles traveled
WARM Tool	Waste Reduction Model
ZEB	zero-emission buses
ZEV	zero-emission vehicle

1 INTRODUCTION

This report contains the methods and results for a greenhouse gas (GHG) emissions inventory and GHG emissions forecast for the City of Arvin. A GHG emissions inventory provides estimates of emissions generated within a defined geographic boundary during a single year. It identifies the sectors, sources, and activities that produce these emissions and their relative contribution, while also providing a baseline to forecast future emissions trends. A GHG emissions forecast evaluates how GHG emissions may change in the future due to growth and the effects of adopted state and federal legislation and regulations. This information can be used for various purposes, including monitoring GHG emissions trends over time, or as the technical basis for planning efforts to reduce GHG emissions, such as a general plan or greenhouse gas reduction plan.

This report was developed as part of a grant provided to the City of Bakersfield by the US Environmental Protection Agency (EPA) as part of the Climate Pollution Reduction Grants program. The grant was provided to support climate pollution reduction planning in the Bakersfield Metropolitan Statistical Area, which includes the entirety of Kern county. Under this grant, funding was allocated to produce GHG emissions inventories and forecasts for each of the 12 jurisdictions in Kern county, including the City of Bakersfield, unincorporated Kern County, and all incorporated cities. These GHG emissions inventories and forecasts will be provided to the subject jurisdiction, the San Joaquin Valley Air Pollution Control District, and Kern Council of Governments (Kern COG).

The GHG emissions inventory and forecast are intended to provide an accounting of GHG emissions generating activities within the City of Arvin geographical boundary for the year 2022, and projections of future emissions based on countywide growth patterns and the effects of adopted state and federal legislation and regulations. This report is accompanied by an Excel-based tool used to develop the GHG emissions inventory, the *EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1* (the EPA Local GHG Inventory Tool). The GHG emissions inventory uses only publicly available data sets, many of which provide countywide estimates of GHG emissions generating activity, such as mobile on-road travel, energy consumption, and fertilizer use. This countywide data was scaled down to the jurisdiction level based on various attribution metrics, including population, commercial building floor space, and acres of agricultural use. GHG emissions were then forecasted using countywide growth projections for vehicle travel, population, and employment.

Because countywide data was used and scaled using attribution metrics, rather than jurisdiction-specific data, the GHG emissions inventory and forecast are intended to provide a general scale of GHG emissions for City of Arvin's contribution to countywide GHG emissions and serve as a starting point for more detailed GHG emissions analyses. The Excel-based tool can be updated with more locally specific and operational data that can be obtained from relevant departments and direct requests to utility providers. GHG emissions forecasts can be replicated using more locally specific growth projections for population and employment. The results can also be used to set local GHG reduction targets and develop and quantify locally-specific measures for reducing GHG emissions. Sufficient detail is provided in this report to ensure that the analyses are replicable, and data inputs can be replaced with more detailed data, if desired.

2 SUMMARY RESULTS

This section presents the results of the GHG emissions inventory and forecast for the City of Arvin, providing a comprehensive overview of historical (2022 as the inventory year) and projected (2030, 2040, and 2045 as the forecast years) emissions. The results are organized by emissions sources, including stationary energy, electricity, Mobile On-road, wastewater, solid waste, and others, as well as by sectors, including residential, commercial/institutional, industrial, and agricultural.

This breakdown enables an understanding of the emissions sources and sectors that contribute most significantly to the City of Arvin's overall emissions. Section 3 of this report provides additional context and methodology related to

each emissions source and sector, including key assumptions, data sources, and allocation methods used in the inventory and forecast development.

2.1 2022 GREENHOUSE GAS EMISSIONS INVENTORY RESULTS

Table 1 below shows the 2022 GHG emissions inventory results for the City of Arvin, categorized by emissions sources and sectors. Figure 1 shows the inventory categorized by emission sources, while Figure 2 shows the inventory categorized by emission sectors.

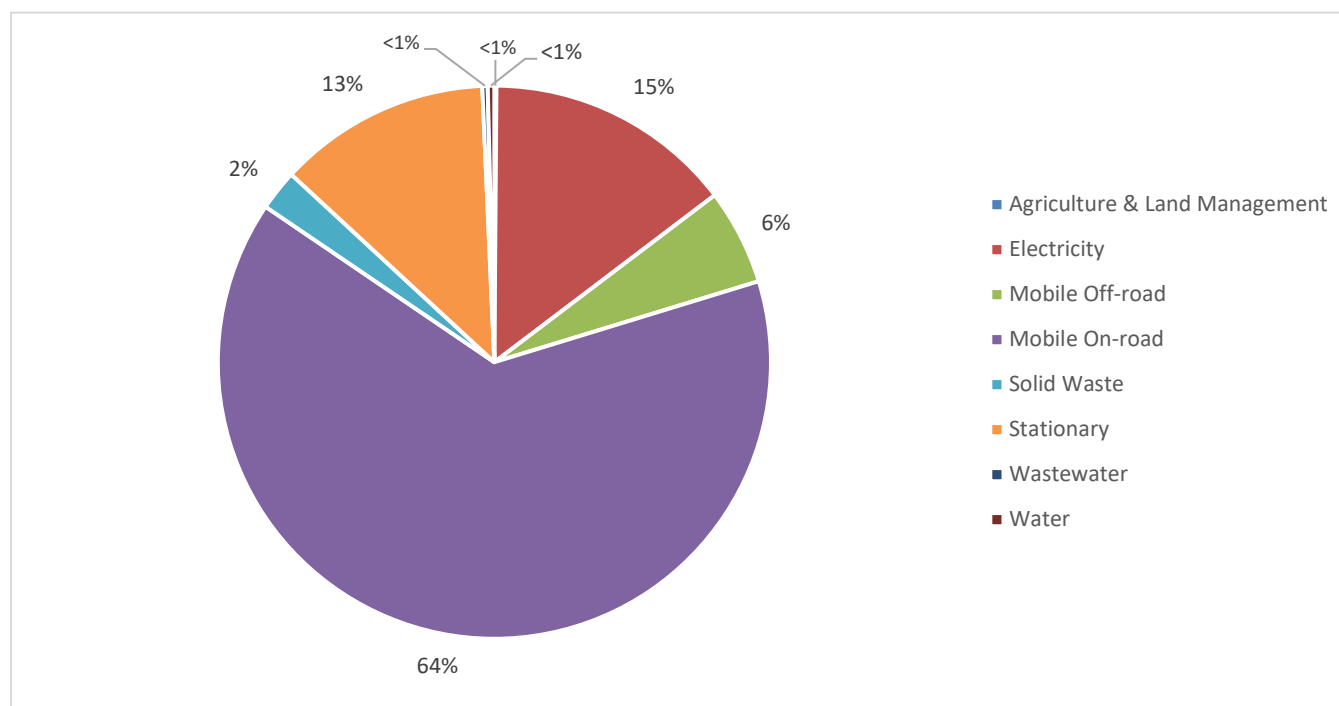
Table 1 City of Arvin 2022 GHG Emissions Inventory Results (MTCO₂e)

Emissions Sources	Emissions Sectors				
	Agricultural	Commercial/Institutional	Industrial	Residential	Total
Agriculture & Land Management	162	—	—	—	162
Electricity	—	3,104	—	16,615	19,719
Mobile Off-road	84	7,489	—	—	7,573
Mobile On-road	—	36,381	—	50,606	86,987
Solid Waste	—	—	—	3,220	3,220
Stationary Energy	—	5,470	—	11,357	16,827
Wastewater	—	428	—	—	428
Water	134	386	—	—	520
Total	379	53,258	—	81,798	135,436

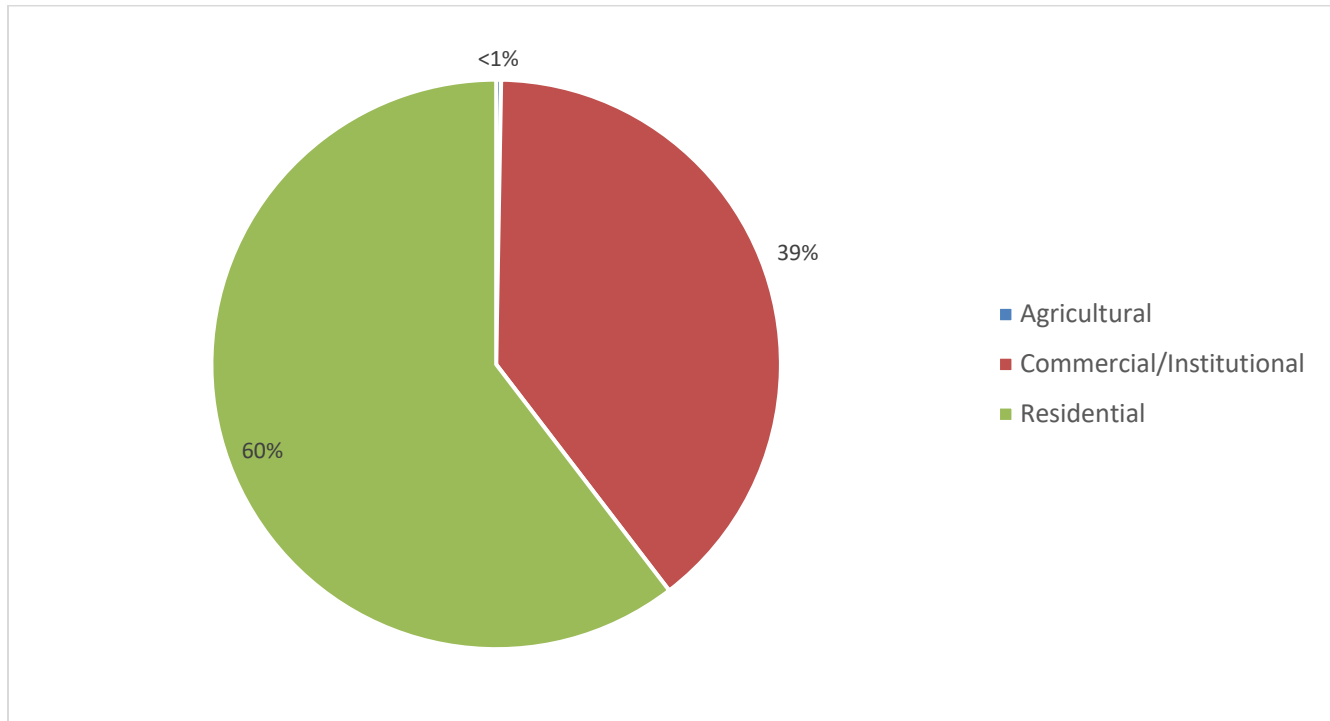
Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 1 City of Arvin 2022 GHG Emissions Inventory by Emissions Sources



Source: Analysis conducted by Ascent in 2025.

Figure 2 City of Arvin 2022 GHG Emissions Inventory by Emissions Sectors

Note: The City of Arvin had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure. Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

2.2 GREENHOUSE GAS EMISSIONS FORECAST RESULTS

Table 2 below shows the projected future GHG emissions for the City of Arvin for the forecast years 2030, 2040 and 2045 under both a business-as-usual (BAU) scenario, as well as a legislative-adjusted BAU (ABAU) scenario, broken down by both emissions sources and sector. The BAU GHG emissions forecasts estimate how community-generated emissions would change over time without additional actions at the State, federal, regional, or local levels, based solely on projected population and employment growth. The ABAU forecasts incorporate the effects of adopted State and federal policies, such as vehicle fuel efficiency standards and increased renewable energy in the electricity grid, but assume no additional local measures.

Table 2 City of Arvin Greenhouse Gas Emissions Forecast for 2030, 2040 and 2045 by Emissions Source and Sector (MTCO_{2e})

Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Stationary Energy	Residential	11,827	11,674	12,388	12,072	12,556	12,190
Stationary Energy	Commercial/Institutional	5,601	5,601	6,056	6,056	6,287	6,287
Stationary Energy	Industrial	—	—	—	—	—	—
Electricity	Residential	17,388	14,041	18,213	1,848	18,459	—
Electricity	Commercial/Institutional	3,194	2,565	3,453	347	3,585	—
Electricity	Industrial	—	—	—	—	—	—
Other Industrial	Industrial	—	—	—	—	—	—
Agriculture – Fertilizer Application	Agricultural	162	162	162	162	162	162

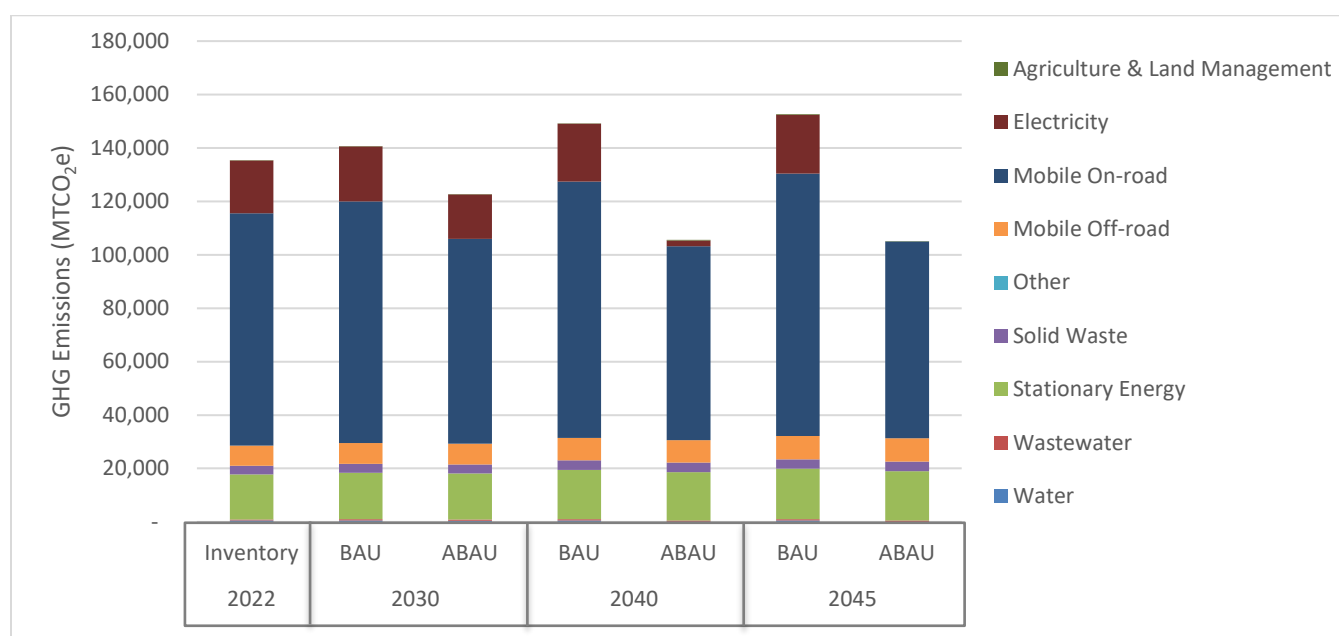
Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Solid Waste	Residential	3,370	3,370	3,530	3,530	3,578	3,578
Wastewater	Commercial/Institutional	446	446	471	471	481	481
Imported Water	Commercial/Institutional	402	323	425	43	434	—
Imported Water	Agricultural	134	107	134	13	134	—
Mobile On-road	Residential	52,963	43,062	55,476	40,032	56,228	39,880
Mobile On-road	Commercial/Institutional	37,442	33,592	40,483	32,584	42,026	33,839
Mobile Off-road	Commercial/Institutional	7,707	7,707	8,333	8,333	8,651	8,651
Mobile Off-road	Agricultural	84	84	84	84	84	84

Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 3 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Arvin's 2022 GHG emissions inventory for comparison, all categorized by emissions sources.

Figure 3 City of Arvin 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sources (MTCO₂e)

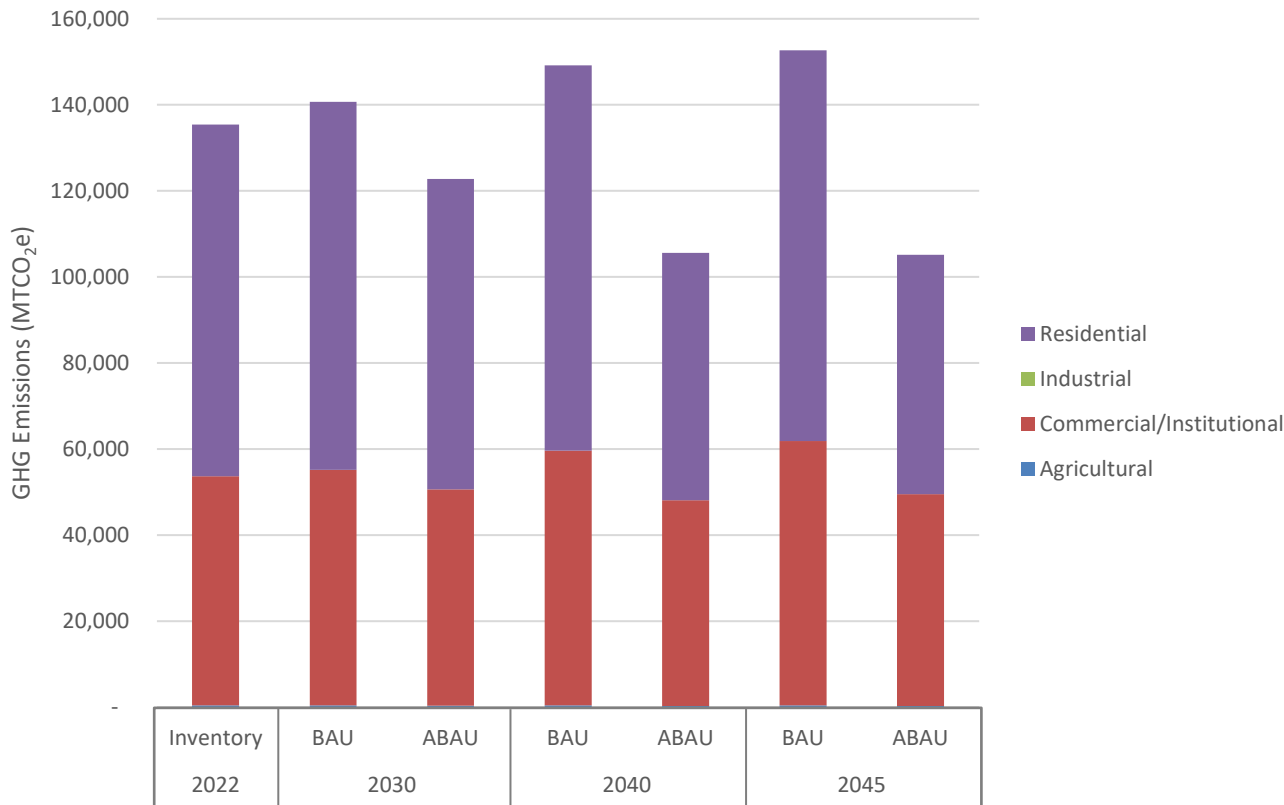


Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 4 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Arvin's 2022 GHG emissions inventory for comparison, all categorized by emissions sectors.

Figure 4 City of Arvin 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sectors (MTCO₂e)



Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent. The City of Arvin had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure. Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025. X

3 GREENHOUSE GAS EMISSIONS INVENTORY METHODS

This section of the report details the methods used to develop the GHG emissions inventory for the City of Arvin. It includes descriptions of the data sources and data processing, and the inputs and outputs for the GHG emissions calculations. The methods are organized by GHG emissions sources (stationary energy, electricity, etc.) for the City of Arvin, based on the EPA Local GHG Inventory Tool.

The EPA Local GHG Inventory Tool was primarily used for GHG emissions calculations. Activity data (e.g., energy consumed, tons of waste landfilled, etc.) inputs for the City of Arvin were entered into the tool and parameters were set to represent local conditions (e.g., annual electricity consumption data was imported into the tool as the input to calculate City of Arvin’s GHG emissions associated with electricity, and the appropriate electricity grid was selected to represent local conditions). GHG emissions from on-road transportation were calculated externally to the EPA Local GHG Inventory Tool, due to data format inconsistencies. All other GHG emissions sources were calculated within, or entered into the tool. The tool also categorizes GHG emissions into different sectors: residential, commercial/institutional, industrial, and agricultural. Industrial and agricultural sectors were only used when explicitly differentiated in the available datasets. In all other cases, sector categorization followed the classifications provided by the EPA Local GHG Inventory Tool or as defined by the underlying data sources.

This report only documents data processing and calculations that were performed outside of the EPA Local GHG Inventory Tool and provides the GHG emissions outputs from the tool; it does not expand on the calculation methods within the tool. Documentation for the EPA Local GHG Inventory Tool can be found on the EPA website at: <https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool>.

3.1 GREENHOUSE GASES AND GLOBAL WARMING POTENTIAL

GHG emissions other than carbon dioxide (CO₂) 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). CO₂ has a GWP factor of one, while all other GHGs have GWP factors measured in multiples of one relative to the GWP of CO₂. This conversion of non-CO₂ gases to one unit enables the reporting of all emissions in terms of carbon dioxide equivalent (CO₂e), 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 (MTCO₂e). For this emissions inventory and forecast, the three primary and most abundant GHGs were accounted for: CO₂, methane (CH₄) and nitrous oxide (N₂O).

Consistent with the best available science, the inventory uses GWP factors published in the Fifth Assessment Report (AR5) from Intergovernmental Panel on Climate Change (IPCC), where CH₄ and N₂O have GWP factors of 28 and 265, respectively (IPCC 2014). These values represent the GWP of GHG on a 100-year time horizon. This means that CH₄ is approximately 28 times stronger than CO₂ and N₂O is 265 times stronger than CO₂ in their potential to warm Earth's atmosphere over the course of 100 years. The use of 100-year GWP values is consistent with the California Air Resources Board (CARB) and EPA GHG accounting methods.

3.2 DATA REVIEW

The general approach for developing the GHG emissions inventory involved the collection of total activity and/or emissions data for Kern county for the year 2022 for each relevant GHG emissions source and then apportioning that data to individual jurisdictions and sectors using appropriate attribution metrics. These metrics include the City of Arvin's contribution to total countywide population, commercial building floor space, and agricultural land acreage. In some cases, such as for landfilled solid waste and industrial facilities, jurisdiction-specific data were available from publicly available resources.

The primary data sources used to compile activity and emissions data for all of Kern county are listed in Table 3.

Table 3 Data Sources for Countywide Activity and Emissions Data

GHG Emission Source	Data Source(s)
Mobile On-road	CARB EMFAC2021 on-road emission inventory model (CARB 2022a)
Mobile Off-road	CARB OFFROAD2021 off-road emission inventory model (CARB 2022b)
Stationary Energy	CEC energy database (CEC 2023), EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases
Electricity	CEC energy database (CEC 2022), Pacific Gas & Electric Co (PG&E)
Imported Water	Water Association of Kern County
Agriculture	CDFA's fertilizing materials tonnage report (CDFA 2025)
Other Industrial Sources	EPA FLIGHT database (EPA 2023)

Notes: CARB = California Air Resources Board; ; CDFA = California's Department of Food & Agriculture CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

Attribution metrics were used to apportion countywide activity and/or emissions data to individual jurisdictions by the appropriate GHG emissions sector. These attribution metrics include:

- ▶ population share for allocating activity associated with the residential sector (US Census Bureau 2025),
- ▶ commercial building floor space share for activity associated with the commercial/institutional sector (Open Energy Data Initiative 2020), and
- ▶ farmland, grazing land, and other agricultural land cover types share for the agricultural sector (DOC 2022).

These attribution metrics and the associated values for each jurisdiction in Kern county are shown in Table 4 below.

Table 4 Attribution Metrics Used to Apportion Countywide Activities and GHG Emissions

Jurisdiction	Population	Population %	Agricultural Land Acreage	Agricultural Land Acreage %	Commercial Building Floor Space in Square Footage	Commercial Building Floor Space in Square Footage %
Arvin	19,613	2.2%	1,487	0.1%	1,400	0.9%
Bakersfield	404,321	44.6%	41,684	1.5%	79,800	50.7%
California City	15,002	1.7%	112	0.0%	1,000	0.6%
Delano	50,498	5.6%	4,141	0.2%	5,800	3.7%
Maricopa	1,217	0.1%	558	0.0%	—	0.0%
McFarland	13,971	1.5%	2,754	0.1%	600	0.4%
Ridgecrest	28,118	3.1%	62	0.0%	4,000	2.5%
Shafter	20,162	2.2%	19,419	0.7%	10,700	6.8%
Taft	7,414	0.8%	4,507	0.2%	1,000	0.6%
Tehachapi	12,855	1.4%	2,764	0.1%	1,700	1.1%
Wasco	26,317	2.9%	3,421	0.1%	1,800	1.1%
Unincorporated County	307,395	33.9%	2,666,205	97.1%	49,700	31.6%
Kern County Total	906,883	100%	2,747,115	100%	157,500	100%

Note: Population and agricultural land acreage data reflect conditions in 2022. The most recent data available for commercial building floor space was from 2019, which was used as the attribution metric in this analysis. Because the calculations relied on percentage shares rather than absolute floor space values, using 2019 data was considered appropriate for consistency across jurisdictions.

Sources: US Census Bureau 2025; DOC 2022; Open Energy Data Initiative 2020; analysis conducted by Ascent in 2025.

For the wastewater and solid waste emissions sources, as well as the industrial emissions sector, data and information were collected at the jurisdiction level to calculate associated GHG emissions.

For wastewater, jurisdiction-specific data were obtained from a variety of sources, including any publicly available data about wastewater treatment plant operations. When such data were not publicly available, default values from the EPA Local GHG Inventory Tool and the Local Governments for Sustainability *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* were used to fill data gaps.

For solid waste, jurisdiction-specific disposal data were sourced from the California Department of Resources Recycling and Recovery (CalRecycle), specifically from the Jurisdiction Disposal and Beneficial Reuse by Destination database.

For the industrial emissions sector, jurisdiction-specific emissions data were also obtained directly from the EPA FLIGHT and CARB MRR databases, which report facility-level emissions for large industrial sources.

Data sources for jurisdiction-specific activity and emissions data are shown in Table 5 below.

Table 5 Data Sources for Jurisdiction-Specific Activity and Emissions Data

GHG Emission Source/Sector	Data Source(s)
Wastewater	Various sources, ICLEI (ICLEI 2019)
Solid Waste	CalRecycle's Jurisdiction Disposal and Beneficial Reuse by Destination database (CalRecycle 2025), EPA FLIGHT database (EPA 2023)
Industrial Sector	EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases

Notes: ICLEI = Local Governments for Sustainability; CalRecycle = California Department of Resources Recycling and Recovery; CARB = California Air Resources Board; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

3.3 INVENTORY METHODS BY GHG EMISSIONS SOURCE

This section details the data and methods used to calculate GHG emissions in the 2022 inventory, organized by emissions source. It presents the corresponding data inputs into the EPA Local GHG Inventory Tool, any data processing that was performed, and the resulting emissions estimates by source and sector for the City of Arvin. All calculations of GHG emissions use the IPCC AR5 GWP values to convert GHG emissions results to CO₂e.

3.3.1 Mobile On-road

The Mobile On-road 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.” The estimation of these emissions relies on EMFAC2021, a statewide mobile source emissions inventory model developed by CARB. EMFAC2021 was used instead of the EPA Local GHG Inventory Tool to calculate mobile on-road GHG emissions because EMFAC2021 provides GHG emissions estimates that more closely represent the vehicle fleet operating on roadways in Kern County. The EPA Local GHG Inventory Tool utilizes national fuel efficiency averages for a select number of vehicle types to calculate GHG emissions, whereas EMFAC2021 considers fuel efficiency by vehicle type and model, providing more accurate estimates of fuel consumption and GHG emissions.

To calculate emissions for the 2022 inventory year, total countywide vehicle miles traveled (VMT) were first obtained from EMFAC2021. These VMT figures were then allocated to emission sectors defined by the EPA’s Local GHG Inventory Tool based on vehicle class, specifically, the residential and commercial/institutional sectors. For the purposes of sector-specific emissions calculations, light-duty vehicles were attributed to the residential sector, as they primarily reflect personal vehicle use by residents. In contrast, medium- and heavy-duty trucks were attributed to the commercial/institutional sector, as these vehicle types are more commonly associated with goods movement, service fleets, and business operations. Sector-specific VMT totals were then apportioned to each jurisdiction based on appropriate attribution metrics: population share for residential VMT and commercial building square footage share for commercial/institutional VMT.

EMFAC2021 was also used to generate countywide GHG emissions factors for the two sectors, expressed in MTCO₂e per vehicle mile traveled. These factors accounted for all vehicle classes, model years, speeds, and fuel types. The sector-specific factors were derived by dividing total countywide emissions of CO₂, CH₄, and N₂O (converted to CO₂e using the appropriate GWP) by the corresponding sector-specific countywide total VMT, with emissions and VMT categorized into the residential and commercial/institutional sectors based on vehicle class.

Finally, each jurisdiction’s total Mobile On-road emissions by sector were calculated by multiplying the jurisdiction’s sector-specific VMT by the respective countywide sector-specific MTCO₂e per VMT emissions factors. Table 6 presents the City of Arvin’s total Mobile On-road VMT, associated sector-specific GHG emissions factors, and the resulting total GHG emissions by sector.

Table 6 City of Arvin Mobile On-road Data Inputs and Results

Vehicle Sector	Total Activity (VMT)	GHG Emissions Factor (MTCO ₂ e/VMT)	GHG Emissions (MTCO ₂ e)
Residential	7,273,976,093	0.00035	50,606
Commercial/Institutional	4,084,478,876	0.0011	36,381

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: CARB 2022a; analysis conducted by Ascent in 2025.

3.3.2 Mobile Off-road

Emissions from Mobile Off-road sources result from the combustion of fuel in various types of off-road vehicles and equipment (e.g. agricultural tractors, construction equipment). Emissions data for these sources were obtained from

CARB's OFFROAD2021 model, which provides detailed estimates for Kern county for the 2022 inventory year. The data include, but are not limited to, information on equipment categories, fuel types, and the amount of fuel consumed.

Using the off-road vehicle categories in OFFROAD2021, the emissions data were organized into two relevant sectors defined by the EPA Local GHG Inventory Tool: agricultural and commercial/institutional. Sector-specific off-road fuel consumption totals were then apportioned to each jurisdiction using appropriate attribution metrics. Specifically, the share of farmland, grazing land, and other agricultural land was used to allocate agricultural emissions, while the commercial building square footage share was used to distribute commercial/institutional emissions.

Finally, each jurisdiction's sector-specific off-road fuel consumption data were entered into the "Mobile-Data" sheet of the EPA Local GHG Inventory Tool to calculate Mobile Off-road emissions. The EPA Local GHG Inventory Tool includes emissions factors by fuel type. Table 7 presents the City of Arvin's total Mobile Off-road fuel consumption by fuel type and the resulting total GHG emissions by sector.

Table 7 City of Arvin Mobile Off-road Data Inputs and Results

Vehicle Sector	Diesel Consumption (gallons)	Gasoline Consumption (gallons)	Liquefied Natural Gas (LNG) Consumption (gallons)	Total Fuel Consumption (gallons)	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	515,991	225,753	12,458	754,203	7,489
Agricultural	7,870	145	—	8,016	84

Notes: GHG = greenhouse Gas; LNG = liquefied natural gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CARB 2022b, analysis conducted by Ascent in 2025.

3.3.3 Stationary Energy

The stationary energy source of GHG emissions includes natural gas combustion in residential, commercial/institutional and industrial uses. Residential uses primarily consume natural gas for space and water heating, and cooking. Commercial/institutional uses may include space heating and cooling, cooking in restaurants, and smaller boilers or generators. Industrial uses are often process-specific uses tied to manufacturing or heavy operations such as process heating, steam generation, and boiler systems. Propane fuel usage was not included in the stationary energy-related calculations as propane usage data for these various uses was not available at the same level of detail or consistency as other stationary energy data sources at the county scale.

RESIDENTIAL AND COMMERCIAL/INSTITUTIONAL

Total countywide natural gas usage data for the 2022 inventory year was obtained from the CEC Energy Reports: Gas Consumption by County, which categorizes usage into residential and non-residential sectors. Residential natural gas consumption was allocated to each jurisdiction based on its share of the county's population.

To isolate commercial/institutional usage, countywide industrial natural gas consumption, sourced from the EPA FLIGHT database and CARB MRR database, was subtracted from the CEC total non-residential usage. The resulting commercial/institutional natural gas usage was then apportioned to each jurisdiction using commercial building floor space share as the attribution metric.

Finally, each jurisdiction's residential and commercial/institutional natural gas usage data were entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate residential and commercial/institutional stationary energy emissions. Table 8 below shows the City of Arvin's total stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions in residential and commercial/institutional sectors.

Table 8 City of Arvin Residential and Commercial/Institutional Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Residential	206,550	11,357
Commercial/Institutional	99,479	5,470

Notes: mcf = thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

INDUSTRIAL

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the City of Arvin. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

For the City of Arvin, the databases showed that no large industrial facilities are located within its geographic boundary, therefore, there is no reported industrial stationary energy associated activity or GHG emissions for the City of Arvin.

3.3.4 Electricity

The electricity source addresses energy-related indirect GHG emissions resulting from the consumption of grid-supplied electricity within the City of Arvin's boundary. Consumption of grid-supplied electricity is considered an "indirect" GHG emissions source, because GHG emissions occur at the source of electricity generation, which is usually outside of a jurisdiction's boundary. The location-based method was used to calculate electricity GHG emissions, which uses regional grid-average emission factors. In the United States, these factors are provided by the EPA's Emissions & Generation Resource Integrated Database (eGRID). Specifically, emission factors for the CAMX eGRID subregion were applied, as this subregion encompasses the geographic area of Kern county.

Total electricity usage data for Kern county in 2022 was obtained from CEC Energy Reports: Electricity by County, which categorized usage into residential and non-residential sectors (CEC 2023). Electricity usage data for the City of Bakersfield, which was also separated into residential and non-residential categories, was acquired directly from the Pacific Gas and Electric Company (PG&E). To estimate electricity usage for the rest of the county (i.e., all jurisdictions excluding Bakersfield), the City of Bakersfield's electricity data was subtracted from the total Kern county data.

Residential electricity usage outside of Bakersfield was apportioned to each jurisdiction based on its share of the county's total population. For non-residential electricity usage, estimates were further categorized into industrial and commercial/institutional sectors using attribution metrics derived from natural gas consumption data previously calculated under stationary energy. In 2022, 93.1 percent of the county's stationary natural gas combustion was attributed to industrial use and 6.9 percent to commercial/institutional use. These same ratios were applied to the county's total non-residential electricity usage, under the assumption that the sectoral split in electricity usage mirrors that of natural gas usage. This assumption was validated using available industrial electricity and natural gas usage data in PG&E's service territory, from the CEC Energy Reports. The electricity-to-gas ratio, expressed as gigawatt-hour per million therms, was calculated by dividing total industrial electricity usage by industrial natural gas consumption for the service territory. The resulting value closely aligns with the assumptions applied in this here, supporting its validity.

The City of Arvin's share of commercial building square footage was used to attribute commercial/institutional electricity usage. Industrial electricity usage was attributed based on the proportion of countywide industrial natural gas within the City of Arvin. No industrial facilities exist in the City of Arvin; therefore, no industrial electricity usage is attributed to the City of Arvin. Finally, the sector-specific electricity usage data for each jurisdiction was entered into the "Electricity-Data" sheet of the EPA Local GHG Inventory Tool to calculate associated GHG emissions.

Table 9 below shows the City of Arvin’s electricity activity data and the associated GHG emissions by emission sectors.

Table 9 City of Arvin Electricity Energy Data Inputs and Results

Sector	Total Activity (kWh of Electricity Consumed)	GHG Emissions (MTCO ₂ e)
Residential	73,357,247	16,615
Commercial/Institutional	13,703,186	3,104
Industrial	—	—

Notes: kWh = kilowatt-hour; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; PG&E 2025; analysis conducted by Ascent in 2025.

3.3.5 Imported Water

The water source category captures GHG emissions from energy use associated with the conveyance, treatment, and distribution of water within a jurisdiction. In Kern county, the WAKC reports that approximately 166,000 acre-feet of water are used annually for municipal and industrial purposes, and 2,294,000 acre-feet for agricultural purposes.

In addition to local surface water, Kern county draws water from several sources. Among these, only water supplied through the State Water Project (SWP) and the federal Central Valley Project (CVP) is considered imported, and therefore potentially results in GHG emissions due to long-distance conveyance. All other sources are classified as local. It was assumed that energy used for extracting, conveying, treating, and distributing local water is captured under the emissions estimates for stationary energy and electricity, since these activities occur within the county. In addition, upon further review, it was also determined that the federal CVP does not consume energy for water delivery to Kern County, as water is primarily conveyed using gravity (Friant Water Authority 2019). As a result, only the SWP, which accounts for 26 percent of the county’s water supply, contributes to GHG emissions. Table 10 provides a summary of the water sources in Kern county and their contribution to the total water supply.

Table 10 Kern County Water Sources

Source	Percentage
Kern River	20%
State Water Project (California Aqueduct)	26%
Federal Central Valley Project (Friant-Kern Canal)	12%
Local Streams and Other Sources (Poso Creek, Kern River, etc.)	6%
Groundwater	36%
Total	100%

Source: WAKC n.d.

Water use in Kern County is characterized into municipal and industrial, and agricultural sectors in data obtained from WAKC. It is assumed that water included in “municipal” uses is delivered to both commercial and residential customers. However, sufficient data was not available to disaggregate the water consumption between industrial, commercial, and residential customers. For the purpose of this GHG emissions inventory, all non-agricultural water consumption was categorized under the commercial/institutional sector.

To allocate sector-specific water usage to individual jurisdictions, the following attribution metrics were used:

- ▶ Agricultural water use was apportioned based on each jurisdiction’s share of farmland, grazing land, and other agricultural land.
- ▶ Commercial/institutional water use was distributed according to the share of commercial building square footage in each jurisdiction.

These apportioned figures were then entered into the “Imported Water” sheet of the EPA Local GHG Inventory Tool, applying a universal 26 percent imported water rate, to estimate the associated GHG emissions from water conveyance and use. Table 11 presents the City of Arvin’s activity data related to imported water, including the percentage of total water supply that is imported and the associated GHG emissions.

Table 11 City of Arvin Imported Water Energy Data Inputs and Results

Sector	Total Activity (Gallons of Water)	Percentage of Water Imported	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	304,153,810	26%	386
Agricultural	105,217,320		134

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: WAKC n.d.; analysis conducted by Ascent in 2025.

3.3.6 Wastewater

The wastewater source accounts for GHG emissions resulting from the treatment of sewage. To support this analysis, a review of publicly available wastewater treatment characteristics was conducted to collect the data required for completing the “Wastewater-Control” tab of the EPA’s Local GHG Inventory Tool. The data sources and corresponding assumptions for the City of Arvin’s wastewater treatment systems are summarized in Table 12. Where jurisdiction-specific data were not publicly available, the default input values provided by the EPA tool were used.

To estimate GHG emissions, population data for each jurisdiction were subsequently entered into the “Wastewater-Entry” tab of the tool. The resulting emissions estimates are also presented in Table 12, alongside the data sources and assumptions used.

Table 12 City of Arvin Wastewater Treatment Assumptions

Wastewater Process/Treatment Type	Conditions Assumed	Data Source	GHG Emissions (MTCO ₂ e)
Population served by septic systems	5 percent of the city's population	ICLEI’s default proportion of population that utilizes septic tanks for an urban area (Box WW.11(alt).2).	428
One or more wastewater treatment plants (WWTPs) where wastewater is treated in aerobic or anaerobic conditions	Aerobic	Obtained from the Arvin Wastewater Treatment Plant Master Plan – Final Report.	
One or more WWTPs conduct or do not conduct nitrification/denitrification	Denitrification	Obtained from the Arvin Wastewater Treatment Plant Master Plan – Final Report.	

Notes: WWTP = wastewater treatment plant; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; ICLEI = Local Governments for Sustainability.

Sources: ICLEI 2019; Stantec 2019; analysis conducted by Ascent in 2025.

3.3.7 Solid Waste

Community-generated solid waste emissions are primarily associated with the decomposition of solid waste in landfills. There are two methods for accounting for GHG emissions associated with waste disposal:

- ▶ Waste generation method – Accounts for the total GHG emissions that would be generated over time as municipal solid waste (MSW) that is sent to a landfill in only the inventory year decomposes.
- ▶ Waste-in-place method – Accounts for the total GHG emissions generated in a given year at a specific landfill location by the decomposition of all MSW previously disposed at the landfill.

Generally, there is some risk of double counting GHG emissions when combining both of these methods, as a portion of the emissions accounted for using the waste generation method may occur at an in-boundary landfill that has emissions reported using the waste-in-place method. However, the scale of the overlapping GHG emissions between the two methods would be expected as very small in comparison to total emission using either accounting method.

WASTE GENERATION

Landfill tonnage data for 2022 was obtained from CalRecycle’s Jurisdiction Disposal and Beneficial Reuse by Destination database. This data was entered into the EPA’s Waste Reduction Model (WARM Tool) as “mixed MSW” to estimate waste generation emissions. The default national average values were used in the WARM Tool, except for Question 7, where the k value was set to “dry” based on the county’s annual precipitation (less than 20 inches) (NCEI 2025). The WARM output was then imported into the EPA Local GHG Inventory Tool’s “Waste Production” tab, with solid-waste associated emissions attributed to the residential sector by default.

The total activity for solid waste disposal and the resulting waste generation GHG emissions results from the WARM Tool are provided in Table 13.

Table 13 City of Arvin Waste Generation Data Inputs and Results

Sector	Total Activity (tons of MSW disposed)	GHG Emissions (MTCO ₂ e) (WARM Output)
Residential	11,157	3,220

Notes: MSW = mixed municipal solid waste; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; WARM = Waste Reduction Model.

Source: CalRecycle 2025; analysis conducted by Ascent in 2025.

WASTE-IN-PLACE

EPA’s FLIGHT database was reviewed to determine emissions from landfills located within the City of Arvin’s geopolitical boundary, which would provide emissions data for any landfills that generated emissions greater than 25,000 MTCO₂e in 2022. No reporting landfills were identified for the City of Arvin.

3.3.8 Agriculture

The agriculture emissions source captures GHG emissions generated from fertilizer application.

FERTILIZER APPLICATION

Fertilizer application results in GHG emissions primarily due to the release of N₂O, a potent GHG with a global warming potential nearly 300 times greater than CO₂. When nitrogen-based fertilizers are applied to soil, a portion of the nitrogen undergoes microbial processes (nitrification and denitrification), which convert it into N₂O. These emissions can occur directly from the soil or indirectly through leaching and runoff

The total tonnage of nitrogen in synthetic fertilizers applied in Kern county during the 2022 inventory year was obtained from CDFA’s fertilizing materials tonnage report. This countywide total was then apportioned to individual jurisdictions based on each jurisdiction’s proportional share of farmland, grazing land, and other agricultural land. Only data for synthetic fertilizers was publicly available for calculation, although other organic or manure-based fertilizers may be used.

The resulting tonnage of nitrogen in synthetic fertilizers estimated for the City of Arvin was entered into the “Agriculture & Land Management” sheet of the EPA’s Local GHG Inventory Tool to calculate the associated emissions. Table 14 provides the estimated total tons of nitrogen applied and resulting GHG emissions.

Table 14 City of Arvin Fertilizer Application Data Inputs and Results

Sector	Total Activity (tons of nitrogen applied)	GHG Emissions (MTCO ₂ e)
Agricultural	23	162

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CDFA 2025; analysis conducted by Ascent in 2025.

4 GREENHOUSE GAS EMISSIONS FORECAST METHODS

This section provides the methods and data used to project future GHG emissions under a BAU scenario, as well as the calculations of reductions from adopted legislation and regulations under an ABAU scenario.

The BAU GHG emissions forecasts assess how emissions generated by community activities will change over time without further State, federal, regional, or local action. The BAU scenario forecast accounts for the changes in population and employment that can influence communitywide GHG emissions. The ABAU scenario forecast includes adopted policies and regulations at the State and federal levels that would affect emissions without any local action, such as regulatory requirements to increase vehicle fuel efficiency and increase renewable energy sources in grid electricity portfolios. These forecasts provide the City of Arvin with information needed to understand specific GHG emissions sources with the greatest opportunities for reduction with future plans, projects, or programs. It is important to note that the ABAU forecasts only account for emissions reductions associated with adopted policies and regulations; they do not account for proposed and/or unadopted GHG reduction actions established by regional, State, and federal agencies or executive orders outside of adopted legislation and regulations.

The GHG emissions forecasts project GHG emissions for the years 2030, 2040, and 2045 to align with key regulatory timelines for the State. Two key legislative actions establish statewide GHG reduction targets for the years 2030 and 2045, including:

- ▶ Senate Bill (SB) 32 of 2016, which sets a statewide GHG reduction target for the year 2030, and
- ▶ Assembly Bill 1279 of 2022, which sets a statewide GHG reduction target for the year 2045.

The forecast years selected do not necessarily align with the targets established by adopted legislation, but they do provide an analysis of emissions that aligns with the relevant horizon years. The year 2040 was also included in the analysis as an interim year between the 2030 and 2045 forecast years.

4.1 GROWTH PROJECTIONS

GHG emissions forecasts were developed based on projected changes in Kern county's demographics, specifically population, employment, and service population (defined as residents plus employees), between 2022 and 2045. These projections were obtained from the Regional Growth Forecast and Demographic Forecast prepared by the Kern COG (Kern COG 2024). It is assumed that the incorporated cities and the unincorporated county will experience demographic growth at the same rate as the county overall, as jurisdiction-specific growth projections were not available at the time of this analysis.

Between 2022 and 2045, Kern county's population and employment are projected to increase by approximately 11.1 and 15.5 percent, respectively. The service population is expected to grow by 12.4 percent. These growth factors were applied to forecast GHG emissions for the years 2030, 2040, and 2045 across various emissions sources included in the inventory. The values used for population, employment, and service population used to project future emissions are provided in Table 15.

Table 15 Kern County Demographics and Calculated Growth Rates for Future Emissions Forecasts

Calculation Factor	2022	2030	2040	2045
Population				
Total Kern County	906,883	949,134	994,167	1,007,627
Kern County Growth from 2022		4.7%	9.6%	11.1%
Employment				
Total Kern County	358,961	369,427	399,432	414,652
Kern County Growth from 2022		2.9%	11.3%	15.5%
Service Population				
Total Kern County	1,265,844	1,318,561	1,393,598	1,422,279
Kern County Growth from 2022		4.2%	10.1%	12.4%

Source: US Census Bureau 2025; Kern COG 2024; analysis conducted by Ascent in 2025.

Additional details on how growth factors were applied to individual sources are provided in the following sections. It is important to note that agricultural emissions, including those from fertilizer application, as well as livestock enteric fermentation and manure management, are assumed to remain constant throughout the forecast period, with no projected increase in activity levels. Agricultural activities are difficult to project in any detail, with production intensities, number of livestock, and crop types being highly susceptible to global markets and local climate patterns. As such, projections of agriculture GHG emissions-generating activities are not attempted.

4.2 BUSINESS-AS-USUAL SCENARIO FORECAST

The BAU forecast represents a projection of future GHG emissions based solely on expected demographic and economic growth (e.g., population, employment, and service population) between 2022 and 2045. It does not account for the potential impacts of future policies, programs, or actions that may reduce emissions, such as energy efficiency improvements, renewable energy adoption, or transportation electrification.

In the BAU scenario, GHG emissions factors are held constant at the levels used in the 2022 GHG inventory, meaning the carbon intensity of electricity, fuels, and other activities is assumed not to change over time. As a result, any changes in future emissions are driven entirely by growth in activity levels, not by improvements in emissions performance.

4.2.1 Business-As-Usual Scenario Forecast Results

Table 16 presents the projected activity data for the City of Arvin across all forecast years, organized by emissions source and sector. Table 16 also indicates which sources and sectors used population, employment, or service population as a growth metric.

Table 16 City of Arvin BAU Scenario Projected Activity Data for All Forecast Years

Source	Sector	Growth Metric	Units	2030	2040	2045
Stationary Energy	Residential	Population	scf	216,173	226,429	229,495
Stationary Energy	Commercial/Institutional	Employment	scf	102,380	110,695	114,913
Stationary Energy	Industrial	Employment	scf	—	—	—
Electricity	Residential	Population	kWh	76,774,890	80,417,567	81,506,355
Electricity	Commercial/Institutional	Employment	kWh	14,102,736	15,248,142	15,829,182
Electricity	Industrial	Employment	kWh	—	—	—
Other Industrial	Industrial	Employment	MTCO ₂ e	—	—	—

Source	Sector	Growth Metric	Units	2030	2040	2045
Agriculture – Fertilizer Application	Agricultural ¹	N/A	ton	23	23	23
Solid Waste	Residential	Population	ton	11,677	12,231	12,396
Wastewater	Commercial/Institutional	Service Population	MTCO ₂ e	446	471	481
Imported Water	Commercial/Institutional	Service Population	Gallon	316,820,567	334,850,316	341,741,667
Imported Water	Agricultural ¹	N/A	Gallon	105,217,320	105,217,320	105,217,320
Mobile On-road	Residential	Population	VMT	164,642,069	172,453,711	174,788,593
Mobile On-road	Commercial/Institutional	Employment	VMT	37,365,085	40,399,827	41,939,288
Mobile Off-road	Commercial/Institutional	Employment	MTCO ₂ e	7,707	8,333	8,651
Mobile Off-road	Agricultural ¹	N/A	MTCO ₂ e	84	84	84

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; scf = standard cubic foot.

¹ Activity levels for the agricultural sector are assumed to remain constant over the forecast period; therefore, growth metrics are listed as “N/A.”

Source: Analysis conducted by Ascent in 2025.

Table 17 below presents the projected GHG emissions for the City of Arvin across all forecast years, also organized by emissions source and sector.

Table 17 City of Arvin BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	11,827	12,388	12,556
Stationary Energy	Commercial/Institutional	MTCO ₂ e	5,601	6,056	6,287
Stationary Energy	Industrial	MTCO ₂ e	—	—	—
Electricity	Residential	MTCO ₂ e	17,388	18,213	18,459
Electricity	Commercial/Institutional	MTCO ₂ e	3,194	3,453	3,585
Electricity	Industrial	MTCO ₂ e	—	—	—
Other Industrial	Industrial	MTCO ₂ e	—	—	—
Agriculture – Fertilizer Application	Agricultural	MTCO ₂ e	162	162	162
Solid Waste	Residential	MTCO ₂ e	3,370	3,530	3,578
Wastewater	Commercial/Institutional	MTCO ₂ e	446	471	481
Imported Water	Commercial/Institutional	MTCO ₂ e	402	425	434
Imported Water	Agricultural	MTCO ₂ e	134	134	134
Mobile On-road	Residential	MTCO ₂ e	52,963	55,476	56,228
Mobile On-road	Commercial/Institutional	MTCO ₂ e	37,442	40,483	42,026
Mobile Off-road	Commercial/Institutional	MTCO ₂ e	7,707	8,333	8,651
Mobile Off-road	Agricultural	MTCO ₂ e	84	84	84

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

4.3 LEGISLATIVE-ADJUSTED BUSINESS-AS-USUAL SCENARIO FORECAST

ABAU emissions forecasts were prepared using the same demographic data that were used for the BAU forecasts, while also accounting for State and federal policies and regulations that would affect local emissions. These forecasts provide the City of Arvin with a more robust understanding of future community emissions based on the GHG reduction efforts at the state and federal level. A summary of applicable legislative reductions is provided in Table 18.

Table 18 Legislative Reductions Summary

Source	Legislative Reduction	Description	Sources Applied
State	Renewable Energy and Zero-Carbon Electricity Requirements [SB 1020 and SB 100]	Requires California energy utilities to procure 60 percent of electricity from eligible renewable and zero-carbon sources by 2030, 95 percent by 2040, and 100 percent by 2045.	Electricity, Imported Water
State	California's Building Energy Efficiency Standards (2019 and 2022 Title 24, Part 6)	Requires all new buildings in California to comply with energy efficiency standards established by CEC. Accounts for the energy efficiency gains in new residential and nonresidential buildings.	Stationary Energy, Electricity
State	Advanced Clean Car I Regulation	Establishes GHG emission reduction standards for model years 2017 through 2025 that are more stringent than federal CAFE standards.	Mobile On-road
State	Truck and Bus Regulation	Requires diesel trucks and buses that operate in California to be upgraded to reduce GHG emissions.	Mobile On-road
Federal	Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles	Establishes fuel efficiency standards for medium- and heavy-duty engines and vehicles.	Mobile On-road

Notes: CAFE = Corporate Average Fuel Economy; CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; SUV = sports utility vehicle; SB = Senate Bill.

4.3.1 Title 24 Adjustments

Future energy use was adjusted to reflect increased emissions-intensity stringency under California's Building Energy Efficiency Standards (California Code of Regulations Title 24 Part 6, hereafter referred to as "Title 24"). Although Title 24 applies to both new residential and nonresidential construction, for the purposes of this forecast, adjustments were applied only to residential construction for reasons described below.

This approach accounts for uncertainties in energy consumption patterns and end uses in nonresidential buildings, and uncertainty in the non-residential building types that would be constructed in the future. Title 24 primarily regulates energy efficiency in building envelopes and lighting systems. This is expected to substantially reduce energy consumption for building types where the primary end uses of energy are lighting and heating, ventilation, and air conditioning, such as new office, institutional, and hotel buildings. However, Title 24 may not significantly affect other high-energy-consuming uses in nonresidential facilities, such as process loads or specialized equipment. As such, limiting adjustments to residential construction provides a more conservative and reliable estimate of future energy-related GHG emissions.

The 2019 Title 24 standards apply to projects constructed after January 1, 2020, while the 2022 standards apply after January 1, 2023. The 2025 Title 24 will go into effect statewide in January of 2026; however, detailed data on the changes in building-level energy consumption between the 2025 code and previous code cycles was not available at the time of this analysis. To estimate changes in future energy consumption under the 2022 standards, electricity and natural gas adjustment factors were calculated based on differences in average residential energy use between buildings built to the 2019 and 2022 standards. These factors were derived from CEC's data specific to the 2019 and 2022 standards and climate zone-based energy usage rates. For the City of Arvin, Climate Zone 13 was used in the analysis.

These adjustment factors were then applied to the ABAU forecasts of energy consumption activity for both stationary energy and electricity use to reflect the impact of legislative energy efficiency improvements on future development.

The adjustment factors, presented in Table 19, show the percentage change in energy use for buildings built to 2022 standards relative to those built to 2019 standards. Positive values indicate an anticipated increase in energy use, while negative values indicate an anticipated decrease in energy use.

As shown in Table 19:

- ▶ ABAU electricity activity is projected to be higher than BAU in each forecast year due to positive adjustment factors.
- ▶ ABAU stationary energy activity is projected to be lower than BAU due to negative adjustment factors.

Importantly, these adjustments were applied only to energy use growth occurring after the 2022 baseline, reflecting new development that would be subject to the 2022 Title 24, or a later cycle of standards. In addition, it is important to note that although average electricity use in new residential buildings is anticipated to rise under 2022 Title 24 (due to an increase in electrical demand associated with electric appliances installed instead of natural gas appliances), emissions from new residential buildings are expected to be lower than they would be under 2019 Title 24 as a result of overall lower building emissions intensities (due to lower emissions factors associated with electricity compared to natural gas).

Table 19 Stationary Energy and Electricity Adjustment Factors and Activity Forecast Results for Residential Buildings

Energy Type	Forecast Scenario	Adjustment Factor	Activity Units	2022	2030	2040	2045
Electricity	BAU	—	kWh	73,357,247	76,774,890	80,417,567	81,506,355
Electricity	ABAU	+12%	kWh	73,357,247	77,183,601	81,261,901	82,480,895
Stationary Energy (Natural Gas)	BAU	—	mcf	206,550	216,173	226,429	229,495
Stationary Energy (Natural Gas)	ABAU	-29%	mcf	206,550	213,372	220,644	222,817

Notes: BAU = Business-as-Usual; ABAU = legislative-adjusted BAU; mcf = one thousand cubic feet; kWh = kilowatt-hour.

Source: Analysis conducted by Ascent in 2025.

4.3.2 Senate Bill 100 and Senate Bill 1020 Adjustments

SB 100 requires that 100 percent of retail electricity sales in California come from renewable and zero-carbon resources by 2045. This legislation builds upon the state's existing Renewables Portfolio Standard (RPS) by increasing the required percentage of RPS-eligible renewable electricity over time. SB 1020 builds on SB 100 by introducing interim targets for GHG-free electricity for the years 2035 and 2040. As shown in Table X, SB 100 and SB 1020 require utility providers to supply electricity that is 60 percent GHG-free by 2030, 95 percent by 2040, and 100 percent by 2045. The emissions sources affected by these adjustments include electricity and imported water, both of which are estimated based on the carbon intensity of the electricity grid.

To estimate future GHG emissions factors, the 2022 GHG-free electricity percentage and GHG emissions factors for the CAMX eGRID subregion were first obtained from the EPA's eGRID database. Using these 2022 values as a baseline, emissions factors for the forecast years (2030, 2040, and 2045) were calculated based on the GHG-free electricity targets established by SB 100 and SB 1020.

Table 20 below demonstrates these GHG-free electricity percentage baseline values and targets, as well as the baseline and calculated emissions factors for the forecast years. Given 2045's 100 percent GHG-free electricity percentage target, the emissions factor for 2045 is 0. In contrast to the ABAU forecast, the CAMX eGRID emissions factors under the BAU scenario are assumed to remain constant at their 2022 baseline values throughout the forecast years.

Table 20 CAMX eGRID Electricity GHG Emissions Factors Adjusted for SB100 and SB1020

Calculation Factor	Units	2022	2030	2040	2045
SB 100 and SB 1020 GHG-free electricity percentage targets	Percent GHG-free	N/A	60%	95%	100%
CAMX eGRID GHG-free electricity percentage baseline and targets	Percent GHG-free	50%	60%	95%	100%
CAMX eGRID baseline and interpolated emissions factors	MTCO ₂ e/MWh	0.2265	0.1819	0.0227	0

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MWh = megawatt-hour; N/A = Not Applicable.

Source: Analysis conducted by Ascent in 2025.

4.3.3 On-road Vehicle Emissions Standards

State and federal regulations are expected to significantly reduce on-road GHG emissions by requiring improvements in vehicle fuel efficiency and accelerating the transition to zero-emission vehicles (ZEVs). The ABAU forecast for the Mobile On-road source takes into consideration the following State and federal regulations:

- ▶ Innovative Clean Transit Regulation, which requires all California public transit agencies to begin phasing in zero-emission buses (ZEB) starting in 2023 and transition to 100 percent ZEB fleets by 2040 and
- ▶ Advanced Clean Trucks Regulation, which requires truck and van manufacturers to sell a growing share of ZEVs beginning in model year 2024.

All these regulations are reflected in EMFAC2021's emissions data for the forecast years (2030, 2040 and 2045), which serve as the basis for the Mobile On-road source's ABAU forecast. In addition to these regulations, EMFAC2021's data also takes into consideration future increases in light-duty ZEV sales, which would be influenced by California's Advanced Clean Cars I regulation.

Accordingly, EMFAC2021's VMT and emissions estimates for forecast years were used to calculate Mobile On-road emissions under the legislative adjustment scenario. As with the inventory methodology, sector-specific emissions factors for each forecast year were calculated by dividing sector-specific VMT by sector-specific emissions for each forecast year. These emissions factors were then multiplied by projected future VMT, which were scaled by relevant activity growth factors (population for the residential sector and employment for the commercial/institutional sector) to estimate future emissions. The baseline and projected future emissions factors calculated using EMFAC2021 are shown in Table 21.

In contrast, under the BAU scenario, Mobile On-road emissions factors are held constant at their 2022 baseline values for all forecast years, reflecting no change in vehicle efficiency or fleet composition.

Table 21 Mobile On-road Baseline and Projected GHG Emissions Factors

Sector	Units	2022	2030	2040	2045
Commercial Institutional	MTCO ₂ e/VMT	0.0010	0.00090	0.00081	0.00081
Residential	MTCO ₂ e/VMT	0.00032	0.00026	0.00023	0.00023

Notes: MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: Analysis conducted by Ascent in 2025.

4.3.4 Legislative-Adjusted Business-as-Usual Scenario Forecast Results

Table 22 presents the projected GHG emissions for the City of Arvin across all forecast years under the ABAU scenario, organized by emissions source and sector. Emissions sources and sectors not impacted by legislative

adjustments are excluded from this table, as their projected GHG emissions are assumed to remain unchanged from the BAU scenario. The full results for projected GHG emissions for the City of Arvin across all forecast years under both the BAU and ABAU scenarios, organized by emissions source and sector, can be found in Table 2.

Table 22 City of Arvin Legislative-Adjusted BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	11,674	12,072	12,190
Electricity	Residential	MTCO ₂ e	14,041	1,848	—
Imported Water	Commercial/Institutional	MTCO ₂ e	323	43	—
Imported Water	Agricultural	MTCO ₂ e	107	13	—
Mobile On-road	Residential	MTCO ₂ e	43,062	40,032	39,880
Mobile On-road	Commercial/Institutional	MTCO ₂ e	33,592	32,584	33,839

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

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Greenhouse Gas Emissions Inventory and Forecast for the City of California City

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June 2025

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LIST OF ABBREVIATIONS

ABAU	legislative-adjusted BAU
AR5	Fifth Assessment Report
BAU	business-as-usual
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CH ₄	methane
CO ₂	carbon dioxide
CVP	Central Valley Project
eGRID	Emissions & Generation Resource Integrated Database
EPA Local GHG Inventory Tool	EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1
EPA	US Environmental Protection Agency
GHG	greenhouse gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
Kern COG	Kern Council of Governments
MRR	Mandatory Greenhouse Gas Reporting Regulation
MSW	municipal solid waste
MTCO _{2e}	metric tons of carbon dioxide equivalent
N ₂ O	nitrous oxide
PG&E	Pacific Gas and Electric Company
RPS	Renewables Portfolio Standard
SB	Senate Bill
SWP	State Water Project
VMT	vehicle miles traveled
WARM Tool	Waste Reduction Model
ZEB	zero-emission buses
ZEV	zero-emission vehicle

1 INTRODUCTION

This report contains the methods and results for a greenhouse gas (GHG) emissions inventory and GHG emissions forecast for the City of California City. A GHG emissions inventory provides estimates of emissions generated within a defined geographic boundary during a single year. It identifies the sectors, sources, and activities that produce these emissions and their relative contribution, while also providing a baseline to forecast future emissions trends. A GHG emissions forecast evaluates how GHG emissions may change in the future due to growth and the effects of adopted state and federal legislation and regulations. This information can be used for various purposes, including monitoring GHG emissions trends over time, or as the technical basis for planning efforts to reduce GHG emissions, such as a general plan or greenhouse gas reduction plan.

This report was developed as part of a grant provided to the City of Bakersfield by the US Environmental Protection Agency (EPA) as part of the Climate Pollution Reduction Grants program. The grant was provided to support climate pollution reduction planning in the Bakersfield Metropolitan Statistical Area, which includes the entirety of Kern county. Under this grant, funding was allocated to produce GHG emissions inventories and forecasts for each of the 12 jurisdictions in Kern county, including the City of Bakersfield, unincorporated Kern County, and all incorporated cities. These GHG emissions inventories and forecasts will be provided to the subject jurisdiction, the San Joaquin Valley Air Pollution Control District, and Kern Council of Governments (Kern COG).

The GHG emissions inventory and forecast are intended to provide an accounting of GHG emissions generating activities within the City of California City geographical boundary for the year 2022, and projections of future emissions based on countywide growth patterns and the effects of adopted state and federal legislation and regulations. This report is accompanied by an Excel-based tool used to develop the GHG emissions inventory, the *EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1* (the EPA Local GHG Inventory Tool). The GHG emissions inventory uses only publicly available data sets, many of which provide countywide estimates of GHG emissions generating activity, such as mobile on-road travel, energy consumption, and fertilizer use. This countywide data was scaled down to the jurisdiction level based on various attribution metrics, including population, commercial building floor space, and acres of agricultural use. GHG emissions were then forecasted using countywide growth projections for vehicle travel, population, and employment.

Because countywide data was used and scaled using attribution metrics, rather than jurisdiction-specific data, the GHG emissions inventory and forecast are intended to provide a general scale of GHG emissions for City of California City's contribution to countywide GHG emissions and serve as a starting point for more detailed GHG emissions analyses. The Excel-based tool can be updated with more locally specific and operational data that can be obtained from relevant departments and direct requests to utility providers. GHG emissions forecasts can be replicated using more locally specific growth projections for population and employment. The results can also be used to set local GHG reduction targets and develop and quantify locally specific measures for reducing GHG emissions. Sufficient detail is provided in this report to ensure that the analyses are replicable, and data inputs can be replaced with more detailed data, if desired.

2 SUMMARY RESULTS

This section presents the results of the GHG emissions inventory and forecast for the City of California City, providing a comprehensive overview of historical (2022 as the inventory year) and projected (2030, 2040, and 2045 as the forecast years) emissions. The results are organized by emissions sources, including stationary energy, electricity, Mobile On-road, wastewater, solid waste, and others, as well as by sectors, including residential, commercial/institutional, industrial, and agricultural.

This breakdown enables an understanding of the emissions sources and sectors that contribute most significantly to the City of California City's overall emissions. Section 3 of this report provides additional context and methodology related to each emissions source and sector, including key assumptions, data sources, and allocation methods used in the inventory and forecast development.

2.1 2022 GREENHOUSE GAS EMISSIONS INVENTORY RESULTS

Table 1 below shows the 2022 GHG emissions inventory results for the City of California City, categorized by emissions sources and sectors. Figure 1 shows the inventory categorized by emission sources, while Figure 2 shows the inventory categorized by emission sectors.

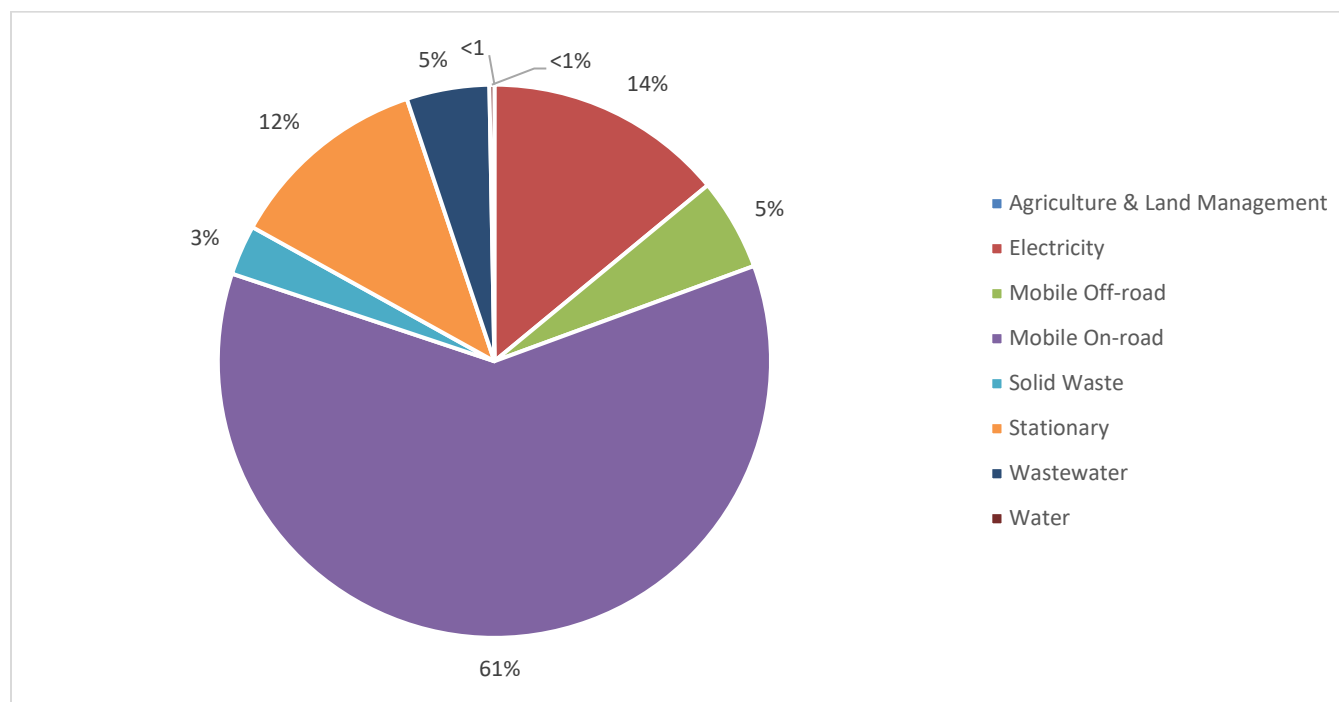
Table 1 City of California City 2022 GHG Emissions Inventory Results (MTCO₂e)

Emissions Sources	Emissions Sectors				
	Agricultural	Commercial/Institutional	Industrial	Residential	Total
Agriculture & Land Management	12	—	—	—	12
Electricity	—	2,217	—	12,709	14,926
Mobile Off-road	6	5,728	—	—	5,734
Mobile On-road	—	25,987	—	38,708	64,695
Solid Waste	—	—	—	3,120	3,120
Stationary Energy	—	3,907	—	8,687	12,594
Wastewater	—	5,153	—	—	5,153
Water	10	295	—	—	305
Total	29	43,287	—	63,225	106,541

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

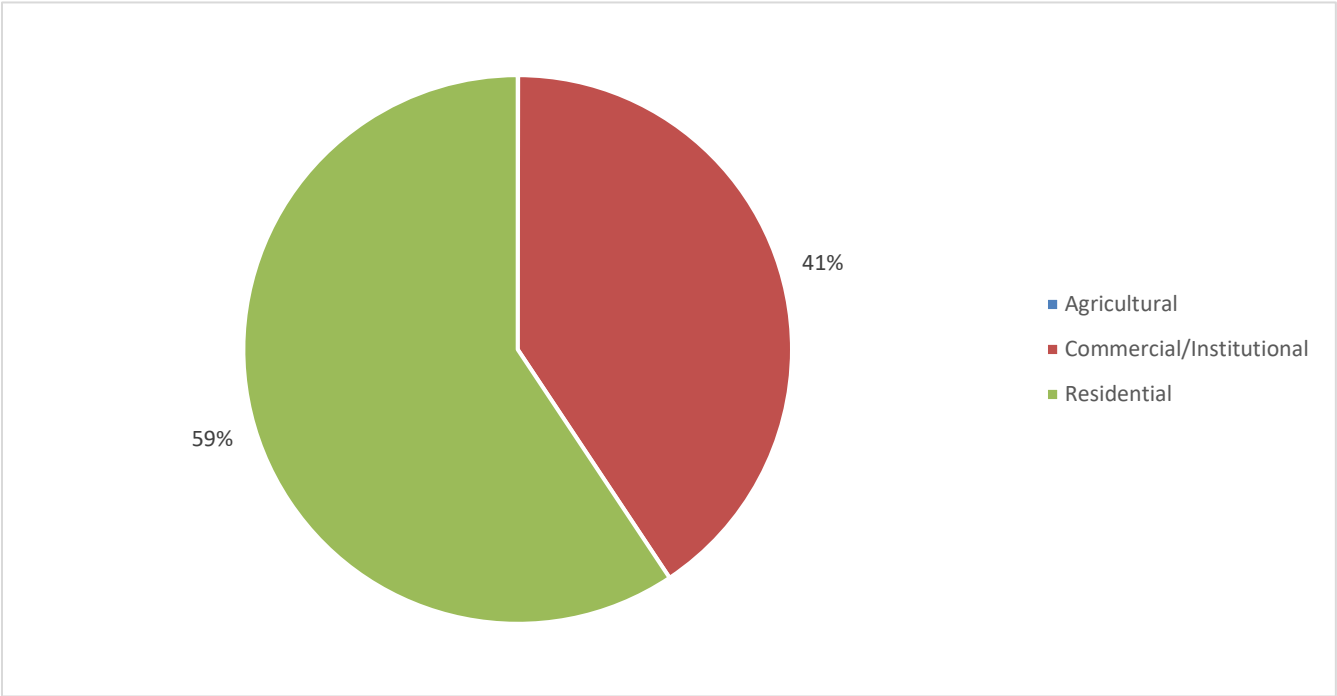
Source: Analysis conducted by Ascent in 2025.

Figure 1 City of California City 2022 GHG Emissions Inventory by Emissions Sources



Source: Analysis conducted by Ascent in 2025.

Figure 2 City of California City 2022 GHG Emissions Inventory by Emissions Sectors



Note: The City of California City had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure. Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

2.2 GREENHOUSE GAS EMISSIONS FORECAST RESULTS

Table 2 below shows the projected future GHG emissions for the City of California City for the forecast years 2030, 2040 and 2045 under both a business-as-usual (BAU) scenario, as well as a legislative-adjusted BAU (ABAU) scenario, broken down by both emissions sources and sector. The BAU GHG emissions forecasts estimate how community-generated emissions would change over time without additional actions at the State, federal, regional, or local levels, based solely on projected population and employment growth. The ABAU forecasts incorporate the effects of adopted State and federal policies, such as vehicle fuel efficiency standards and increased renewable energy in the electricity grid, but assume no additional local measures.

Table 2 City of California City Greenhouse Gas Emissions Forecast for 2030, 2040 and 2045 by Emissions Source and Sector (MTCO₂e)

Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Stationary Energy	Residential	9,046	8,929	9,476	9,234	9,604	9,324
Stationary Energy	Commercial/Institutional	4,001	4,001	4,326	4,326	4,491	4,491
Stationary Energy	Industrial	—	—	—	—	—	—
Electricity	Residential	13,300	10,740	13,931	1,413	14,120	—
Electricity	Commercial/Institutional	2,281	1,832	2,467	248	2,561	—
Electricity	Industrial	—	—	—	—	—	—
Other Industrial	Industrial	—	—	—	—	—	—

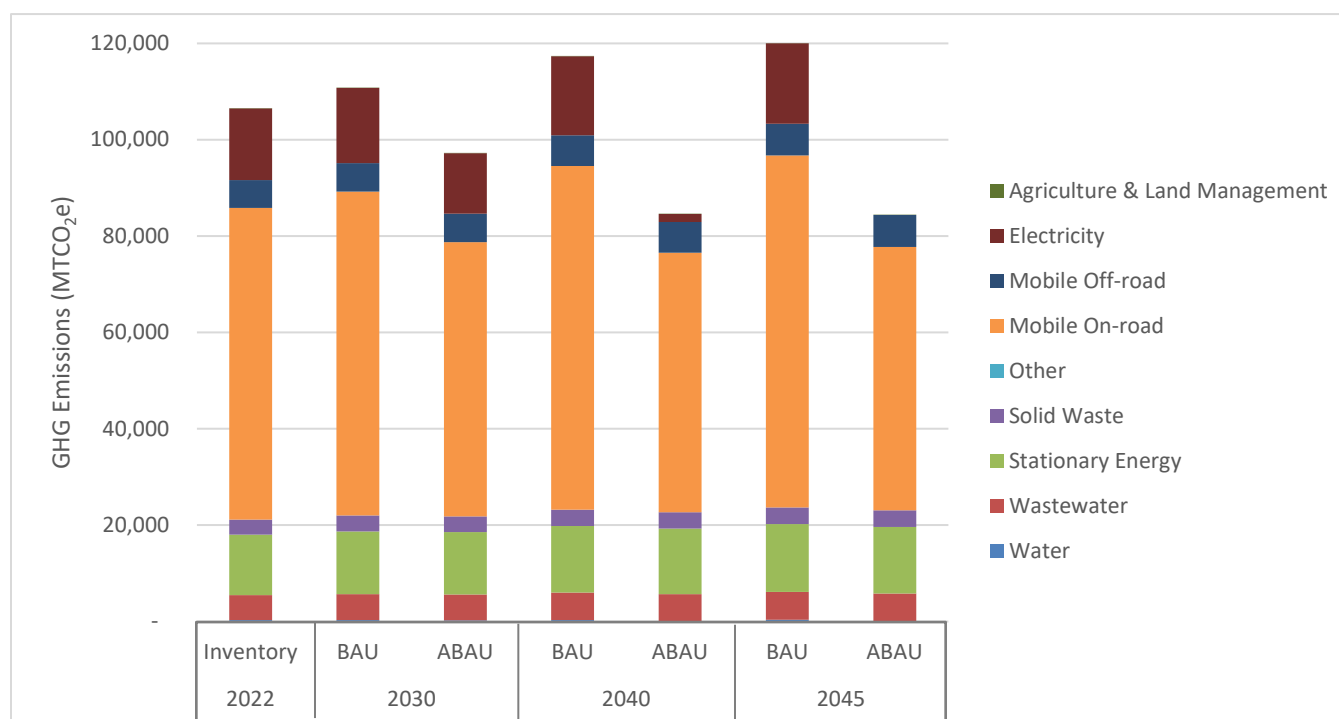
Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Agriculture – Fertilizer Application	Agricultural	12	12	12	12	12	12
Solid Waste	Residential	3,265	3,265	3,420	3,420	3,466	3,466
Wastewater	Commercial/Institutional	5,523	5,523	5,837	5,837	5,957	5,957
Imported Water	Commercial/Institutional	308	247	325	33	332	—
Imported Water	Agricultural	10	8	10	1	10	—
Mobile On-road	Residential	40,512	32,938	42,434	30,621	43,008	30,504
Mobile On-road	Commercial/Institutional	26,744	23,995	28,916	23,275	30,018	24,171
Mobile Off-road	Commercial/Institutional	5,895	5,895	6,374	6,374	6,617	6,617
Mobile Off-road	Agricultural	6	6	6	6	6	6

Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 3 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of California City's 2022 GHG emissions inventory for comparison, all categorized by emissions sources.

Figure 3 City of California City 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sources (MTCO_{2e})

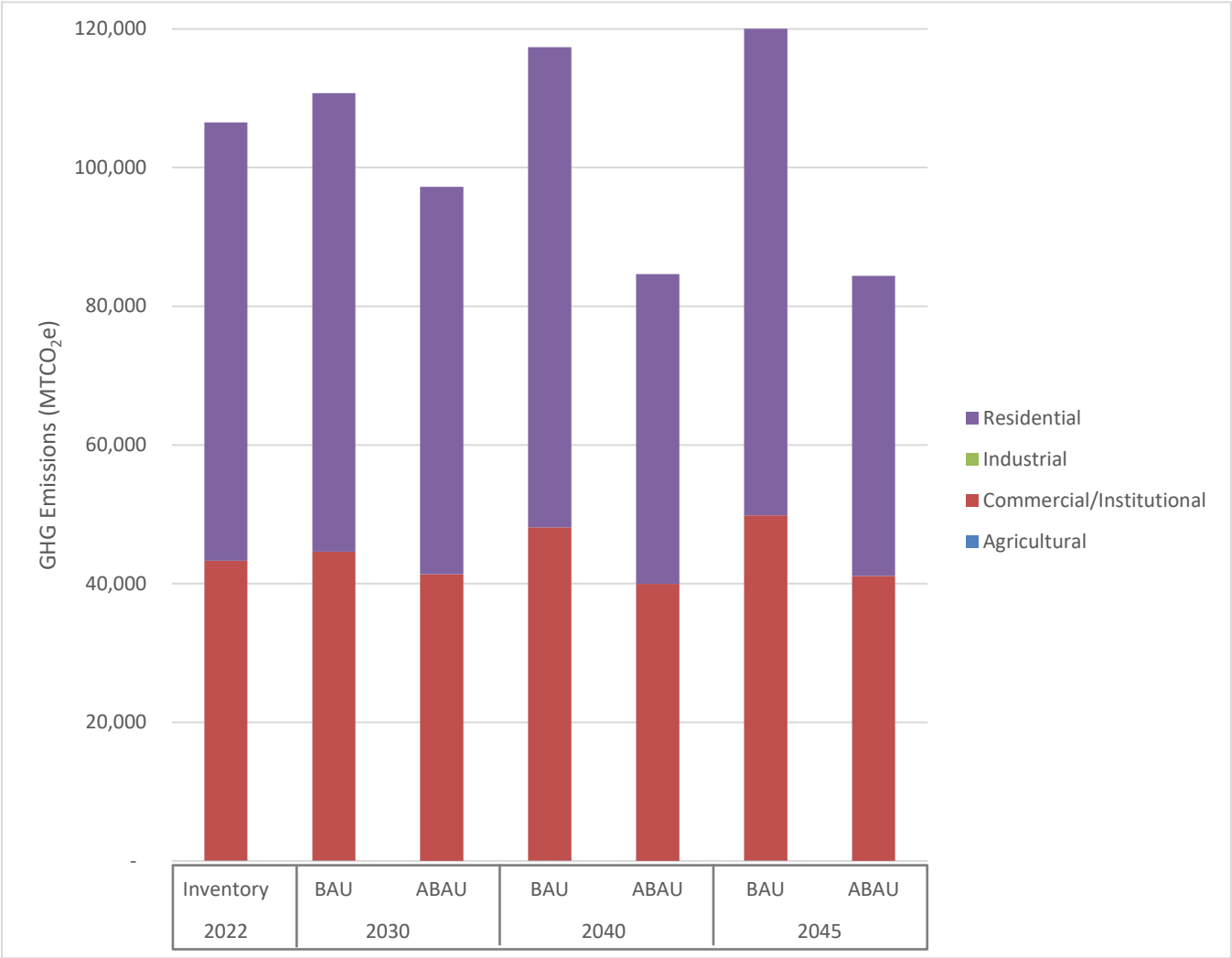


Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 4 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of California City’s 2022 GHG emissions inventory for comparison, all categorized by emissions sectors.

Figure 4 City of California City 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sectors (MTCO₂e)



Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent. The City of California City had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure. Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

3 GREENHOUSE GAS EMISSIONS INVENTORY METHODS

This section of the report details the methods used to develop the GHG emissions inventory for the City of California City. It includes descriptions of the data sources and data processing, and the inputs and outputs for the GHG emissions calculations. The methods are organized by GHG emissions sources (stationary energy, electricity, etc.) for the City of California City, based on the EPA Local GHG Inventory Tool.

The EPA Local GHG Inventory Tool was primarily used for GHG emissions calculations. Activity data (e.g., energy consumed, tons of waste landfilled, etc.) inputs for the City of California City were entered into the tool and parameters were set to represent local conditions (e.g., annual electricity consumption data was imported into the tool as the input to calculate City of California City's GHG emissions associated with electricity, and the appropriate electricity grid was selected to represent local conditions). GHG emissions from on-road transportation were calculated externally to the EPA Local GHG Inventory Tool, due to data format inconsistencies. All other GHG emissions sources were calculated within, or entered into the tool. The tool also categorizes GHG emissions into different sectors: residential, commercial/institutional, industrial, and agricultural. Industrial and agricultural sectors were only used when explicitly differentiated in the available datasets. In all other cases, sector categorization followed the classifications provided by the EPA Local GHG Inventory Tool or as defined by the underlying data sources.

This report only documents data processing and calculations that were performed outside of the EPA Local GHG Inventory Tool and provides the GHG emissions outputs from the tool; it does not expand on the calculation methods within the tool. Documentation for the EPA Local GHG Inventory Tool can be found on the EPA website at: <https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool>.

3.1 GREENHOUSE GASES AND GLOBAL WARMING POTENTIAL

GHG emissions other than carbon dioxide (CO₂) 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). CO₂ has a GWP factor of one, while all other GHGs have GWP factors measured in multiples of one relative to the GWP of CO₂. This conversion of non-CO₂ gases to one unit enables the reporting of all emissions in terms of carbon dioxide equivalent (CO₂e), 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 (MTCO₂e). For this emissions inventory and forecast, the three primary and most abundant GHGs were accounted for: CO₂, methane (CH₄) and nitrous oxide (N₂O).

Consistent with the best available science, the inventory uses GWP factors published in the Fifth Assessment Report (AR5) from Intergovernmental Panel on Climate Change (IPCC), where CH₄ and N₂O have GWP factors of 28 and 265, respectively (IPCC 2014). These values represent the GWP of GHG on a 100-year time horizon. This means that CH₄ is approximately 28 times stronger than CO₂ and N₂O is 265 times stronger than CO₂ in their potential to warm Earth's atmosphere over the course of 100 years. The use of 100-year GWP values is consistent with the California Air Resources Board (CARB) and EPA GHG accounting methods.

3.2 DATA REVIEW

The general approach for developing the GHG emissions inventory involved the collection of total activity and/or emissions data for Kern county for the year 2022 for each relevant GHG emissions source and then apportioning that data to individual jurisdictions and sectors using appropriate attribution metrics. These metrics include the City of California City's contribution to total countywide population, commercial building floor space, and agricultural land acreage. In some cases, such as for landfilled solid waste and industrial facilities, jurisdiction-specific data were available from publicly available resources.

The primary data sources used to compile activity and emissions data for all of Kern county are listed in Table 3.

Table 3 Data Sources for Countywide Activity and Emissions Data

GHG Emission Source	Data Source(s)
Mobile On-road	CARB EMFAC2021 on-road emission inventory model (CARB 2022a)
Mobile Off-road	CARB OFFROAD2021 off-road emission inventory model (CARB 2022b)

GHG Emission Source	Data Source(s)
Stationary Energy	CEC energy database (CEC 2023), EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases
Electricity	CEC energy database (CEC 2022), Pacific Gas & Electric Co (PG&E)
Imported Water	Water Association of Kern County
Agriculture	CDFA's fertilizing materials tonnage report (CDFA 2025)
Other Industrial Sources	EPA FLIGHT database (EPA 2023)

Notes: CARB = California Air Resources Board; ; CDFA = California's Department of Food & Agriculture CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

Attribution metrics were used to apportion countywide activity and/or emissions data to individual jurisdictions by the appropriate GHG emissions sector. These attribution metrics include:

- ▶ population share for allocating activity associated with the residential sector (US Census Bureau 2025),
- ▶ commercial building floor space share for activity associated with the commercial/institutional sector (Open Energy Data Initiative 2020), and
- ▶ farmland, grazing land, and other agricultural land cover types share for the agricultural sector (DOC 2022).

These attribution metrics and the associated values for each jurisdiction in Kern county are shown in Table 4 below.

Table 4 Attribution Metrics Used to Apportion Countywide Activities and GHG Emissions

Jurisdiction	Population	Population %	Agricultural Land Acreage	Agricultural Land Acreage %	Commercial Building Floor Space in Square Footage	Commercial Building Floor Space in Square Footage %
California City	19,613	2.2%	1,487	0.1%	1,400	0.9%
Bakersfield	404,321	44.6%	41,684	1.5%	79,800	50.7%
California City	15,002	1.7%	112	0.0%	1,000	0.6%
Delano	50,498	5.6%	4,141	0.2%	5,800	3.7%
Maricopa	1,217	0.1%	558	0.0%	—	0.0%
McFarland	13,971	1.5%	2,754	0.1%	600	0.4%
Ridgecrest	28,118	3.1%	62	0.0%	4,000	2.5%
Shafter	20,162	2.2%	19,419	0.7%	10,700	6.8%
Taft	7,414	0.8%	4,507	0.2%	1,000	0.6%
Tehachapi	12,855	1.4%	2,764	0.1%	1,700	1.1%
Wasco	26,317	2.9%	3,421	0.1%	1,800	1.1%
Unincorporated County	307,395	33.9%	2,666,205	97.1%	49,700	31.6%
Kern County Total	906,883	100%	2,747,115	100%	157,500	100%

Note: Population and agricultural land acreage data reflect conditions in 2022. The most recent data available for commercial building floor space was from 2019, which was used as the attribution metric in this analysis. Because the calculations relied on percentage shares rather than absolute floor space values, using 2019 data was considered appropriate for consistency across jurisdictions.

Sources: US Census Bureau 2025; DOC 2022; Open Energy Data Initiative 2020; analysis conducted by Ascent in 2025.

For the wastewater and solid waste emissions sources, as well as the industrial emissions sector, data and information were collected at the jurisdiction level to calculate associated GHG emissions.

For wastewater, jurisdiction-specific data were obtained from a variety of sources, including any publicly available data about wastewater treatment plant operations. When such data were not publicly available, default values from the EPA Local GHG Inventory Tool and the Local Governments for Sustainability *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* were used to fill data gaps.

For solid waste, jurisdiction-specific disposal data were sourced from the California Department of Resources Recycling and Recovery (CalRecycle), specifically from the Jurisdiction Disposal and Beneficial Reuse by Destination database.

For the industrial emissions sector, jurisdiction-specific emissions data were also obtained directly from the EPA FLIGHT and CARB MRR databases, which report facility-level emissions for large industrial sources.

Data sources for jurisdiction-specific activity and emissions data are shown in Table 5 below.

Table 5 Data Sources for Jurisdiction-Specific Activity and Emissions Data

GHG Emission Source/Sector	Data Source(s)
Wastewater	ICLEI (ICLEI 2019)
Solid Waste	CalRecycle's Jurisdiction Disposal and Beneficial Reuse by Destination database (CalRecycle 2025), EPA FLIGHT database (EPA 2023)
Industrial Sector	EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases

Notes: ICLEI = Local Governments for Sustainability; CalRecycle = California Department of Resources Recycling and Recovery; CARB = California Air Resources Board; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

3.3 INVENTORY METHODS BY GHG EMISSIONS SOURCE

This section details the data and methods used to calculate GHG emissions in the 2022 inventory, organized by emissions source. It presents the corresponding data inputs into the EPA Local GHG Inventory Tool, any data processing that was performed, and the resulting emissions estimates by source and sector for the City of California City. All calculations of GHG emissions use the IPCC AR5 GWP values to convert GHG emissions results to CO₂e.

3.3.1 Mobile On-road

The Mobile On-road 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." The estimation of these emissions relies on EMFAC2021, a statewide mobile source emissions inventory model developed by CARB. EMFAC2021 was used instead of the EPA Local GHG Inventory Tool to calculate mobile on-road GHG emissions because EMFAC2021 provides GHG emissions estimates that more closely represent the vehicle fleet operating on roadways in Kern County. The EPA Local GHG Inventory Tool utilizes national fuel efficiency averages for a select number of vehicle types to calculate GHG emissions, whereas EMFAC2021 considers fuel efficiency by vehicle type and model, providing more accurate estimates of fuel consumption and GHG emissions.

To calculate emissions for the 2022 inventory year, total countywide vehicle miles traveled (VMT) were first obtained from EMFAC2021. These VMT figures were then allocated to emission sectors defined by the EPA's Local GHG Inventory Tool based on vehicle class, specifically, the residential and commercial/institutional sectors. For the purposes of sector-specific emissions calculations, light-duty vehicles were attributed to the residential sector, as they primarily reflect personal vehicle use by residents. In contrast, medium- and heavy-duty trucks were attributed to the commercial/institutional sector, as these vehicle types are more commonly associated with goods movement, service fleets, and business operations. Sector-specific VMT totals were then apportioned to each jurisdiction based on appropriate attribution metrics: population share for residential VMT and commercial building square footage share for commercial/institutional VMT.

EMFAC2021 was also used to generate countywide GHG emissions factors for the two sectors, expressed in MTCO₂e per vehicle mile traveled. These factors accounted for all vehicle classes, model years, speeds, and fuel types. The sector-specific factors were derived by dividing total countywide emissions of CO₂, CH₄, and N₂O (converted to CO₂e using the appropriate GWP) by the corresponding sector-specific countywide total VMT, with emissions and VMT categorized into the residential and commercial/institutional sectors based on vehicle class.

Finally, each jurisdiction's total Mobile On-road emissions by sector were calculated by multiplying the jurisdiction's sector-specific VMT by the respective countywide sector-specific MTCO₂e per VMT emissions factors. Table 6 presents the City of California City's total Mobile On-road VMT, associated sector-specific GHG emissions factors, and the resulting total GHG emissions by sector.

Table 6 City of California City Mobile On-road Data Inputs and Results

Vehicle Sector	Total Activity (VMT)	GHG Emissions Factor (MTCO ₂ e/VMT)	GHG Emissions (MTCO ₂ e)
Residential	120,328,851	0.00035	38,708
Commercial/Institutional	25,933,199	0.0011	25,987

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: CARB 2022a; analysis conducted by Ascent in 2025.

3.3.2 Mobile Off-road

Emissions from Mobile Off-road sources result from the combustion of fuel in various types of off-road vehicles and equipment (e.g. agricultural tractors, construction equipment). Emissions data for these sources were obtained from CARB's OFFROAD2021 model, which provides detailed estimates for Kern county for the 2022 inventory year. The data include, but are not limited to, information on equipment categories, fuel types, and the amount of fuel consumed.

Using the off-road vehicle categories in OFFROAD2021, the emissions data were organized into two relevant sectors defined by the EPA Local GHG Inventory Tool: agricultural and commercial/institutional. Sector-specific off-road fuel consumption totals were then apportioned to each jurisdiction using appropriate attribution metrics. Specifically, the share of farmland, grazing land, and other agricultural land was used to allocate agricultural emissions, while the commercial building square footage share was used to distribute commercial/institutional emissions.

Finally, each jurisdiction's sector-specific off-road fuel consumption data were entered into the "Mobile-Data" sheet of the EPA Local GHG Inventory Tool to calculate Mobile Off-road emissions. The EPA Local GHG Inventory Tool includes emissions factors by fuel type. Table 7 presents the City of California City's total Mobile Off-road fuel consumption by fuel type and the resulting total GHG emissions by sector.

Table 7 City of California City Mobile Off-road Data Inputs and Results

Vehicle Sector	Diesel Consumption (gallons)	Gasoline Consumption (gallons)	Liquefied Natural Gas (LNG) Consumption (gallons)	Total Fuel Consumption (gallons)	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	592	11	—	603	5,728
Agricultural	394,683	172,679	9,529	576,891	6

Notes: GHG = greenhouse Gas; LNG = liquefied natural gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CARB 2022b, analysis conducted by Ascent in 2025.

3.3.3 Stationary Energy

The stationary energy source of GHG emissions includes natural gas combustion in residential, commercial/institutional and industrial uses. Residential uses primarily consume natural gas for space and water heating, and cooking. Commercial/institutional uses may include space heating and cooling, cooking in restaurants, and smaller boilers or generators. Industrial uses are often process-specific uses tied to manufacturing or heavy operations such as process heating, steam generation, and boiler systems. Propane fuel usage was not included in the stationary energy-related calculations as propane usage data for these various uses was not available at the same level of detail or consistency as other stationary energy data sources at the county scale.

RESIDENTIAL AND COMMERCIAL/INSTITUTIONAL

Total countywide natural gas usage data for the 2022 inventory year was obtained from the CEC Energy Reports: Gas Consumption by County, which categorizes usage into residential and non-residential sectors. Residential natural gas consumption was allocated to each jurisdiction based on its share of the county's population.

To isolate commercial/institutional usage, countywide industrial natural gas consumption, sourced from the EPA FLIGHT database and CARB MRR database, was subtracted from the CEC total non-residential usage. The resulting commercial/institutional natural gas usage was then apportioned to each jurisdiction using commercial building floor space share as the attribution metric.

Finally, each jurisdiction's residential and commercial/institutional natural gas usage data were entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate residential and commercial/institutional stationary energy emissions. Table 8 below shows the City of California City's total stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions in residential and commercial/institutional sectors.

Table 8 City of California City Residential and Commercial/Institutional Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Residential	157,990	8,687
Commercial/Institutional	71,056	3,907

Notes: mcf = thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

INDUSTRIAL

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the City of California City. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

For the City of California City, the databases showed that no large industrial facilities are located within its geographic boundary, therefore, there is no reported industrial stationary energy associated activity or GHG emissions for the City of California City.

3.3.4 Electricity

The electricity source addresses energy-related indirect GHG emissions resulting from the consumption of grid-supplied electricity within the City of California City's boundary. Consumption of grid-supplied electricity is considered an "indirect" GHG emissions source, because GHG emissions occur at the source of electricity generation, which is usually outside of a jurisdiction's boundary. The location-based method was used to calculate electricity GHG emissions, which uses regional grid-average emission factors. In the United States, these factors are provided by the EPA's Emissions & Generation Resource Integrated Database (eGRID). Specifically, emission factors for the CAMX eGRID subregion were applied, as this subregion encompasses the geographic area of Kern county.

Total electricity usage data for Kern county in 2022 was obtained from CEC Energy Reports: Electricity by County, which categorized usage into residential and non-residential sectors (CEC 2023). Electricity usage data for the City of Bakersfield, which was also separated into residential and non-residential categories, was acquired directly from the Pacific Gas and Electric Company (PG&E). To estimate electricity usage for the rest of the county (i.e., all jurisdictions excluding Bakersfield), the City of Bakersfield's electricity data was subtracted from the total Kern county data.

Residential electricity usage outside of Bakersfield was apportioned to each jurisdiction based on its share of the county's total population. For non-residential electricity usage, estimates were further categorized into industrial and commercial/institutional sectors using attribution metrics derived from natural gas consumption data previously calculated under stationary energy. In 2022, 93.1 percent of the county's stationary natural gas combustion was attributed to industrial use and 6.9 percent to commercial/institutional use. These same ratios were applied to the county's total non-residential electricity usage, under the assumption that the sectoral split in electricity usage mirrors that of natural gas usage. This assumption was validated using available industrial electricity and natural gas usage data in PG&E's service territory, from the CEC Energy Reports. The electricity-to-gas ratio, expressed as gigawatt-hour per million therms, was calculated by dividing total industrial electricity usage by industrial natural gas consumption for the service territory. The resulting value closely aligns with the assumptions applied in this here, supporting its validity.

The City of California City's share of commercial building square footage was used to attribute commercial/institutional electricity usage. Industrial electricity usage was attributed based on the proportion of countywide industrial natural gas within the City of California City. Finally, the sector-specific electricity usage data for each jurisdiction was entered into the "Electricity-Data" sheet of the EPA Local GHG Inventory Tool to calculate associated GHG emissions.

Table 9 below shows the City of California City's electricity activity data and the associated GHG emissions by emission sectors.

Table 9 City of California City Electricity Energy Data Inputs and Results

Sector	Total Activity (kWh of Electricity Consumed)	GHG Emissions (MTCO ₂ e)
Residential	56,111,019	12,709
Commercial/Institutional	9,787,990	2,217
Industrial	—	—

Notes: kWh = kilowatt-hour; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; PG&E 2025; analysis conducted by Ascent in 2025.

3.3.5 Imported Water

The water source category captures GHG emissions from energy use associated with the conveyance, treatment, and distribution of water within a jurisdiction. In Kern county, the WAKC reports that approximately 166,000 acre-feet of water are used annually for municipal and industrial purposes, and 2,294,000 acre-feet for agricultural purposes.

In addition to local surface water, Kern county draws water from several sources. Among these, only water supplied through the State Water Project (SWP) and the federal Central Valley Project (CVP) is considered imported, and therefore potentially results in GHG emissions due to long-distance conveyance. All other sources are classified as local. It was assumed that energy used for extracting, conveying, treating, and distributing local water is captured under the emissions estimates for stationary energy and electricity, since these activities occur within the county. In addition, upon further review, it was also determined that the federal CVP does not consume energy for water delivery to Kern County, as water is primarily conveyed using gravity (Friant Water Authority 2019). As a result, only the SWP, which accounts for 26 percent of the county's water supply, contributes to GHG emissions Table 10 provides a summary of the water sources in Kern county and their contribution to the total water supply.

Table 10 Kern County Water Sources

Source	Percentage
Kern River	20%
State Water Project (California Aqueduct)	26%
Federal Central Valley Project (Friant-Kern Canal)	12%
Local Streams and Other Sources (Poso Creek, Kern River, etc.)	6%

Source	Percentage
Groundwater	36%
Total	100%

Source: WAKC n.d.

Water use in Kern County is characterized into municipal and industrial, and agricultural sectors in data obtained from WAKC. It is assumed that water included in “municipal” uses is delivered to both commercial and residential customers. However, sufficient data was not available to disaggregate the water consumption between industrial, commercial, and residential customers. For the purpose of this GHG emissions inventory, all non-agricultural water consumption was categorized under the commercial/institutional sector.

To allocate sector-specific water usage to individual jurisdictions, the following attribution metrics were used:

- ▶ Agricultural water use was apportioned based on each jurisdiction’s share of farmland, grazing land, and other agricultural land.
- ▶ Commercial/institutional water use was distributed according to the share of commercial building square footage in each jurisdiction.

These apportioned figures were then entered into the “Imported Water” sheet of the EPA Local GHG Inventory Tool, applying a universal 26 percent imported water rate, to estimate the associated GHG emissions from water conveyance and use. Table 11 presents the City of California City’s activity data related to imported water, including the percentage of total water supply that is imported and the associated GHG emissions.

Table 11 City of California City Imported Water Energy Data Inputs and Results

Sector	Total Activity (Gallons of Water)	Percentage of Water Imported	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	232,647,502	26%	295
Agricultural	7,911,595		10

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: WAKC n.d.; analysis conducted by Ascent in 2025.

3.3.6 Wastewater

The wastewater source accounts for GHG emissions resulting from the treatment of sewage. To support this analysis, a review of publicly available wastewater treatment characteristics was conducted to collect the data required for completing the “Wastewater-Control” tab of the EPA’s Local GHG Inventory Tool. The data sources and corresponding assumptions for the City of California City’s wastewater treatment systems are summarized in Table 12. Where jurisdiction-specific data were not publicly available, the default input values provided by the EPA tool were used.

To estimate GHG emissions, population data for each jurisdiction were subsequently entered into the “Wastewater-Entry” tab of the tool. The resulting emissions estimates are also presented in Table 12, alongside the data sources and assumptions used.

Table 12 City of California City Wastewater Treatment Assumptions

Wastewater Process/Treatment Type	Conditions Assumed	Data Source	GHG Emissions (MTCO ₂ e)
Population served by septic systems	37 percent of the city’s population	Obtained according to the City’s Local Agency Management Program for Onsite Wastewater Treatment System.	5,302
One or more wastewater treatment plants (WWTPs) where wastewater is	Anerobic	No public information is available. The default value is anerobic.	

Wastewater Process/Treatment Type	Conditions Assumed	Data Source	GHG Emissions (MTCO ₂ e)
treated in aerobic or anaerobic conditions			
One or more WWTPs conduct or do not conduct nitrification/denitrification	No nitrification/denitrification	No public information is available. The default value is no nitrification/denitrification.	

Notes: WWTP = wastewater treatment plant; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; ICLEI = Local Governments for Sustainability.

Sources: ICLEI 2019; analysis conducted by Ascent in 2025.

3.3.7 Solid Waste

Community-generated solid waste emissions are primarily associated with the decomposition of solid waste in landfills. There are two methods for accounting for GHG emissions associated with waste disposal:

- ▶ Waste generation method – Accounts for the total GHG emissions that would be generated over time as municipal solid waste (MSW) that is sent to a landfill in only the inventory year decomposes.
- ▶ Waste-in-place method – Accounts for the total GHG emissions generated in a given year at a specific landfill location by the decomposition of all MSW previously disposed at the landfill.

Generally, there is some risk of double counting GHG emissions when combining both of these methods, as a portion of the emissions accounted for using the waste generation method may occur at an in-boundary landfill that has emissions reported using the waste-in-place method. However, the scale of the overlapping GHG emissions between the two methods would be expected as very small in comparison to total emission using either accounting method.

WASTE GENERATION

Landfill tonnage data for 2022 was obtained from CalRecycle’s Jurisdiction Disposal and Beneficial Reuse by Destination database. This data was entered into the EPA’s Waste Reduction Model (WARM Tool) as “mixed MSW” to estimate waste generation emissions. The default national average values were used in the WARM Tool, except for Question 7, where the k value was set to “dry” based on the county’s annual precipitation (less than 20 inches) (NCEI 2025). The WARM output was then imported into the EPA Local GHG Inventory Tool’s “Waste Production” tab, with solid-waste associated emissions attributed to the residential sector by default.

The total activity for solid waste disposal and the resulting waste generation GHG emissions results from the WARM Tool are provided in Table 13.

Table 13 City of California City Waste Generation Data Inputs and Results

Sector	Total Activity (tons of MSW disposed)	GHG Emissions (MTCO ₂ e) (WARM Output)
Residential	10,810	3,120

Notes: MSW = mixed municipal solid waste; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; WARM = Waste Reduction Model.

Source: CalRecycle 2025; analysis conducted by Ascent in 2025.

WASTE-IN-PLACE

EPA’s FLIGHT database was reviewed to determine emissions from landfills located within the City of California City’s geopolitical boundary, which would provide emissions data for any landfills that generated emissions greater than 25,000 MTCO₂e in 2022. No reporting landfills were identified for the City of California City.

3.3.8 Agriculture

The agriculture emissions source captures GHG emissions generated from fertilizer application.

FERTILIZER APPLICATION

Fertilizer application results in GHG emissions primarily due to the release of N₂O, a potent GHG with a global warming potential nearly 300 times greater than CO₂. When nitrogen-based fertilizers are applied to soil, a portion of the nitrogen undergoes microbial processes (nitrification and denitrification), which convert it into N₂O. These emissions can occur directly from the soil or indirectly through leaching and runoff.

The total tonnage of nitrogen in synthetic fertilizers applied in Kern county during the 2022 inventory year was obtained from CDFA's fertilizing materials tonnage report. This countywide total was then apportioned to individual jurisdictions based on each jurisdiction's proportional share of farmland, grazing land, and other agricultural land. Only data for synthetic fertilizers was publicly available for calculation, although other organic or manure-based fertilizers may be used.

The resulting tonnage of nitrogen in synthetic fertilizers estimated for the City of California City was entered into the "Agriculture & Land Management" sheet of the EPA's Local GHG Inventory Tool to calculate the associated emissions. Table 14 provides the estimated total tons of nitrogen applied and resulting GHG emissions.

Table 14 City of California City Fertilizer Application Data Inputs and Results

Sector	Total Activity (tons of nitrogen applied)	GHG Emissions (MTCO ₂ e)
Agricultural	2	12

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CDFA 2025; analysis conducted by Ascent in 2025.

4 GREENHOUSE GAS EMISSIONS FORECAST METHODS

This section provides the methods and data used to project future GHG emissions under a BAU scenario, as well as the calculations of reductions from adopted legislation and regulations under an ABAU scenario.

The BAU GHG emissions forecasts assess how emissions generated by community activities will change over time without further State, federal, regional, or local action. The BAU scenario forecast accounts for the changes in population and employment that can influence communitywide GHG emissions. The ABAU scenario forecast includes adopted policies and regulations at the State and federal levels that would affect emissions without any local action, such as regulatory requirements to increase vehicle fuel efficiency and increase renewable energy sources in grid electricity portfolios. These forecasts provide the City of California City with information needed to understand specific GHG emissions sources with the greatest opportunities for reduction with future plans, projects, or programs. It is important to note that the ABAU forecasts only account for emissions reductions associated with adopted policies and regulations; they do not account for proposed and/or unadopted GHG reduction actions established by regional, State, and federal agencies or executive orders outside of adopted legislation and regulations.

The GHG emissions forecasts project GHG emissions for the years 2030, 2040, and 2045 to align with key regulatory timelines for the State. Two key legislative actions establish statewide GHG reduction targets for the years 2030 and 2045, including:

- ▶ Senate Bill (SB) 32 of 2016, which sets a statewide GHG reduction target for the year 2030, and
- ▶ Assembly Bill 1279 of 2022, which sets a statewide GHG reduction target for the year 2045.

The forecast years selected do not necessarily align with the targets established by adopted legislation, but they do provide an analysis of emissions that aligns with the relevant horizon years. The year 2040 was also included in the analysis as an interim year between the 2030 and 2045 forecast years.

4.1 GROWTH PROJECTIONS

GHG emissions forecasts were developed based on projected changes in Kern county’s demographics, specifically population, employment, and service population (defined as residents plus employees), between 2022 and 2045. These projections were obtained from the Regional Growth Forecast and Demographic Forecast prepared by the Kern COG (Kern COG 2024). It is assumed that the incorporated cities and the unincorporated county will experience demographic growth at the same rate as the county overall, as jurisdiction-specific growth projections were not available at the time of this analysis.

Between 2022 and 2045, Kern county’s population and employment are projected to increase by approximately 11.1 and 15.5 percent, respectively. The service population is expected to grow by 12.4 percent. These growth factors were applied to forecast GHG emissions for the years 2030, 2040, and 2045 across various emissions sources included in the inventory. The values used for population, employment, and service population used to project future emissions are provided in Table 15.

Table 15 Kern County Demographics and Calculated Growth Rates for Future Emissions Forecasts

Calculation Factor	2022	2030	2040	2045
Population				
Total Kern County	906,883	949,134	994,167	1,007,627
Kern County Growth from 2022		4.7%	9.6%	11.1%
Employment				
Total Kern County	358,961	369,427	399,432	414,652
Kern County Growth from 2022		2.9%	11.3%	15.5%
Service Population				
Total Kern County	1,265,844	1,318,561	1,393,598	1,422,279
Kern County Growth from 2022		4.2%	10.1%	12.4%

Source: US Census Bureau 2025; Kern COG 2024; analysis conducted by Ascent in 2025.

Additional details on how growth factors were applied to individual sources are provided in the following sections. It is important to note that agricultural emissions, including those from fertilizer application, as well as livestock enteric fermentation and manure management, are assumed to remain constant throughout the forecast period, with no projected increase in activity levels. Agricultural activities are difficult to project in any detail, with production intensities, number of livestock, and crop types being highly susceptible to global markets and local climate patterns. As such, projections of agriculture GHG emissions-generating activities are not attempted.

4.2 BUSINESS-AS-USUAL SCENARIO FORECAST

The BAU forecast represents a projection of future GHG emissions based solely on expected demographic and economic growth (e.g., population, employment, and service population) between 2022 and 2045. It does not account for the potential impacts of future policies, programs, or actions that may reduce emissions, such as energy efficiency improvements, renewable energy adoption, or transportation electrification.

In the BAU scenario, GHG emissions factors are held constant at the levels used in the 2022 GHG inventory, meaning the carbon intensity of electricity, fuels, and other activities is assumed not to change over time. As a result, any changes in future emissions are driven entirely by growth in activity levels, not by improvements in emissions performance.

4.2.1 Business-As-Usual Scenario Forecast Results

Table 16 presents the projected activity data for the City of California City across all forecast years, organized by emissions source and sector. Table 16 also indicates which sources and sectors used population, employment, or service population as a growth metric.

Table 16 City of California City BAU Scenario Projected Activity Data for All Forecast Years

Source	Sector	Growth Metric	Units	2030	2040	2045
Stationary Energy	Residential	Population	scf	165,351	173,196	175,541
Stationary Energy	Commercial/Institutional	Employment	scf	73,128	79,068	82,081
Stationary Energy	Industrial	Employment	scf	—	—	—
Electricity	Residential	Population	kWh	58,725,177	61,511,464	62,344,279
Electricity	Commercial/Institutional	Employment	kWh	10,073,383	10,891,530	11,306,558
Electricity	Industrial	Employment	kWh	—	—	—
Other Industrial	Industrial	Employment	MTCO ₂ e	—	—	—
Agriculture – Fertilizer Application	Agricultural ¹	N/A	ton	2	2	2
Solid Waste	Residential	Population	ton	11,314	11,850	12,011
Wastewater	Commercial/Institutional	Service Population	MTCO ₂ e	5,523	5,837	5,957
Imported Water	Commercial/Institutional	Service Population	Gallon	242,336,315	256,127,285	261,398,485
Imported Water	Agricultural ¹	N/A	Gallon	7,911,595	7,911,595	7,911,595
Mobile On-road	Residential	Population	VMT	125,934,856	131,909,987	133,695,940
Mobile On-road	Commercial/Institutional	Employment	VMT	26,689,346	28,857,019	29,956,634
Mobile Off-road	Commercial/Institutional	Employment	MTCO ₂ e	5,895	6,374	6,617
Mobile Off-road	Agricultural ¹	N/A	MTCO ₂ e	6	6	6

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; scf = standard cubic foot.

¹ Activity levels for the agricultural sector are assumed to remain constant over the forecast period; therefore, growth metrics are listed as “N/A.”

Source: Analysis conducted by Ascent in 2025.

Table 17 below presents the projected GHG emissions for the City of California City across all forecast years, also organized by emissions source and sector.

Table 17 City of California City BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	9,046	9,476	9,604
Stationary Energy	Commercial/Institutional	MTCO ₂ e	4,001	4,326	4,491
Stationary Energy	Industrial	MTCO ₂ e	—	—	—
Electricity	Residential	MTCO ₂ e	13,300	13,931	14,120
Electricity	Commercial/Institutional	MTCO ₂ e	2,281	2,467	2,561
Electricity	Industrial	MTCO ₂ e	—	—	—
Other Industrial	Industrial	MTCO ₂ e	—	—	—

Source	Sector	Units	2030	2040	2045
Agriculture – Fertilizer Application	Agricultural	MTCO ₂ e	12	12	12
Solid Waste	Residential	MTCO ₂ e	3,265	3,420	3,466
Wastewater	Commercial/Institutional	MTCO ₂ e	5,523	5,837	5,957
Imported Water	Commercial/Institutional	MTCO ₂ e	308	325	332
Imported Water	Agricultural	MTCO ₂ e	10	10	10
Mobile On-road	Residential	MTCO ₂ e	40,512	42,434	43,008
Mobile On-road	Commercial/Institutional	MTCO ₂ e	26,744	28,916	30,018
Mobile Off-road	Commercial/Institutional	MTCO ₂ e	5,895	6,374	6,617
Mobile Off-road	Agricultural	MTCO ₂ e	6	6	6

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

4.3 LEGISLATIVE-ADJUSTED BUSINESS-AS-USUAL SCENARIO FORECAST

ABAU emissions forecasts were prepared using the same demographic data that were used for the BAU forecasts, while also accounting for State and federal policies and regulations that would affect local emissions. These forecasts provide the City of California City with a more robust understanding of future community emissions based on the GHG reduction efforts at the state and federal level. A summary of applicable legislative reductions is provided in Table 18.

Table 18 Legislative Reductions Summary

Source	Legislative Reduction	Description	Sources Applied
State	Renewable Energy and Zero-Carbon Electricity Requirements [SB 1020 and SB 100]	Requires California energy utilities to procure 60 percent of electricity from eligible renewable and zero-carbon sources by 2030, 95 percent by 2040, and 100 percent by 2045.	Electricity, Imported Water
State	California's Building Energy Efficiency Standards (2019 and 2022 Title 24, Part 6)	Requires all new buildings in California to comply with energy efficiency standards established by CEC. Accounts for the energy efficiency gains in new residential and nonresidential buildings.	Stationary Energy, Electricity
State	Advanced Clean Car I Regulation	Establishes GHG emission reduction standards for model years 2017 through 2025 that are more stringent than federal CAFE standards.	Mobile On-road
State	Truck and Bus Regulation	Requires diesel trucks and buses that operate in California to be upgraded to reduce GHG emissions.	Mobile On-road
Federal	Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles	Establishes fuel efficiency standards for medium- and heavy-duty engines and vehicles.	Mobile On-road

Notes: CAFE = Corporate Average Fuel Economy; CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; SUV = sports utility vehicle; SB = Senate Bill.

4.3.1 Title 24 Adjustments

Future energy use was adjusted to reflect increased emissions-intensity stringency under California's Building Energy Efficiency Standards (California Code of Regulations Title 24 Part 6, hereafter referred to as "Title 24"). Although Title 24 applies to both new residential and nonresidential construction, for the purposes of this forecast, adjustments were applied only to residential construction for reasons described below.

This approach accounts for uncertainties in energy consumption patterns and end uses in nonresidential buildings, and uncertainty in the non-residential building types that would be constructed in the future. Title 24 primarily regulates energy efficiency in building envelopes and lighting systems. This is expected to substantially reduce energy consumption for building types where the primary end uses of energy are lighting and heating, ventilation, and air conditioning, such as new office, institutional, and hotel buildings. However, Title 24 may not significantly affect other high-energy-consuming uses in nonresidential facilities, such as process loads or specialized equipment. As such, limiting adjustments to residential construction provides a more conservative and reliable estimate of future energy-related GHG emissions.

The 2019 Title 24 standards apply to projects constructed after January 1, 2020, while the 2022 standards apply after January 1, 2023. The 2025 Title 24 will go into effect statewide in January of 2026; however, detailed data on the changes in building-level energy consumption between the 2025 code and previous code cycles was not available at the time of this analysis. To estimate changes in future energy consumption under the 2022 standards, electricity and natural gas adjustment factors were calculated based on differences in average residential energy use between buildings built to the 2019 and 2022 standards. These factors were derived from CEC's data specific to the 2019 and 2022 standards and climate zone-based energy usage rates. For the City of California City, Climate Zone 13 was used in the analysis.

These adjustment factors were then applied to the ABAU forecasts of energy consumption activity for both stationary energy and electricity use to reflect the impact of legislative energy efficiency improvements on future development. The adjustment factors, presented in Table 19, show the percentage change in energy use for buildings built to 2022 standards relative to those built to 2019 standards. Positive values indicate an anticipated increase in energy use, while negative values indicate an anticipated decrease in energy use.

As shown in Table 19:

- ▶ ABAU electricity activity is projected to be higher than BAU in each forecast year due to positive adjustment factors.
- ▶ ABAU stationary energy activity is projected to be lower than BAU due to negative adjustment factors.

Importantly, these adjustments were applied only to energy use growth occurring after the 2022 baseline, reflecting new development that would be subject to the 2022 Title 24, or a later cycle of standards. In addition, it is important to note that although average electricity use in new residential buildings is anticipated to rise under 2022 Title 24 (due to an increase in electrical demand associated with electric appliances installed instead of natural gas appliances), emissions from new residential buildings are expected to be lower than they would be under 2019 Title 24 as a result of overall lower building emissions intensities (due to lower emissions factors associated with electricity compared to natural gas).

Table 19 Stationary Energy and Electricity Adjustment Factors and Activity Forecast Results for Residential Buildings

Energy Type	Forecast Scenario	Adjustment Factor	Activity Units	2022	2030	2040	2045
Electricity	BAU	—	kWh	56,111,019	58,725,177	61,511,464	62,344,279
Electricity	ABAU	+12%	kWh	56,111,019	59,037,801	62,157,296	63,089,705
Stationary Energy (Natural Gas)	BAU	—	mcf	157,990	165,351	173,196	175,541
Stationary Energy (Natural Gas)	ABAU	-29%	mcf	157,990	163,209	168,771	170,433

Notes: BAU = Business-as-Usual; ABAU = legislative-adjusted BAU; mcf = one thousand cubic feet; kWh = kilowatt-hour.

Source: Analysis conducted by Ascent in 2025.

4.3.2 Senate Bill 100 and Senate Bill 1020 Adjustments

SB 100 requires that 100 percent of retail electricity sales in California come from renewable and zero-carbon resources by 2045. This legislation builds upon the state’s existing Renewables Portfolio Standard (RPS) by increasing the required percentage of RPS-eligible renewable electricity over time. SB 1020 builds on SB 100 by introducing interim targets for GHG-free electricity for the years 2035 and 2040. As shown in Table 20, SB 100 and SB 1020 require utility providers to supply electricity that is 60 percent GHG-free by 2030, 95 percent by 2040, and 100 percent by 2045. The emissions sources affected by these adjustments include electricity and imported water, both of which are estimated based on the carbon intensity of the electricity grid.

To estimate future GHG emissions factors, the 2022 GHG-free electricity percentage and GHG emissions factors for the CAMX eGRID subregion were first obtained from the EPA’s eGRID database. Using these 2022 values as a baseline, emissions factors for the forecast years (2030, 2040, and 2045) were calculated based on the GHG-free electricity targets established by SB 100 and SB 1020.

Table 20 below demonstrates these GHG-free electricity percentage baseline values and targets, as well as the baseline and calculated emissions factors for the forecast years. Given 2045’s 100 percent GHG-free electricity percentage target, the emissions factor for 2045 is 0. In contrast to the ABAU forecast, the CAMX eGRID emissions factors under the BAU scenario are assumed to remain constant at their 2022 baseline values throughout the forecast years.

Table 20 CAMX eGRID Electricity GHG Emissions Factors Adjusted for SB100 and SB1020

Calculation Factor	Units	2022	2030	2040	2045
SB 100 and SB 1020 GHG-free electricity percentage targets	Percent GHG-free	N/A	60%	95%	100%
CAMX eGRID GHG-free electricity percentage baseline and targets	Percent GHG-free	50%	60%	95%	100%
CAMX eGRID baseline and interpolated emissions factors	MTCO ₂ e/MWh	0.2265	0.1819	0.0227	0

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MWh = megawatt-hour; N/A = Not Applicable.

Source: Analysis conducted by Ascent in 2025.

4.3.3 On-road Vehicle Emissions Standards

State and federal regulations are expected to significantly reduce on-road GHG emissions by requiring improvements in vehicle fuel efficiency and accelerating the transition to zero-emission vehicles (ZEVs). The ABAU forecast for the Mobile On-road source takes into consideration the following State and federal regulations:

- ▶ Innovative Clean Transit Regulation, which requires all California public transit agencies to begin phasing in zero-emission buses (ZEB) starting in 2023 and transition to 100 percent ZEB fleets by 2040 and
- ▶ Advanced Clean Trucks Regulation, which requires truck and van manufacturers to sell a growing share of ZEVs beginning in model year 2024.

All these regulations are reflected in EMFAC2021’s emissions data for the forecast years (2030, 2040 and 2045), which serve as the basis for the Mobile On-road source’s ABAU forecast. In addition to these regulations, EMFAC2021’s data also takes into consideration future increases in light-duty ZEV sales, which would be influenced by California’s Advanced Clean Cars I regulation.

Accordingly, EMFAC2021’s VMT and emissions estimates for forecast years were used to calculate Mobile On-road emissions under the legislative adjustment scenario. As with the inventory methodology, sector-specific emissions factors for each forecast year were calculated by dividing sector-specific VMT by sector-specific emissions for each forecast year. These emissions factors were then multiplied by projected future VMT, which were scaled by relevant activity growth factors (population for the residential sector and employment for the commercial/institutional sector)

to estimate future emissions. The baseline and projected future emissions factors calculated using EMFAC2021 are shown in Table 21.

In contrast, under the BAU scenario, Mobile On-road emissions factors are held constant at their 2022 baseline values for all forecast years, reflecting no change in vehicle efficiency or fleet composition.

Table 21 Mobile On-road Baseline and Projected GHG Emissions Factors

Sector	Units	2022	2030	2040	2045
Commercial Institutional	MTCO ₂ e/VMT	0.0010	0.00090	0.00081	0.00081
Residential	MTCO ₂ e/VMT	0.00032	0.00026	0.00023	0.00023

Notes: MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: Analysis conducted by Ascent in 2025.

4.3.4 Legislative-Adjusted Business-as-Usual Scenario Forecast Results

Table 22 presents the projected GHG emissions for the City of California City across all forecast years under the ABAU scenario, organized by emissions source and sector. Emissions sources and sectors not impacted by legislative adjustments are excluded from this table, as their projected GHG emissions are assumed to remain unchanged from the BAU scenario. The full results for projected GHG emissions for the City of California City across all forecast years under both the BAU and ABAU scenarios, organized by emissions source and sector, can be found in Table 2.

Table 22 City of California City Legislative-Adjusted BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	8,929	9,234	9,324
Electricity	Residential	MTCO ₂ e	10,740	1,413	—
Imported Water	Commercial/Institutional	MTCO ₂ e	247	33	—
Imported Water	Agricultural	MTCO ₂ e	8	1	—
Mobile On-road	Residential	MTCO ₂ e	32,938	30,621	30,504
Mobile On-road	Commercial/Institutional	MTCO ₂ e	23,995	23,275	24,171

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

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Greenhouse Gas Emissions Inventory and Forecast for the City of Delano

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LIST OF ABBREVIATIONS

ABAU	legislative-adjusted BAU
AR5	Fifth Assessment Report
BAU	business-as-usual
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CH ₄	methane
CO ₂	carbon dioxide
CVP	Central Valley Project
eGRID	Emissions & Generation Resource Integrated Database
EPA Local GHG Inventory Tool	EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1
EPA	US Environmental Protection Agency
GHG	greenhouse gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
Kern COG	Kern Council of Governments
MRR	Mandatory Greenhouse Gas Reporting Regulation
MSW	municipal solid waste
MTCO _{2e}	metric tons of carbon dioxide equivalent
N ₂ O	nitrous oxide
PG&E	Pacific Gas and Electric Company
RPS	Renewables Portfolio Standard
SB	Senate Bill
SWP	State Water Project
VMT	vehicle miles traveled
WARM Tool	Waste Reduction Model
ZEB	zero-emission buses
ZEV	zero-emission vehicle

1 INTRODUCTION

This report contains the methods and results for a greenhouse gas (GHG) emissions inventory and GHG emissions forecast for the City of Delano. A GHG emissions inventory provides estimates of emissions generated within a defined geographic boundary during a single year. It identifies the sectors, sources, and activities that produce these emissions and their relative contribution, while also providing a baseline to forecast future emissions trends. A GHG emissions forecast evaluates how GHG emissions may change in the future due to growth and the effects of adopted state and federal legislation and regulations. This information can be used for various purposes, including monitoring GHG emissions trends over time, or as the technical basis for planning efforts to reduce GHG emissions, such as a general plan or greenhouse gas reduction plan.

This report was developed as part of a grant provided to the City of Bakersfield by the US Environmental Protection Agency (EPA) as part of the Climate Pollution Reduction Grants program. The grant was provided to support climate pollution reduction planning in the Bakersfield Metropolitan Statistical Area, which includes the entirety of Kern county. Under this grant, funding was allocated to produce GHG emissions inventories and forecasts for each of the 12 jurisdictions in Kern county, including the City of Bakersfield, unincorporated Kern County, and all incorporated cities. These GHG emissions inventories and forecasts will be provided to the subject jurisdiction, the San Joaquin Valley Air Pollution Control District, and Kern Council of Governments (Kern COG).

The GHG emissions inventory and forecast are intended to provide an accounting of GHG emissions generating activities within the City of Delano geographical boundary for the year 2022, and projections of future emissions based on countywide growth patterns and the effects of adopted state and federal legislation and regulations. This report is accompanied by an Excel-based tool used to develop the GHG emissions inventory, the EPA *Local Greenhouse Gas Inventory Tool: Community Module version 2025.1* (the EPA Local GHG Inventory Tool). The GHG emissions inventory uses only publicly available data sets, many of which provide countywide estimates of GHG emissions generating activity, such as mobile on-road travel, energy consumption, and fertilizer use. This countywide data was scaled down to the jurisdiction level based on various attribution metrics, including population, commercial building floor space, and acres of agricultural use. GHG emissions were then forecasted using countywide growth projections for vehicle travel, population, and employment.

Because countywide data was used and scaled using attribution metrics, rather than jurisdiction-specific data, the GHG emissions inventory and forecast are intended to provide a general scale of GHG emissions for City of Delano's contribution to countywide GHG emissions and serve as a starting point for more detailed GHG emissions analyses. The Excel-based tool can be updated with more locally specific and operational data that can be obtained from relevant departments and direct requests to utility providers. GHG emissions forecasts can be replicated using more locally specific growth projections for population and employment. The results can also be used to set local GHG reduction targets and develop and quantify locally specific measures for reducing GHG emissions. Sufficient detail is provided in this report to ensure that the analyses are replicable, and data inputs can be replaced with more detailed data, if desired.

2 SUMMARY RESULTS

This section presents the results of the GHG emissions inventory and forecast for the City of Delano, providing a comprehensive overview of historical (2022 as the inventory year) and projected (2030, 2040, and 2045 as the forecast years) emissions. The results are organized by emissions sources, including stationary energy, electricity, Mobile On-road, wastewater, solid waste, and others, as well as by sectors, including residential, commercial/institutional, industrial, and agricultural.

This breakdown enables an understanding of the emissions sources and sectors that contribute most significantly to the City of Delano's overall emissions. Section 3 of this report provides additional context and methodology related to each emissions source and sector, including key assumptions, data sources, and allocation methods used in the inventory and forecast development.

2.1 2022 GREENHOUSE GAS EMISSIONS INVENTORY RESULTS

Table 1 below shows the 2022 GHG emissions inventory results for the City of Delano, categorized by emissions sources and sectors. Figure 1 shows the inventory categorized by emission sources, while Figure 2 shows the inventory categorized by emission sectors.

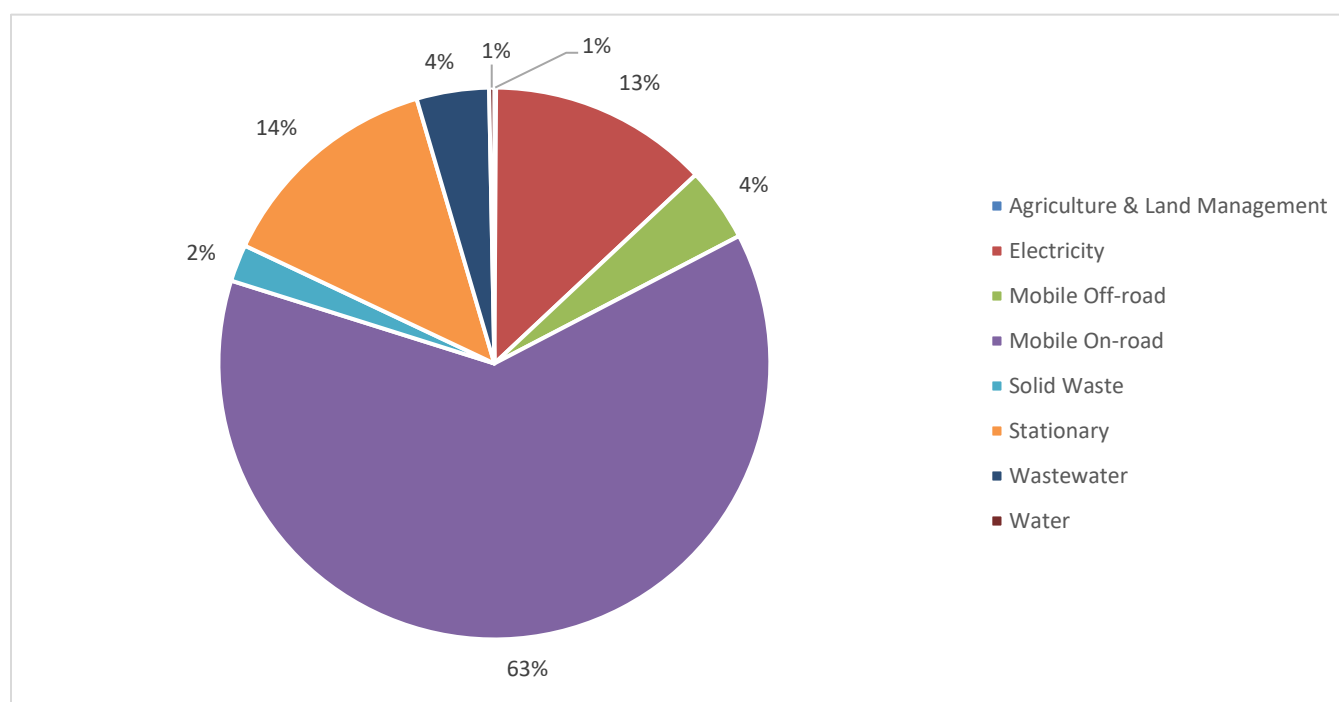
Table 1 City of Delano 2022 GHG Emissions Inventory Results (MTCO₂e)

Emissions Sources	Emissions Sectors				
	Agricultural	Commercial/Institutional	Industrial	Residential	Total
Agriculture & Land Management	450	—	—	—	450
Electricity	—	12,858	2,426	42,780	58,064
Mobile Off-road	234	19,281	—	—	19,516
Mobile On-road	—	150,722	—	130,296	281,018
Solid Waste	—	—	—	9,750	9,750
Stationary Energy	—	22,661	8,484	29,242	60,388
Wastewater	—	19,073	—	—	19,073
Water	372	994	—	—	1,366
Total	1,056	225,590	10,911	212,068	449,625

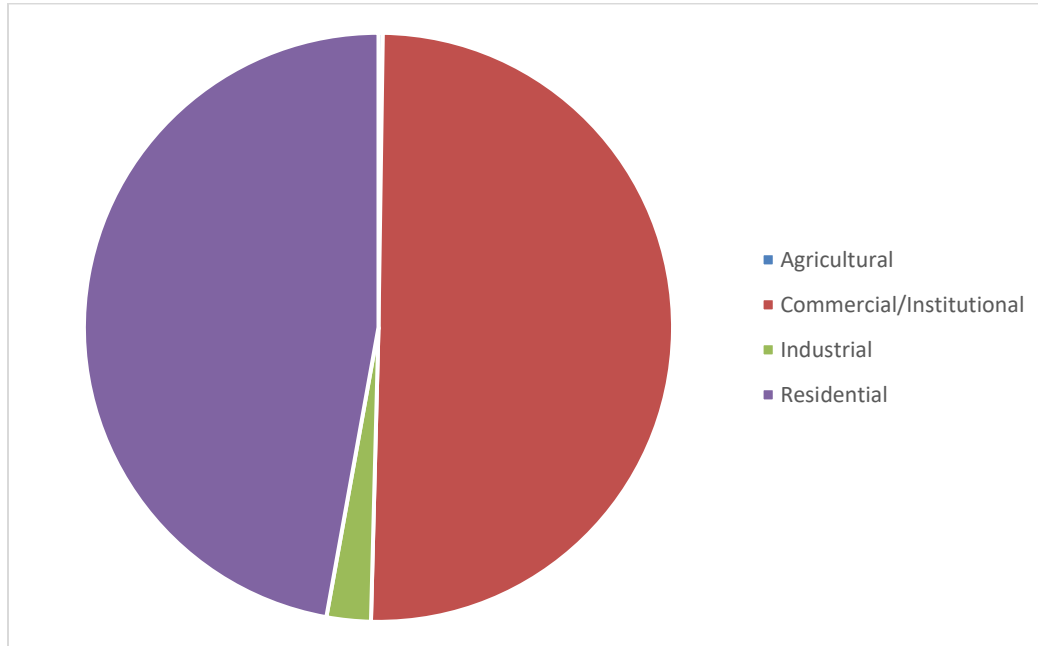
Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 1 City of Delano 2022 GHG Emissions Inventory by Emissions Sources



Source: Analysis conducted by Ascent in 2025.

Figure 2 City of Delano 2022 GHG Emissions Inventory by Emissions Sectors

Note: Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

2.2 GREENHOUSE GAS EMISSIONS FORECAST RESULTS

Table 2 below shows the projected future GHG emissions for the City of Delano for the forecast years 2030, 2040 and 2045 under both a business-as-usual (BAU) scenario, as well as a legislative-adjusted BAU (ABAU) scenario, broken down by both emissions sources and sector. The BAU GHG emissions forecasts estimate how community-generated emissions would change over time without additional actions at the State, federal, regional, or local levels, based solely on projected population and employment growth. The ABAU forecasts incorporate the effects of adopted State and federal policies, such as vehicle fuel efficiency standards and increased renewable energy in the electricity grid, but assume no additional local measures.

Table 2 City of Delano Greenhouse Gas Emissions Forecast for 2030, 2040 and 2045 by Emissions Source and Sector (MTCO₂e)

Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Stationary Energy	Residential	30,451	30,057	31,896	31,081	32,328	31,387
Stationary Energy	Commercial/Institutional	23,205	23,205	25,090	25,090	26,046	26,046
Stationary Energy	Industrial	8,688	8,688	9,394	9,394	9,752	9,752
Electricity	Residential	44,769	36,150	46,893	4,758	47,528	—
Electricity	Commercial/Institutional	13,232	10,628	14,307	1,436	14,852	—
Electricity	Industrial	2,497	2,005	2,700	271	2,802	—
Other Industrial	Industrial	—	—	—	—	—	—
Agriculture – Fertilizer Application	Agricultural	450	450	450	450	450	450
Solid Waste	Residential	10,204	10,204	10,688	10,688	10,832	10,832
Wastewater	Commercial/Institutional	19,868	19,868	20,998	20,998	21,430	21,430

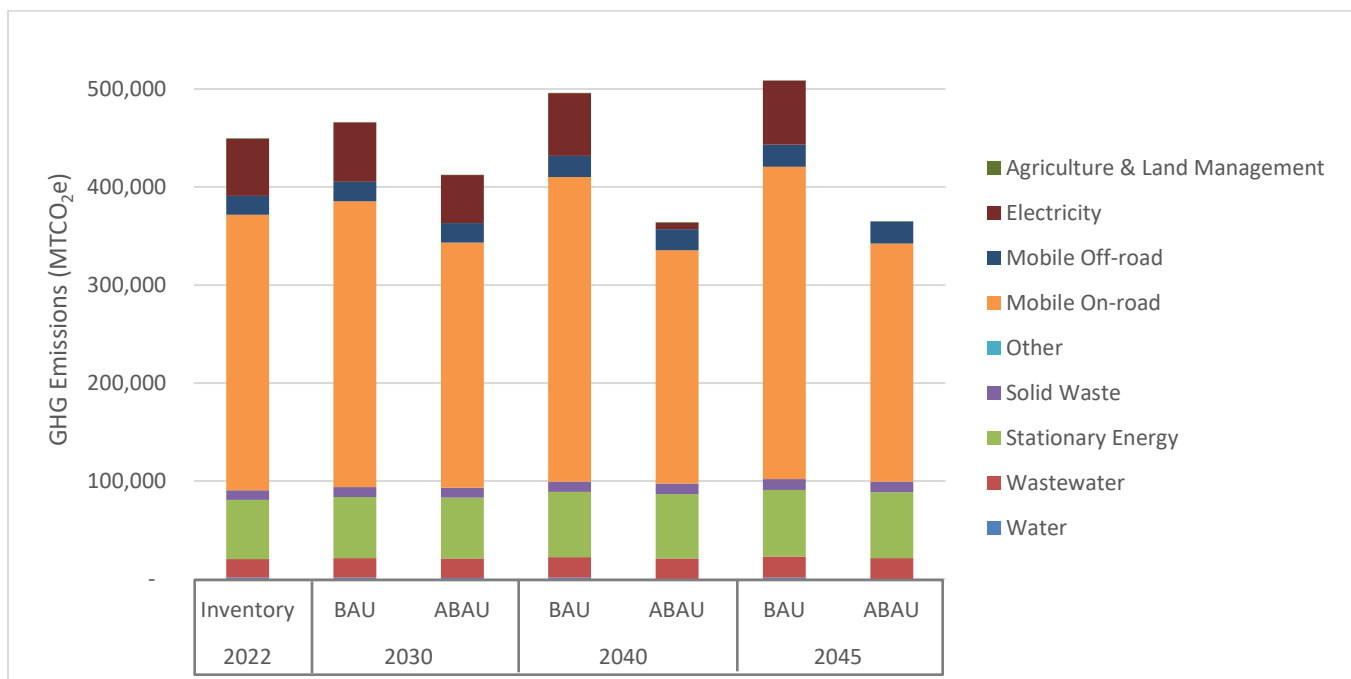
Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Imported Water	Commercial/Institutional	1,035	832	1,094	110	1,117	—
Imported Water	Agricultural	372	299	372	37	372	—
Mobile On-road	Residential	136,366	110,874	142,836	103,072	144,770	102,679
Mobile On-road	Commercial/Institutional	155,117	139,169	167,715	134,993	174,106	140,191
Mobile Off-road	Commercial/Institutional	19,844	19,844	21,455	21,455	22,273	22,273
Mobile Off-road	Agricultural	234	234	234	234	234	234

Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 3 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Delano's 2022 GHG emissions inventory for comparison, all categorized by emissions sources.

Figure 3 City of Delano 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sources (MTCO₂e)

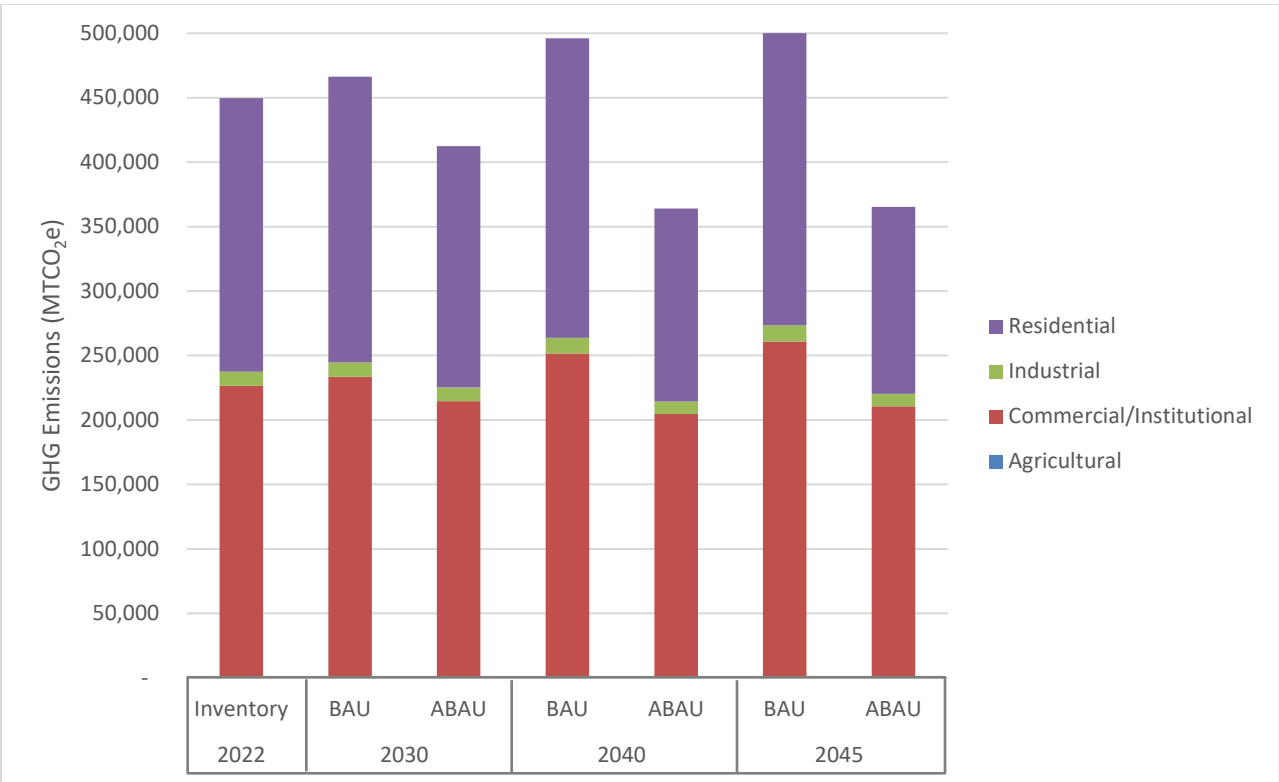


Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 4 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Delano's 2022 GHG emissions inventory for comparison, all categorized by emissions sectors.

Figure 4 City of Delano 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sectors (MTCO₂e)



Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent. Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

3 GREENHOUSE GAS EMISSIONS INVENTORY METHODS

This section of the report details the methods used to develop the GHG emissions inventory for the City of Delano. It includes descriptions of the data sources and data processing, and the inputs and outputs for the GHG emissions calculations. The methods are organized by GHG emissions sources (stationary energy, electricity, etc.) for the City of Delano, based on the EPA Local GHG Inventory Tool.

The EPA Local GHG Inventory Tool was primarily used for GHG emissions calculations. Activity data (e.g., energy consumed, tons of waste landfilled, etc.) inputs for the City of Delano were entered into the tool and parameters were set to represent local conditions (e.g., annual electricity consumption data was imported into the tool as the input to calculate City of Delano’s GHG emissions associated with electricity, and the appropriate electricity grid was selected to represent local conditions). GHG emissions from on-road transportation were calculated externally to the EPA Local GHG Inventory Tool, due to data format inconsistencies. All other GHG emissions sources were calculated within, or entered into the tool. The tool also categorizes GHG emissions into different sectors: residential, commercial/institutional, industrial, and agricultural. Industrial and agricultural sectors were only used when explicitly differentiated in the available datasets. In all other cases, sector categorization followed the classifications provided by the EPA Local GHG Inventory Tool or as defined by the underlying data sources.

This report only documents data processing and calculations that were performed outside of the EPA Local GHG Inventory Tool and provides the GHG emissions outputs from the tool; it does not expand on the calculation methods within the tool. Documentation for the EPA Local GHG Inventory Tool can be found on the EPA website at: <https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool>.

3.1 GREENHOUSE GASES AND GLOBAL WARMING POTENTIAL

GHG emissions other than carbon dioxide (CO₂) 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). CO₂ has a GWP factor of one, while all other GHGs have GWP factors measured in multiples of one relative to the GWP of CO₂. This conversion of non-CO₂ gases to one unit enables the reporting of all emissions in terms of carbon dioxide equivalent (CO₂e), 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 (MTCO₂e). For this emissions inventory and forecast, the three primary and most abundant GHGs were accounted for: CO₂, methane (CH₄) and nitrous oxide (N₂O).

Consistent with the best available science, the inventory uses GWP factors published in the Fifth Assessment Report (AR5) from Intergovernmental Panel on Climate Change (IPCC), where CH₄ and N₂O have GWP factors of 28 and 265, respectively (IPCC 2014). These values represent the GWP of GHG on a 100-year time horizon. This means that CH₄ is approximately 28 times stronger than CO₂ and N₂O is 265 times stronger than CO₂ in their potential to warm Earth's atmosphere over the course of 100 years. The use of 100-year GWP values is consistent with the California Air Resources Board (CARB) and EPA GHG accounting methods.

3.2 DATA REVIEW

The general approach for developing the GHG emissions inventory involved the collection of total activity and/or emissions data for Kern county for the year 2022 for each relevant GHG emissions source and then apportioning that data to individual jurisdictions and sectors using appropriate attribution metrics. These metrics include the City of Delano's contribution to total countywide population, commercial building floor space, and agricultural land acreage. In some cases, such as for landfilled solid waste and industrial facilities, jurisdiction-specific data were available from publicly available resources.

The primary data sources used to compile activity and emissions data for all of Kern county are listed in Table 3.

Table 3 Data Sources for Countywide Activity and Emissions Data

GHG Emission Source	Data Source(s)
Mobile On-road	CARB EMFAC2021 on-road emission inventory model (CARB 2022a)
Mobile Off-road	CARB OFFROAD2021 off-road emission inventory model (CARB 2022b)
Stationary Energy	CEC energy database (CEC 2023), EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases
Electricity	CEC energy database (CEC 2022), Pacific Gas & Electric Co (PG&E)
Imported Water	Water Association of Kern County
Agriculture	CDFA's fertilizing materials tonnage report (CDFA 2025)
Other Industrial Sources	EPA FLIGHT database (EPA 2023)

Notes: CARB = California Air Resources Board; ; CDFA = California's Department of Food & Agriculture CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

Attribution metrics were used to apportion countywide activity and/or emissions data to individual jurisdictions by the appropriate GHG emissions sector. These attribution metrics include:

- ▶ population share for allocating activity associated with the residential sector (US Census Bureau 2025),
- ▶ commercial building floor space share for activity associated with the commercial/institutional sector (Open Energy Data Initiative 2020), and
- ▶ farmland, grazing land, and other agricultural land cover types share for the agricultural sector (DOC 2022).

These attribution metrics and the associated values for each jurisdiction in Kern county are shown in Table 4 below.

Table 4 Attribution Metrics Used to Apportion Countywide Activities and GHG Emissions

Jurisdiction	Population	Population %	Agricultural Land Acreage	Agricultural Land Acreage %	Commercial Building Floor Space in Square Footage	Commercial Building Floor Space in Square Footage %
Delano	19,613	2.2%	1,487	0.1%	1,400	0.9%
Bakersfield	404,321	44.6%	41,684	1.5%	79,800	50.7%
California City	15,002	1.7%	112	0.0%	1,000	0.6%
Delano	50,498	5.6%	4,141	0.2%	5,800	3.7%
Maricopa	1,217	0.1%	558	0.0%	—	0.0%
McFarland	13,971	1.5%	2,754	0.1%	600	0.4%
Ridgecrest	28,118	3.1%	62	0.0%	4,000	2.5%
Shafter	20,162	2.2%	19,419	0.7%	10,700	6.8%
Taft	7,414	0.8%	4,507	0.2%	1,000	0.6%
Tehachapi	12,855	1.4%	2,764	0.1%	1,700	1.1%
Wasco	26,317	2.9%	3,421	0.1%	1,800	1.1%
Unincorporated County	307,395	33.9%	2,666,205	97.1%	49,700	31.6%
Kern County Total	906,883	100%	2,747,115	100%	157,500	100%

Note: Population and agricultural land acreage data reflect conditions in 2022. The most recent data available for commercial building floor space was from 2019, which was used as the attribution metric in this analysis. Because the calculations relied on percentage shares rather than absolute floor space values, using 2019 data was considered appropriate for consistency across jurisdictions.

Sources: US Census Bureau 2025; DOC 2022; Open Energy Data Initiative 2020; analysis conducted by Ascent in 2025.

For the wastewater and solid waste emissions sources, as well as the industrial emissions sector, data and information were collected at the jurisdiction level to calculate associated GHG emissions.

For wastewater, jurisdiction-specific data were obtained from a variety of sources, including any publicly available data about wastewater treatment plant operations. When such data were not publicly available, default values from the EPA Local GHG Inventory Tool and the Local Governments for Sustainability *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* were used to fill data gaps.

For solid waste, jurisdiction-specific disposal data were sourced from the California Department of Resources Recycling and Recovery (CalRecycle), specifically from the Jurisdiction Disposal and Beneficial Reuse by Destination database.

For the industrial emissions sector, jurisdiction-specific emissions data were also obtained directly from the EPA FLIGHT and CARB MRR databases, which report facility-level emissions for large industrial sources.

Data sources for jurisdiction-specific activity and emissions data are shown in Table 5 below.

Table 5 Data Sources for Jurisdiction-Specific Activity and Emissions Data

GHG Emission Source/Sector	Data Source(s)
Wastewater	ICLEI (ICLEI 2019)
Solid Waste	CalRecycle's Jurisdiction Disposal and Beneficial Reuse by Destination database (CalRecycle 2025), EPA FLIGHT database (EPA 2023)
Industrial Sector	EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases

Notes: ICLEI = Local Governments for Sustainability; CalRecycle = California Department of Resources Recycling and Recovery; CARB = California Air Resources Board; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

3.3 INVENTORY METHODS BY GHG EMISSIONS SOURCE

This section details the data and methods used to calculate GHG emissions in the 2022 inventory, organized by emissions source. It presents the corresponding data inputs into the EPA Local GHG Inventory Tool, any data processing that was performed, and the resulting emissions estimates by source and sector for the City of Delano. All calculations of GHG emissions use the IPCC AR5 GWP values to convert GHG emissions results to CO₂e.

3.3.1 Mobile On-road

The Mobile On-road 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.” The estimation of these emissions relies on EMFAC2021, a statewide mobile source emissions inventory model developed by CARB. EMFAC2021 was used instead of the EPA Local GHG Inventory Tool to calculate mobile on-road GHG emissions because EMFAC2021 provides GHG emissions estimates that more closely represent the vehicle fleet operating on roadways in Kern County. The EPA Local GHG Inventory Tool utilizes national fuel efficiency averages for a select number of vehicle types to calculate GHG emissions, whereas EMFAC2021 considers fuel efficiency by vehicle type and model, providing more accurate estimates of fuel consumption and GHG emissions.

To calculate emissions for the 2022 inventory year, total countywide vehicle miles traveled (VMT) were first obtained from EMFAC2021. These VMT figures were then allocated to emission sectors defined by the EPA’s Local GHG Inventory Tool based on vehicle class, specifically, the residential and commercial/institutional sectors. For the purposes of sector-specific emissions calculations, light-duty vehicles were attributed to the residential sector, as they primarily reflect personal vehicle use by residents. In contrast, medium- and heavy-duty trucks were attributed to the commercial/institutional sector, as these vehicle types are more commonly associated with goods movement, service fleets, and business operations. Sector-specific VMT totals were then apportioned to each jurisdiction based on appropriate attribution metrics: population share for residential VMT and commercial building square footage share for commercial/institutional VMT.

EMFAC2021 was also used to generate countywide GHG emissions factors for the two sectors, expressed in MTCO₂e per vehicle mile traveled. These factors accounted for all vehicle classes, model years, speeds, and fuel types. The sector-specific factors were derived by dividing total countywide emissions of CO₂, CH₄, and N₂O (converted to CO₂e using the appropriate GWP) by the corresponding sector-specific countywide total VMT, with emissions and VMT categorized into the residential and commercial/institutional sectors based on vehicle class.

Finally, each jurisdiction’s total Mobile On-road emissions by sector were calculated by multiplying the jurisdiction’s sector-specific VMT by the respective countywide sector-specific MTCO₂e per VMT emissions factors. Table 6 presents the City of Delano’s total Mobile On-road VMT, associated sector-specific GHG emissions factors, and the resulting total GHG emissions by sector.

Table 6 City of Delano Mobile On-road Data Inputs and Results

Vehicle Sector	Total Activity (VMT)	GHG Emissions Factor (MTCO ₂ e/VMT)	GHG Emissions (MTCO ₂ e)
Residential	405,037,083	0.00035	130,296
Commercial/Institutional	150,412,555	0.0011	150,722

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: CARB 2022a; analysis conducted by Ascent in 2025.

3.3.2 Mobile Off-road

Emissions from Mobile Off-road sources result from the combustion of fuel in various types of off-road vehicles and equipment (e.g. agricultural tractors, construction equipment). Emissions data for these sources were obtained from

CARB's OFFROAD2021 model, which provides detailed estimates for Kern county for the 2022 inventory year. The data include, but are not limited to, information on equipment categories, fuel types, and the amount of fuel consumed.

Using the off-road vehicle categories in OFFROAD2021, the emissions data were organized into two relevant sectors defined by the EPA Local GHG Inventory Tool: agricultural and commercial/institutional. Sector-specific off-road fuel consumption totals were then apportioned to each jurisdiction using appropriate attribution metrics. Specifically, the share of farmland, grazing land, and other agricultural land was used to allocate agricultural emissions, while the commercial building square footage share was used to distribute commercial/institutional emissions.

Finally, each jurisdiction's sector-specific off-road fuel consumption data were entered into the "Mobile-Data" sheet of the EPA Local GHG Inventory Tool to calculate Mobile Off-road emissions. The EPA Local GHG Inventory Tool includes emissions factors by fuel type. Table 7 presents the City of Delano's total Mobile Off-road fuel consumption by fuel type and the resulting total GHG emissions by sector.

Table 7 City of Delano Mobile Off-road Data Inputs and Results

Vehicle Sector	Diesel Consumption (gallons)	Gasoline Consumption (gallons)	Liquefied Natural Gas (LNG) Consumption (gallons)	Total Fuel Consumption (gallons)	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	1,328,535	581,252	32,076	1,941,863	19,281
Agricultural	21,913	405	—	22,318	234

Notes: GHG = greenhouse Gas; LNG = liquefied natural gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CARB 2022b, analysis conducted by Ascent in 2025.

3.3.3 Stationary Energy

The stationary energy source of GHG emissions includes natural gas combustion in residential, commercial/institutional and industrial uses. Residential uses primarily consume natural gas for space and water heating, and cooking. Commercial/institutional uses may include space heating and cooling, cooking in restaurants, and smaller boilers or generators. Industrial uses are often process-specific uses tied to manufacturing or heavy operations such as process heating, steam generation, and boiler systems. Propane fuel usage was not included in the stationary energy-related calculations as propane usage data for these various uses was not available at the same level of detail or consistency as other stationary energy data sources at the county scale.

RESIDENTIAL AND COMMERCIAL/INSTITUTIONAL

Total countywide natural gas usage data for the 2022 inventory year was obtained from the CEC Energy Reports: Gas Consumption by County, which categorizes usage into residential and non-residential sectors. Residential natural gas consumption was allocated to each jurisdiction based on its share of the county's population.

To isolate commercial/institutional usage, countywide industrial natural gas consumption, sourced from the EPA FLIGHT database and CARB MRR database, was subtracted from the CEC total non-residential usage. The resulting commercial/institutional natural gas usage was then apportioned to each jurisdiction using commercial building floor space share as the attribution metric.

Finally, each jurisdiction's residential and commercial/institutional natural gas usage data were entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate residential and commercial/institutional stationary energy emissions. Table 8 below shows the City of Delano's total stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions in residential and commercial/institutional sectors.

Table 8 City of Delano Residential and Commercial/Institutional Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Residential	531,808	29,242
Commercial/Institutional	412,127	22,661

Notes: mcf = thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

INDUSTRIAL

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the City of Delano. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the City of Delano. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

Jurisdiction-specific emissions data were then converted into estimates of natural gas consumption using IPCC Fourth Assessment Report (AR4) GWP values and Subpart C Tier 1 GHG emissions factors, given that the emissions data obtained from the EPA FLIGHT and CARB MRR databases were calculated using AR4 GWP values. This approach was taken to ensure consistency with the emissions data obtained from the EPA FLIGHT and CARB MRR databases, which were originally calculated using AR4 GWP values. These converted fuel usage estimates were subsequently entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate industrial stationary energy emissions for each jurisdiction.

Table 9 below shows the City of Delano's industrial stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions.

Table 9 City of Delano Industrial Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Industrial	154,301	8,484

Notes: mcf = one thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

The list of industrial facilities from which data was used to estimate jurisdiction-specific industrial stationary energy emissions is provided in Table 10. In some cases, a facility may use a separate address for reporting purposes than where the facility is physically located. The reporting addresses and physical locations of facilities were reviewed such that GHG emissions could be allocated to jurisdictions based on the physical location within the jurisdiction's boundary. Note that the GHG emission totals provided in Table 10 are obtained directly from the CARB or EPA data sources and have not been converted to AR5 GWPs. As such, these totals may not match those reported in Table 10 above.

Table 10 City of Delano Industrial Facilities Located in Geographical Boundary

Facility Name	GHG Emissions (MTCO ₂ e)	Physical Location Notes
Delano Energy Center, LLC	8,501	Physical location is the same as the reporting location.

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

3.3.4 Electricity

The electricity source addresses energy-related indirect GHG emissions resulting from the consumption of grid-supplied electricity within the City of Delano’s boundary. Consumption of grid-supplied electricity is considered an “indirect” GHG emissions source, because GHG emissions occur at the source of electricity generation, which is usually outside of a jurisdiction’s boundary. The location-based method was used to calculate electricity GHG emissions, which uses regional grid-average emission factors. In the United States, these factors are provided by the EPA’s Emissions & Generation Resource Integrated Database (eGRID). Specifically, emission factors for the CAMX eGRID subregion were applied, as this subregion encompasses the geographic area of Kern county.

Total electricity usage data for Kern county in 2022 was obtained from CEC Energy Reports: Electricity by County, which categorized usage into residential and non-residential sectors (CEC 2023). Electricity usage data for the City of Bakersfield, which was also separated into residential and non-residential categories, was acquired directly from the Pacific Gas and Electric Company (PG&E). To estimate electricity usage for the rest of the county (i.e., all jurisdictions excluding Bakersfield), the City of Bakersfield’s electricity data was subtracted from the total Kern county data.

Residential electricity usage outside of Bakersfield was apportioned to each jurisdiction based on its share of the county’s total population. For non-residential electricity usage, estimates were further categorized into industrial and commercial/institutional sectors using attribution metrics derived from natural gas consumption data previously calculated under stationary energy. In 2022, 93.1 percent of the county’s stationary natural gas combustion was attributed to industrial use and 6.9 percent to commercial/institutional use. These same ratios were applied to the county’s total non-residential electricity usage, under the assumption that the sectoral split in electricity usage mirrors that of natural gas usage. This assumption was validated using available industrial electricity and natural gas usage data in PG&E’s service territory, from the CEC Energy Reports. The electricity-to-gas ratio, expressed as gigawatt-hour per million therms, was calculated by dividing total industrial electricity usage by industrial natural gas consumption for the service territory. The resulting value closely aligns with the assumptions applied in this here, supporting its validity.

The City of Delano’s share of commercial building square footage was used to attribute commercial/institutional electricity usage. Industrial electricity usage was attributed based on the proportion of countywide industrial natural gas within the City of Delano. Finally, the sector-specific electricity usage data for each jurisdiction was entered into the “Electricity-Data” sheet of the EPA Local GHG Inventory Tool to calculate associated GHG emissions.

Table 11 below shows the City of Delano’s electricity activity data and the associated GHG emissions by emission sectors.

Table 11 City of Delano Electricity Energy Data Inputs and Results

Sector	Total Activity (kWh of Electricity Consumed)	GHG Emissions (MTCO ₂ e)
Residential	188,874,433	42,780
Commercial/Institutional	56,770,341	12,858
Industrial	10,712,000	2,426

Notes: kWh = kilowatt-hour; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; PG&E 2025; analysis conducted by Ascent in 2025.

3.3.5 Imported Water

The water source category captures GHG emissions from energy use associated with the conveyance, treatment, and distribution of water within a jurisdiction. In Kern county, the WAKC reports that approximately 166,000 acre-feet of water are used annually for municipal and industrial purposes, and 2,294,000 acre-feet for agricultural purposes.

In addition to local surface water, Kern county draws water from several sources. Among these, only water supplied through the State Water Project (SWP) and the federal Central Valley Project (CVP) is considered imported, and therefore potentially results in GHG emissions due to long-distance conveyance. All other sources are classified as

local. It was assumed that energy used for extracting, conveying, treating, and distributing local water is captured under the emissions estimates for stationary energy and electricity, since these activities occur within the county. In addition, upon further review, it was also determined that the federal CVP does not consume energy for water delivery to Kern County, as water is primarily conveyed using gravity (Friant Water Authority 2019). As a result, only the SWP, which accounts for 26 percent of the county's water supply, contributes to GHG emissions. Table 12 provides a summary of the water sources in Kern county and their contribution to the total water supply.

Table 12 Kern County Water Sources

Source	Percentage
Kern River	20%
State Water Project (California Aqueduct)	26%
Federal Central Valley Project (Friant-Kern Canal)	12%
Local Streams and Other Sources (Poso Creek, Kern River, etc.)	6%
Groundwater	36%
Total	100%

Source: WAKC n.d.

Water use in Kern County is characterized into municipal and industrial, and agricultural sectors in data obtained from WAKC. It is assumed that water included in "municipal" uses is delivered to both commercial and residential customers. However, sufficient data was not available to disaggregate the water consumption between industrial, commercial, and residential customers. For the purpose of this GHG emissions inventory, all non-agricultural water consumption was categorized under the commercial/institutional sector.

To allocate sector-specific water usage to individual jurisdictions, the following attribution metrics were used:

- ▶ Agricultural water use was apportioned based on each jurisdiction's share of farmland, grazing land, and other agricultural land.
- ▶ Commercial/institutional water use was distributed according to the share of commercial building square footage in each jurisdiction.

These apportioned figures were then entered into the "Imported Water" sheet of the EPA Local GHG Inventory Tool, applying a universal 26 percent imported water rate, to estimate the associated GHG emissions from water conveyance and use. Table 13 presents the City of Delano's activity data related to imported water, including the percentage of total water supply that is imported and the associated GHG emissions.

Table 13 City of Delano Imported Water Energy Data Inputs and Results

Sector	Total Activity (Gallons of Water)	Percentage of Water Imported	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	783,111,157	26%	994
Agricultural	292,945,200		372

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: WAKC n.d.; analysis conducted by Ascent in 2025.

3.3.6 Wastewater

The wastewater source accounts for GHG emissions resulting from the treatment of sewage. To support this analysis, a review of publicly available wastewater treatment characteristics was conducted to collect the data required for completing the "Wastewater-Control" tab of the EPA's Local GHG Inventory Tool. The data sources and corresponding assumptions for the City of Delano's wastewater treatment systems are summarized in Table 12. Where jurisdiction-specific data were not publicly available, the default input values provided by the EPA tool were used.

To estimate GHG emissions, population data for each jurisdiction were subsequently entered into the “Wastewater-Entry” tab of the tool. The resulting emissions estimates are also presented in Table 14, alongside the data sources and assumptions used.

Table 14 City of Delano Wastewater Treatment Assumptions

Wastewater Process/Treatment Type	Conditions Assumed	Data Source	GHG Emissions (MTCO ₂ e)
Population served by septic systems	5 percent of the city's population	ICLEI's default proportion of population that utilizes septic tanks for an urban area (Box WW.11(alt).2).	19,073
One or more wastewater treatment plants (WWTPs) where wastewater is treated in aerobic or anaerobic conditions	Anerobic	No public information is available. The default value is anerobic.	
One or more WWTPs conduct or do not conduct nitrification/denitrification	Denitrification	Obtained from the City's website.	

Notes: WWTP = wastewater treatment plant; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; ICLEI = Local Governments for Sustainability.

Sources: ICLEI 2019; analysis conducted by Ascent in 2025.

3.3.7 Solid Waste

Community-generated solid waste emissions are primarily associated with the decomposition of solid waste in landfills. There are two methods for accounting for GHG emissions associated with waste disposal:

- ▶ Waste generation method – Accounts for the total GHG emissions that would be generated over time as municipal solid waste (MSW) that is sent to a landfill in only the inventory year decomposes.
- ▶ Waste-in-place method – Accounts for the total GHG emissions generated in a given year at a specific landfill location by the decomposition of all MSW previously disposed at the landfill.

Generally, there is some risk of double counting GHG emissions when combining both of these methods, as a portion of the emissions accounted for using the waste generation method may occur at an in-boundary landfill that has emissions reported using the waste-in-place method. However, the scale of the overlapping GHG emissions between the two methods would be expected as very small in comparison to total emission using either accounting method.

WASTE GENERATION

Landfill tonnage data for 2022 was obtained from CalRecycle's Jurisdiction Disposal and Beneficial Reuse by Destination database. This data was entered into the EPA's Waste Reduction Model (WARM Tool) as “mixed MSW” to estimate waste generation emissions. The default national average values were used in the WARM Tool, except for Question 7, where the k value was set to “dry” based on the county's annual precipitation (less than 20 inches) (NCEI 2025). The WARM output was then imported into the EPA Local GHG Inventory Tool's “Waste Production” tab, with solid-waste associated emissions attributed to the residential sector by default.

The total activity for solid waste disposal and the resulting waste generation GHG emissions results from the WARM Tool are provided in Table 15.

Table 15 City of Delano Waste Generation Data Inputs and Results

Sector	Total Activity (tons of MSW disposed)	GHG Emissions (MTCO ₂ e) (WARM Output)
Residential	33,781	9,750

Notes: MSW = mixed municipal solid waste; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; WARM = Waste Reduction Model.

Source: CalRecycle 2025; analysis conducted by Ascent in 2025.

WASTE-IN-PLACE

EPA's FLIGHT database was reviewed to determine emissions from landfills located within the City of Delano's geopolitical boundary, which would provide emissions data for any landfills that generated emissions greater than 25,000 MTCO₂e in 2022. No reporting landfills were identified for the City of Delano.

3.3.8 Agriculture

The agriculture emissions source captures GHG emissions generated from fertilizer application.

FERTILIZER APPLICATION

Fertilizer application results in GHG emissions primarily due to the release of N₂O, a potent GHG with a global warming potential nearly 300 times greater than CO₂. When nitrogen-based fertilizers are applied to soil, a portion of the nitrogen undergoes microbial processes (nitrification and denitrification), which convert it into N₂O. These emissions can occur directly from the soil or indirectly through leaching and runoff.

The total tonnage of nitrogen in synthetic fertilizers applied in Kern county during the 2022 inventory year was obtained from CDFA's fertilizing materials tonnage report. This countywide total was then apportioned to individual jurisdictions based on each jurisdiction's proportional share of farmland, grazing land, and other agricultural land. Only data for synthetic fertilizers was publicly available for calculation, although other organic or manure-based fertilizers may be used.

The resulting tonnage of nitrogen in synthetic fertilizers estimated for the City of Delano was entered into the "Agriculture & Land Management" sheet of the EPA's Local GHG Inventory Tool to calculate the associated emissions. Table 16 provides the estimated total tons of nitrogen applied and resulting GHG emissions.

Table 16 City of Delano Fertilizer Application Data Inputs and Results

Sector	Total Activity (tons of nitrogen applied)	GHG Emissions (MTCO ₂ e)
Agricultural	63	450

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CDFA 2025; analysis conducted by Ascent in 2025.

4 GREENHOUSE GAS EMISSIONS FORECAST METHODS

This section provides the methods and data used to project future GHG emissions under a BAU scenario, as well as the calculations of reductions from adopted legislation and regulations under an ABAU scenario.

The BAU GHG emissions forecasts assess how emissions generated by community activities will change over time without further State, federal, regional, or local action. The BAU scenario forecast accounts for the changes in population and employment that can influence communitywide GHG emissions. The ABAU scenario forecast includes adopted policies and regulations at the State and federal levels that would affect emissions without any local action, such as regulatory requirements to increase vehicle fuel efficiency and increase renewable energy sources in grid electricity portfolios. These forecasts provide the City of Delano with information needed to understand specific GHG emissions sources with the greatest opportunities for reduction with future plans, projects, or programs. It is important to note that the ABAU forecasts only account for emissions reductions associated with adopted policies and regulations; they do not account for proposed and/or unadopted GHG reduction actions established by regional, State, and federal agencies or executive orders outside of adopted legislation and regulations.

The GHG emissions forecasts project GHG emissions for the years 2030, 2040, and 2045 to align with key regulatory timelines for the State. Two key legislative actions establish statewide GHG reduction targets for the years 2030 and 2045, including:

- ▶ Senate Bill (SB) 32 of 2016, which sets a statewide GHG reduction target for the year 2030, and
- ▶ Assembly Bill 1279 of 2022, which sets a statewide GHG reduction target for the year 2045.

The forecast years selected do not necessarily align with the targets established by adopted legislation, but they do provide an analysis of emissions that aligns with the relevant horizon years. The year 2040 was also included in the analysis as an interim year between the 2030 and 2045 forecast years.

4.1 GROWTH PROJECTIONS

GHG emissions forecasts were developed based on projected changes in Kern county’s demographics, specifically population, employment, and service population (defined as residents plus employees), between 2022 and 2045. These projections were obtained from the Regional Growth Forecast and Demographic Forecast prepared by the Kern COG (Kern COG 2024). It is assumed that the incorporated cities and the unincorporated county will experience demographic growth at the same rate as the county overall, as jurisdiction-specific growth projections were not available at the time of this analysis.

Between 2022 and 2045, Kern county’s population and employment are projected to increase by approximately 11.1 and 15.5 percent, respectively. The service population is expected to grow by 12.4 percent. These growth factors were applied to forecast GHG emissions for the years 2030, 2040, and 2045 across various emissions sources included in the inventory. The values used for population, employment, and service population used to project future emissions are provided in Table 17.

Table 17 Kern County Demographics and Calculated Growth Rates for Future Emissions Forecasts

Calculation Factor	2022	2030	2040	2045
Population				
Total Kern County	906,883	949,134	994,167	1,007,627
Kern County Growth from 2022		4.7%	9.6%	11.1%
Employment				
Total Kern County	358,961	369,427	399,432	414,652
Kern County Growth from 2022		2.9%	11.3%	15.5%
Service Population				
Total Kern County	1,265,844	1,318,561	1,393,598	1,422,279
Kern County Growth from 2022		4.2%	10.1%	12.4%

Source: US Census Bureau 2025; Kern COG 2024; analysis conducted by Ascent in 2025.

Additional details on how growth factors were applied to individual sources are provided in the following sections. It is important to note that agricultural emissions, including those from fertilizer application, as well as livestock enteric fermentation and manure management, are assumed to remain constant throughout the forecast period, with no projected increase in activity levels. Agricultural activities are difficult to project in any detail, with production intensities, number of livestock, and crop types being highly susceptible to global markets and local climate patterns. As such, projections of agriculture GHG emissions-generating activities are not attempted.

4.2 BUSINESS-AS-USUAL SCENARIO FORECAST

The BAU forecast represents a projection of future GHG emissions based solely on expected demographic and economic growth (e.g., population, employment, and service population) between 2022 and 2045. It does not account for the potential impacts of future policies, programs, or actions that may reduce emissions, such as energy efficiency improvements, renewable energy adoption, or transportation electrification.

In the BAU scenario, GHG emissions factors are held constant at the levels used in the 2022 GHG inventory, meaning the carbon intensity of electricity, fuels, and other activities is assumed not to change over time. As a result, any changes in future emissions are driven entirely by growth in activity levels, not by improvements in emissions performance.

4.2.1 Business-As-Usual Scenario Forecast Results

Table 18 presents the projected activity data for the City of Delano across all forecast years, organized by emissions source and sector. Table 18 also indicates which sources and sectors used population, employment, or service population as a growth metric.

Table 18 City of Delano BAU Scenario Projected Activity Data for All Forecast Years

Source	Sector	Growth Metric	Units	2030	2040	2045
Stationary Energy	Residential	Population	scf	556,585	582,992	590,886
Stationary Energy	Commercial/Institutional	Employment	scf	424,144	458,592	476,067
Stationary Energy	Industrial	Employment	scf	158,800	171,698	178,240
Electricity	Residential	Population	kWh	197,673,910	207,052,787	209,856,112
Electricity	Commercial/Institutional	Employment	kWh	58,425,621	63,170,872	65,578,038
Electricity	Industrial	Employment	kWh	11,024,335	11,919,716	12,373,925
Other Industrial	Industrial	Employment	MTCO ₂ e	—	—	—
Agriculture – Fertilizer Application	Agricultural ¹	N/A	ton	63	63	63
Solid Waste	Residential	Population	ton	35,354	37,032	37,533
Wastewater	Commercial/Institutional	Service Population	MTCO ₂ e	19,868	20,998	21,430
Imported Water	Commercial/Institutional	Service Population	Gallon	815,724,518	862,146,090	879,889,394
Imported Water	Agricultural ¹	N/A	Gallon	292,945,200	292,945,200	292,945,200
Mobile On-road	Residential	Population	VMT	423,907,368	444,020,165	450,031,834
Mobile On-road	Commercial/Institutional	Employment	VMT	154,798,207	167,370,711	173,748,477
Mobile Off-road	Commercial/Institutional	Employment	MTCO ₂ e	19,844	21,455	22,273
Mobile Off-road	Agricultural ¹	N/A	MTCO ₂ e	234	234	234

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; scf = standard cubic foot.

¹ Activity levels for the agricultural sector are assumed to remain constant over the forecast period; therefore, growth metrics are listed as “N/A.”

Source: Analysis conducted by Ascent in 2025.

Table 19 below presents the projected GHG emissions for the City of Delano across all forecast years, also organized by emissions source and sector.

Table 19 City of Delano BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	30,451	31,896	32,328
Stationary Energy	Commercial/Institutional	MTCO ₂ e	23,205	25,090	26,046
Stationary Energy	Industrial	MTCO ₂ e	8,688	9,394	9,752
Electricity	Residential	MTCO ₂ e	44,769	46,893	47,528

Source	Sector	Units	2030	2040	2045
Electricity	Commercial/Institutional	MTCO ₂ e	13,232	14,307	14,852
Electricity	Industrial	MTCO ₂ e	2,497	2,700	2,802
Other Industrial	Industrial	MTCO ₂ e	—	—	—
Agriculture – Fertilizer Application	Agricultural	MTCO ₂ e	450	450	450
Solid Waste	Residential	MTCO ₂ e	10,204	10,688	10,832
Wastewater	Commercial/Institutional	MTCO ₂ e	19,868	20,998	21,430
Imported Water	Commercial/Institutional	MTCO ₂ e	1,035	1,094	1,117
Imported Water	Agricultural	MTCO ₂ e	372	372	372
Mobile On-road	Residential	MTCO ₂ e	136,366	142,836	144,770
Mobile On-road	Commercial/Institutional	MTCO ₂ e	155,117	167,715	174,106
Mobile Off-road	Commercial/Institutional	MTCO ₂ e	19,844	21,455	22,273
Mobile Off-road	Agricultural	MTCO ₂ e	234	234	234

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

4.3 LEGISLATIVE-ADJUSTED BUSINESS-AS-USUAL SCENARIO FORECAST

ABAU emissions forecasts were prepared using the same demographic data that were used for the BAU forecasts, while also accounting for State and federal policies and regulations that would affect local emissions. These forecasts provide the City of Delano with a more robust understanding of future community emissions based on the GHG reduction efforts at the state and federal level. A summary of applicable legislative reductions is provided in Table 20.

Table 20 Legislative Reductions Summary

Source	Legislative Reduction	Description	Sources Applied
State	Renewable Energy and Zero-Carbon Electricity Requirements [SB 1020 and SB 100]	Requires California energy utilities to procure 60 percent of electricity from eligible renewable and zero-carbon sources by 2030, 95 percent by 2040, and 100 percent by 2045.	Electricity, Imported Water
State	California's Building Energy Efficiency Standards (2019 and 2022 Title 24, Part 6)	Requires all new buildings in California to comply with energy efficiency standards established by CEC. Accounts for the energy efficiency gains in new residential and nonresidential buildings.	Stationary Energy, Electricity
State	Advanced Clean Car I Regulation	Establishes GHG emission reduction standards for model years 2017 through 2025 that are more stringent than federal CAFE standards.	Mobile On-road
State	Truck and Bus Regulation	Requires diesel trucks and buses that operate in California to be upgraded to reduce GHG emissions.	Mobile On-road
Federal	Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles	Establishes fuel efficiency standards for medium- and heavy-duty engines and vehicles.	Mobile On-road

Notes: CAFE = Corporate Average Fuel Economy; CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; SUV = sports utility vehicle; SB = Senate Bill.

4.3.1 Title 24 Adjustments

Future energy use was adjusted to reflect increased emissions-intensity stringency under California's Building Energy Efficiency Standards (California Code of Regulations Title 24 Part 6, hereafter referred to as "Title 24"). Although Title

24 applies to both new residential and nonresidential construction, for the purposes of this forecast, adjustments were applied only to residential construction for reasons described below.

This approach accounts for uncertainties in energy consumption patterns and end uses in nonresidential buildings, and uncertainty in the non-residential building types that would be constructed in the future. Title 24 primarily regulates energy efficiency in building envelopes and lighting systems. This is expected to substantially reduce energy consumption for building types where the primary end uses of energy are lighting and heating, ventilation, and air conditioning, such as new office, institutional, and hotel buildings. However, Title 24 may not significantly affect other high-energy-consuming uses in nonresidential facilities, such as process loads or specialized equipment. As such, limiting adjustments to residential construction provides a more conservative and reliable estimate of future energy-related GHG emissions.

The 2019 Title 24 standards apply to projects constructed after January 1, 2020, while the 2022 standards apply after January 1, 2023. The 2025 Title 24 will go into effect statewide in January of 2026; however, detailed data on the changes in building-level energy consumption between the 2025 code and previous code cycles was not available at the time of this analysis. To estimate changes in future energy consumption under the 2022 standards, electricity and natural gas adjustment factors were calculated based on differences in average residential energy use between buildings built to the 2019 and 2022 standards. These factors were derived from CEC's data specific to the 2019 and 2022 standards and climate zone-based energy usage rates. For the City of Delano, Climate Zone 13 was used in the analysis.

These adjustment factors were then applied to the ABAU forecasts of energy consumption activity for both stationary energy and electricity use to reflect the impact of legislative energy efficiency improvements on future development. The adjustment factors, presented in Table 21, show the percentage change in energy use for buildings built to 2022 standards relative to those built to 2019 standards. Positive values indicate an anticipated increase in energy use, while negative values indicate an anticipated decrease in energy use.

As shown in Table 21:

- ▶ ABAU electricity activity is projected to be higher than BAU in each forecast year due to positive adjustment factors.
- ▶ ABAU stationary energy activity is projected to be lower than BAU due to negative adjustment factors.

Importantly, these adjustments were applied only to energy use growth occurring after the 2022 baseline, reflecting new development that would be subject to the 2022 Title 24, or a later cycle of standards. In addition, it is important to note that although average electricity use in new residential buildings is anticipated to rise under 2022 Title 24 (due to an increase in electrical demand associated with electric appliances installed instead of natural gas appliances), emissions from new residential buildings are expected to be lower than they would be under 2019 Title 24 as a result of overall lower building emissions intensities (due to lower emissions factors associated with electricity compared to natural gas).

Table 21 Stationary Energy and Electricity Adjustment Factors and Activity Forecast Results for Residential Buildings

Energy Type	Forecast Scenario	Adjustment Factor	Activity Units	2022	2030	2040	2045
Electricity	BAU	—	kWh	188,874,433	197,673,910	207,052,787	209,856,112
Electricity	ABAU	+12%	kWh	188,874,433	198,726,227	209,226,711	212,365,281
Stationary Energy (Natural Gas)	BAU	—	mcf	531,808	556,585	582,992	590,886
Stationary Energy (Natural Gas)	ABAU	-29%	mcf	531,808	549,374	568,096	573,692

Notes: BAU = Business-as-Usual; ABAU = legislative-adjusted BAU; mcf = one thousand cubic feet; kWh = kilowatt-hour.

Source: Analysis conducted by Ascent in 2025.

4.3.2 Senate Bill 100 and Senate Bill 1020 Adjustments

SB 100 requires that 100 percent of retail electricity sales in California come from renewable and zero-carbon resources by 2045. This legislation builds upon the state’s existing Renewables Portfolio Standard (RPS) by increasing the required percentage of RPS-eligible renewable electricity over time. SB 1020 builds on SB 100 by introducing interim targets for GHG-free electricity for the years 2035 and 2040. As shown in Table 22, SB 100 and SB 1020 require utility providers to supply electricity that is 60 percent GHG-free by 2030, 95 percent by 2040, and 100 percent by 2045. The emissions sources affected by these adjustments include electricity and imported water, both of which are estimated based on the carbon intensity of the electricity grid.

To estimate future GHG emissions factors, the 2022 GHG-free electricity percentage and GHG emissions factors for the CAMX eGRID subregion were first obtained from the EPA’s eGRID database. Using these 2022 values as a baseline, emissions factors for the forecast years (2030, 2040, and 2045) were calculated based on the GHG-free electricity targets established by SB 100 and SB 1020.

Table 22 below demonstrates these GHG-free electricity percentage baseline values and targets, as well as the baseline and calculated emissions factors for the forecast years. Given 2045’s 100 percent GHG-free electricity percentage target, the emissions factor for 2045 is 0. In contrast to the ABAU forecast, the CAMX eGRID emissions factors under the BAU scenario are assumed to remain constant at their 2022 baseline values throughout the forecast years.

Table 22 CAMX eGRID Electricity GHG Emissions Factors Adjusted for SB100 and SB1020

Calculation Factor	Units	2022	2030	2040	2045
SB 100 and SB 1020 GHG-free electricity percentage targets	Percent GHG-free	—	60%	95%	100%
CAMX eGRID GHG-free electricity percentage baseline and targets	Percent GHG-free	50%	60%	95%	100%
CAMX eGRID baseline and interpolated emissions factors	MTCO ₂ e/MWh	0.2265	0.1819	0.0227	0

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MWh = megawatt-hour.

Source: Analysis conducted by Ascent in 2025.

4.3.3 On-road Vehicle Emissions Standards

State and federal regulations are expected to significantly reduce on-road GHG emissions by requiring improvements in vehicle fuel efficiency and accelerating the transition to zero-emission vehicles (ZEVs). The ABAU forecast for the Mobile On-road source takes into consideration the following State and federal regulations:

- ▶ Innovative Clean Transit Regulation, which requires all California public transit agencies to begin phasing in zero-emission buses (ZEB) starting in 2023 and transition to 100 percent ZEB fleets by 2040 and
- ▶ Advanced Clean Trucks Regulation, which requires truck and van manufacturers to sell a growing share of ZEVs beginning in model year 2024.

All these regulations are reflected in EMFAC2021’s emissions data for the forecast years (2030, 2040 and 2045), which serve as the basis for the Mobile On-road source’s ABAU forecast. In addition to these regulations, EMFAC2021’s data also takes into consideration future increases in light-duty ZEV sales, which would be influenced by California’s Advanced Clean Cars I regulation.

Accordingly, EMFAC2021’s VMT and emissions estimates for forecast years were used to calculate Mobile On-road emissions under the legislative adjustment scenario. As with the inventory methodology, sector-specific emissions factors for each forecast year were calculated by dividing sector-specific VMT by sector-specific emissions for each forecast year. These emissions factors were then multiplied by projected future VMT, which were scaled by relevant activity growth factors (population for the residential sector and employment for the commercial/institutional sector)

to estimate future emissions. The baseline and projected future emissions factors calculated using EMFAC2021 are shown in Table 23.

In contrast, under the BAU scenario, Mobile On-road emissions factors are held constant at their 2022 baseline values for all forecast years, reflecting no change in vehicle efficiency or fleet composition.

Table 23 Mobile On-road Baseline and Projected GHG Emissions Factors

Sector	Units	2022	2030	2040	2045
Commercial Institutional	MTCO ₂ e/VMT	0.0010	0.00090	0.00081	0.00081
Residential	MTCO ₂ e/VMT	0.00032	0.00026	0.00023	0.00023

Notes: MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: Analysis conducted by Ascent in 2025.

4.3.4 Legislative-Adjusted Business-as-Usual Scenario Forecast Results

Table 24 presents the projected GHG emissions for the City of Delano across all forecast years under the ABAU scenario, organized by emissions source and sector. Emissions sources and sectors not impacted by legislative adjustments are excluded from this table, as their projected GHG emissions are assumed to remain unchanged from the BAU scenario. The full results for projected GHG emissions for the City of Delano across all forecast years under both the BAU and ABAU scenarios, organized by emissions source and sector, can be found in Table 2.

Table 24 City of Delano Legislative-Adjusted BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	30,057	31,081	31,387
Electricity	Residential	MTCO ₂ e	36,150	4,758	—
Imported Water	Commercial/Institutional	MTCO ₂ e	832	110	—
Imported Water	Agricultural	MTCO ₂ e	299	37	—
Mobile On-road	Residential	MTCO ₂ e	110,874	103,072	102,679
Mobile On-road	Commercial/Institutional	MTCO ₂ e	139,169	134,993	140,191

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

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Greenhouse Gas Emissions Inventory and Forecast for the City of Maricopa

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June 2025

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LIST OF ABBREVIATIONS

ABAU	legislative-adjusted BAU
AR5	Fifth Assessment Report
BAU	business-as-usual
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CH ₄	methane
CO ₂	carbon dioxide
CVP	Central Valley Project
eGRID	Emissions & Generation Resource Integrated Database
EPA Local GHG Inventory Tool	EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1
EPA	US Environmental Protection Agency
GHG	greenhouse gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
Kern COG	Kern Council of Governments
MRR	Mandatory Greenhouse Gas Reporting Regulation
MSW	municipal solid waste
MTCO _{2e}	metric tons of carbon dioxide equivalent
N ₂ O	nitrous oxide
PG&E	Pacific Gas and Electric Company
RPS	Renewables Portfolio Standard
SB	Senate Bill
SWP	State Water Project
VMT	vehicle miles traveled
WARM Tool	Waste Reduction Model
ZEB	zero-emission buses
ZEV	zero-emission vehicle

1 INTRODUCTION

This report contains the methods and results for a greenhouse gas (GHG) emissions inventory and GHG emissions forecast for the City of Maricopa. A GHG emissions inventory provides estimates of emissions generated within a defined geographic boundary during a single year. It identifies the sectors, sources, and activities that produce these emissions and their relative contribution, while also providing a baseline to forecast future emissions trends. A GHG emissions forecast evaluates how GHG emissions may change in the future due to growth and the effects of adopted state and federal legislation and regulations. This information can be used for various purposes, including monitoring GHG emissions trends over time, or as the technical basis for planning efforts to reduce GHG emissions, such as a general plan or greenhouse gas reduction plan.

This report was developed as part of a grant provided to the City of Bakersfield by the US Environmental Protection Agency (EPA) as part of the Climate Pollution Reduction Grants program. The grant was provided to support climate pollution reduction planning in the Bakersfield Metropolitan Statistical Area, which includes the entirety of Kern county. Under this grant, funding was allocated to produce GHG emissions inventories and forecasts for each of the 12 jurisdictions in Kern county, including the City of Bakersfield, unincorporated Kern County, and all incorporated cities. These GHG emissions inventories and forecasts will be provided to the subject jurisdiction, the San Joaquin Valley Air Pollution Control District, and Kern Council of Governments (Kern COG).

The GHG emissions inventory and forecast are intended to provide an accounting of GHG emissions generating activities within the City of Maricopa geographical boundary for the year 2022, and projections of future emissions based on countywide growth patterns and the effects of adopted state and federal legislation and regulations. This report is accompanied by an Excel-based tool used to develop the GHG emissions inventory, the EPA *Local Greenhouse Gas Inventory Tool: Community Module version 2025.1* (the EPA Local GHG Inventory Tool). The GHG emissions inventory uses only publicly available data sets, many of which provide countywide estimates of GHG emissions generating activity, such as mobile on-road travel, energy consumption, and fertilizer use. This countywide data was scaled down to the jurisdiction level based on various attribution metrics, including population, commercial building floor space, and acres of agricultural use. GHG emissions were then forecasted using countywide growth projections for vehicle travel, population, and employment.

Because countywide data was used and scaled using attribution metrics, rather than jurisdiction-specific data, the GHG emissions inventory and forecast are intended to provide a general scale of GHG emissions for City of Maricopa's contribution to countywide GHG emissions and serve as a starting point for more detailed GHG emissions analyses. The Excel-based tool can be updated with more locally specific and operational data that can be obtained from relevant departments and direct requests to utility providers. GHG emissions forecasts can be replicated using more locally specific growth projections for population and employment. The results can also be used to set local GHG reduction targets and develop and quantify locally specific measures for reducing GHG emissions. Sufficient detail is provided in this report to ensure that the analyses are replicable, and data inputs can be replaced with more detailed data, if desired.

2 SUMMARY RESULTS

This section presents the results of the GHG emissions inventory and forecast for the City of Maricopa, providing a comprehensive overview of historical (2022 as the inventory year) and projected (2030, 2040, and 2045 as the forecast years) emissions. The results are organized by emissions sources, including stationary energy, electricity, Mobile On-road, wastewater, solid waste, and others, as well as by sectors, including residential, commercial/institutional, industrial, and agricultural.

This breakdown enables an understanding of the emissions sources and sectors that contribute most significantly to the City of Maricopa's overall emissions. Section 3 of this report provides additional context and methodology related to each emissions source and sector, including key assumptions, data sources, and allocation methods used in the inventory and forecast development.

2.1 2022 GREENHOUSE GAS EMISSIONS INVENTORY RESULTS

Table 1 below shows the 2022 GHG emissions inventory results for the City of Maricopa, categorized by emissions sources and sectors. Figure 1 shows the inventory categorized by emission sources, while Figure 2 shows the inventory categorized by emission sectors.

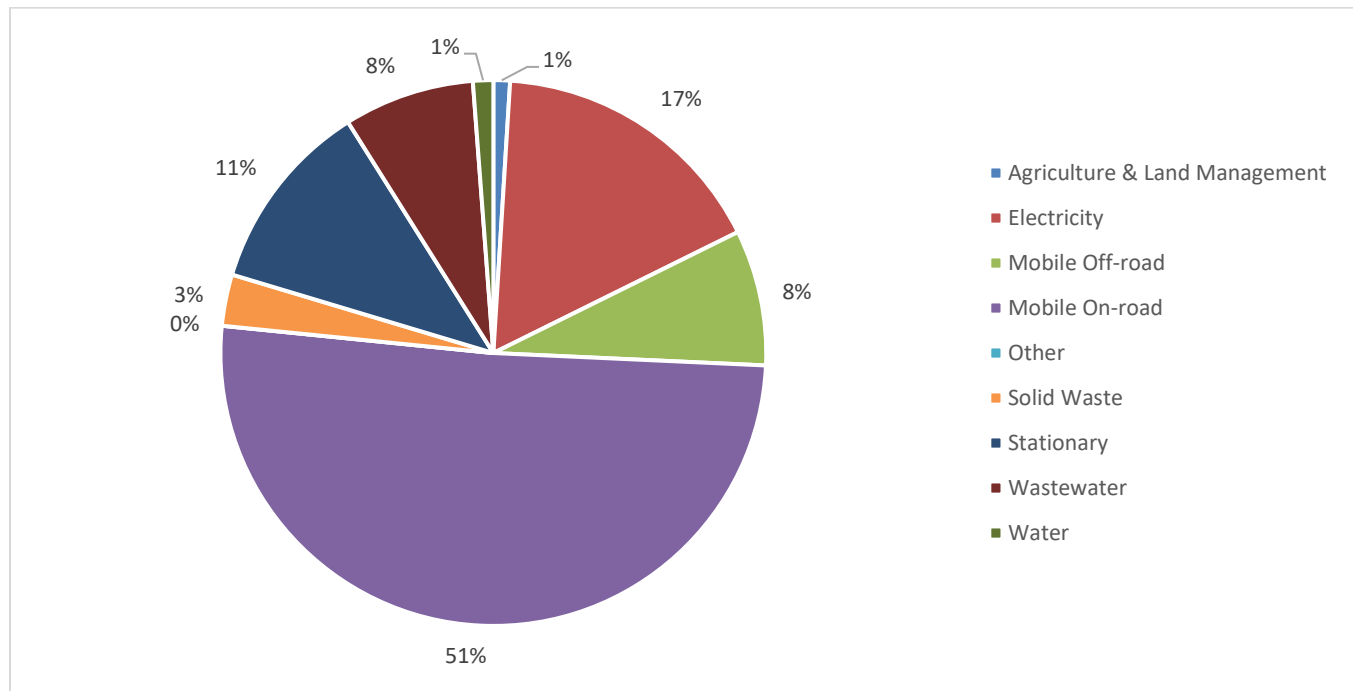
Table 1 City of Maricopa 2022 GHG Emissions Inventory Results (MTCO₂e)

Emissions Sources	Emissions Sectors				
	Agricultural	Commercial/Institutional	Industrial	Residential	Total
Agriculture & Land Management	61				61
Electricity		—	—	1,031	1,031
Mobile Off-road	32	465			496
Mobile On-road		—		3,140	3,140
Solid Waste		—		188	188
Stationary Energy		—	—	705	705
Wastewater		478			478
Water	50	24			74
Total	142	967	—	5,064	6,173

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

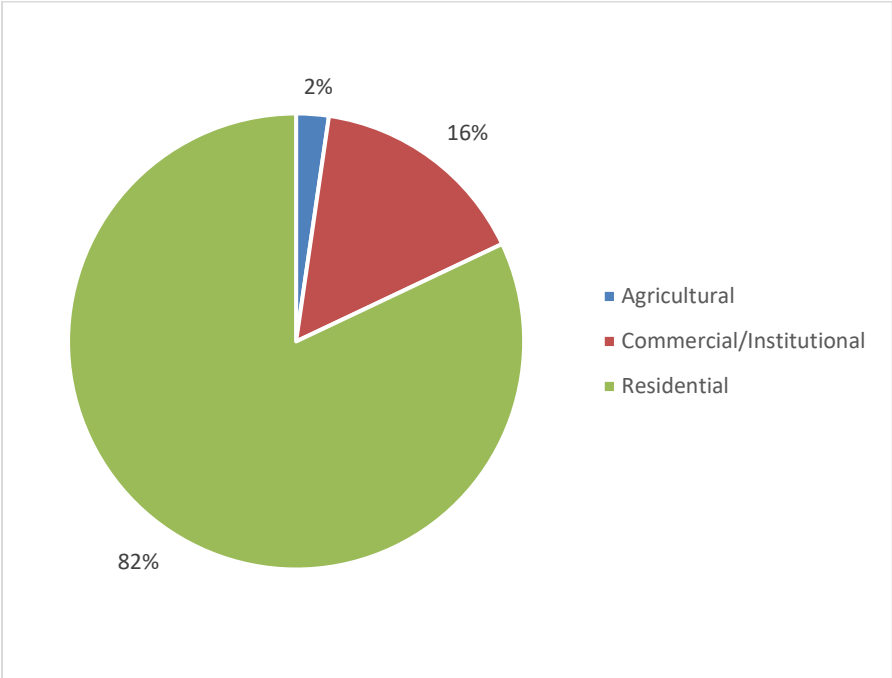
Source: Analysis conducted by Ascent in 2025.

Figure 1 City of Maricopa 2022 GHG Emissions Inventory by Emissions Sources



Source: Analysis conducted by Ascent in 2025.

Figure 2 City of Maricopa 2022 GHG Emissions Inventory by Emissions Sectors



Note: The City of Maricopa had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure.

Source: Analysis conducted by Ascent in 2025.

2.2 GREENHOUSE GAS EMISSIONS FORECAST RESULTS

Table 2 below shows the projected future GHG emissions for the City of Maricopa for the forecast years 2030, 2040 and 2045 under both a business-as-usual (BAU) scenario, as well as a legislative-adjusted BAU (ABAU) scenario, broken down by both emissions sources and sector. The BAU GHG emissions forecasts estimate how community-generated emissions would change over time without additional actions at the State, federal, regional, or local levels, based solely on projected population and employment growth. The ABAU forecasts incorporate the effects of adopted State and federal policies, such as vehicle fuel efficiency standards and increased renewable energy in the electricity grid, but assume no additional local measures.

Table 2 City of Maricopa Greenhouse Gas Emissions Forecast for 2030, 2040 and 2045 by Emissions Source and Sector (MTCO₂e)

Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Stationary Energy	Residential	734	724	769	749	779	756
Stationary Energy	Commercial/Institutional	0	0	0	0	0	0
Stationary Energy	Industrial	—	—	—	—	—	—
Electricity	Residential	1,079	871	1,130	115	1,145	—
Electricity	Commercial/Institutional	0	0	0	0	0	—
Electricity	Industrial	—	—	—	—	—	—
Other Industrial	Industrial	—	—	—	—	—	—
Agriculture – Fertilizer Application	Agricultural	61	61	61	61	61	61
Solid Waste	Residential	197	197	206	206	209	209

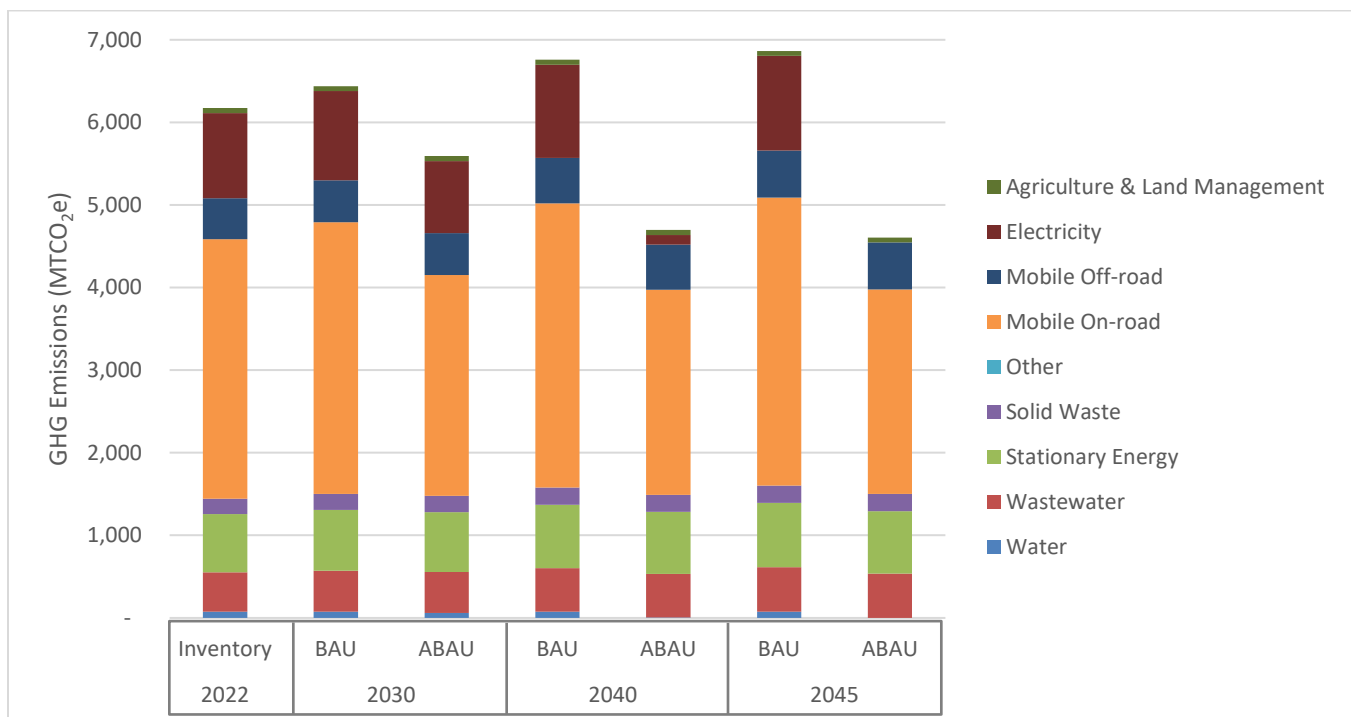
Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Wastewater	Commercial/Institutional	498	498	526	526	537	537
Imported Water	Commercial/Institutional	25	20	26	3	27	—
Imported Water	Agricultural	50	40	50	5	50	—
Mobile On-road	Residential	3,286	2,672	3,442	2,484	3,489	2,475
Mobile On-road	Commercial/Institutional	0	0	0	0	0	0
Mobile Off-road	Commercial/Institutional	478	478	517	517	537	537
Mobile Off-road	Agricultural	32	32	32	32	32	32

Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 3 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Maricopa's 2022 GHG emissions inventory for comparison, all categorized by emissions sources.

Figure 3 City of Maricopa 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sources (MTCO₂e)

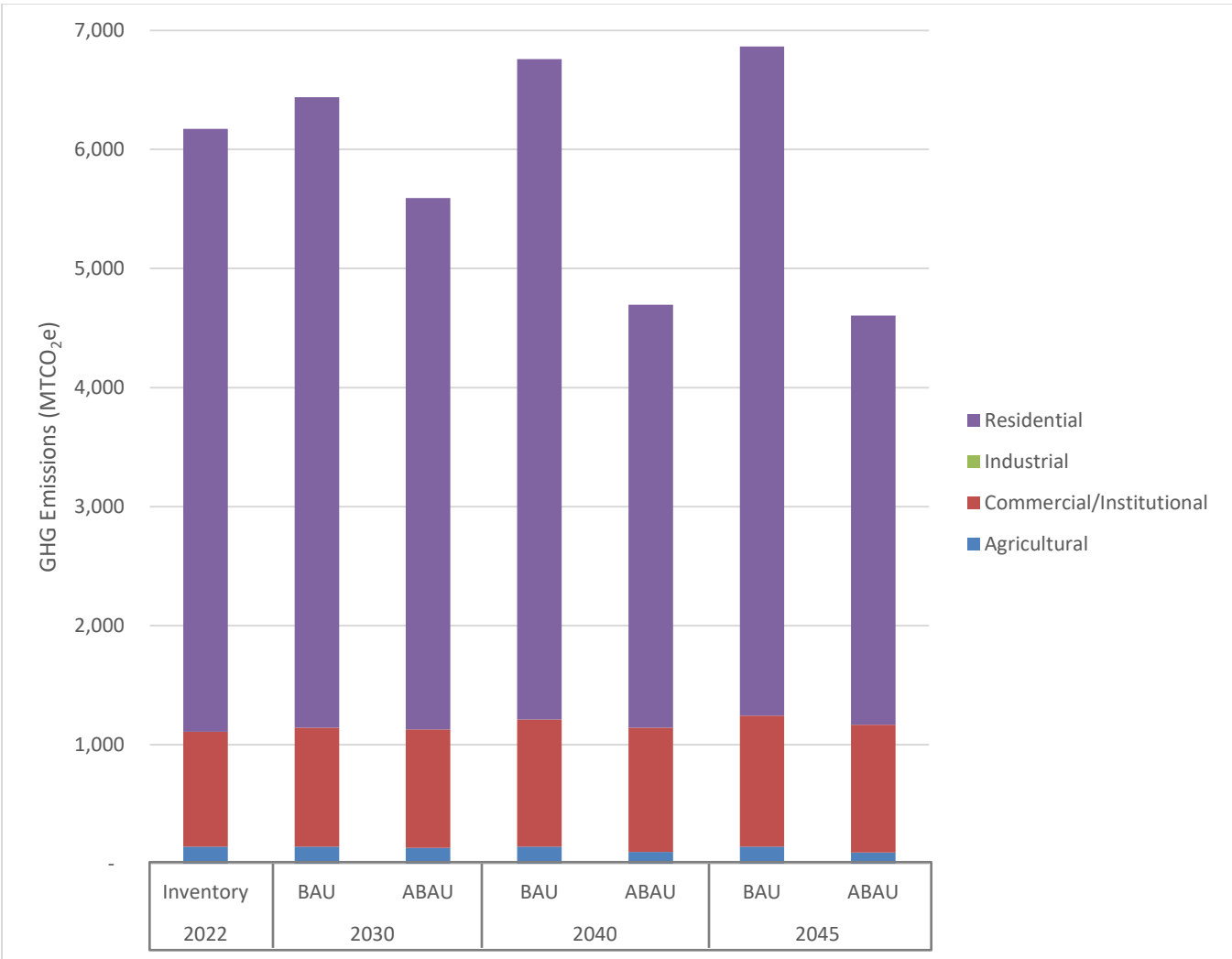


Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 4 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Maricopa's 2022 GHG emissions inventory for comparison, all categorized by emissions sectors.

Figure 4 City of Maricopa 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sectors (MTCO₂e)



Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent. The City of Maricopa had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure.

Source: Analysis conducted by Ascent in 2025.

3 GREENHOUSE GAS EMISSIONS INVENTORY METHODS

This section of the report details the methods used to develop the GHG emissions inventory for the City of Maricopa. It includes descriptions of the data sources and data processing, and the inputs and outputs for the GHG emissions calculations. The methods are organized by GHG emissions sources (stationary energy, electricity, etc.) for the City of Maricopa, based on the EPA Local GHG Inventory Tool.

The EPA Local GHG Inventory Tool was primarily used for GHG emissions calculations. Activity data (e.g., energy consumed, tons of waste landfilled, etc.) inputs for the City of Maricopa were entered into the tool and parameters were set to represent local conditions (e.g., annual electricity consumption data was imported into the tool as the input to calculate City of Maricopa’s GHG emissions associated with electricity, and the appropriate electricity grid was selected to represent local conditions). GHG emissions from on-road transportation were calculated externally to the EPA Local GHG Inventory Tool, due to data format inconsistencies. All other GHG emissions sources were calculated within, or entered into the tool. The tool also categorizes GHG emissions into different sectors: residential, commercial/institutional, industrial, and agricultural. Industrial and agricultural sectors were only used when explicitly

differentiated in the available datasets. In all other cases, sector categorization followed the classifications provided by the EPA Local GHG Inventory Tool or as defined by the underlying data sources.

This report only documents data processing and calculations that were performed outside of the EPA Local GHG Inventory Tool and provides the GHG emissions outputs from the tool; it does not expand on the calculation methods within the tool. Documentation for the EPA Local GHG Inventory Tool can be found on the EPA website at: <https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool>.

3.1 GREENHOUSE GASES AND GLOBAL WARMING POTENTIAL

GHG emissions other than carbon dioxide (CO₂) 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). CO₂ has a GWP factor of one, while all other GHGs have GWP factors measured in multiples of one relative to the GWP of CO₂. This conversion of non-CO₂ gases to one unit enables the reporting of all emissions in terms of carbon dioxide equivalent (CO₂e), 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 (MTCO₂e). For this emissions inventory and forecast, the three primary and most abundant GHGs were accounted for: CO₂, methane (CH₄) and nitrous oxide (N₂O).

Consistent with the best available science, the inventory uses GWP factors published in the Fifth Assessment Report (AR5) from Intergovernmental Panel on Climate Change (IPCC), where CH₄ and N₂O have GWP factors of 28 and 265, respectively (IPCC 2014). These values represent the GWP of GHG on a 100-year time horizon. This means that CH₄ is approximately 28 times stronger than CO₂ and N₂O is 265 times stronger than CO₂ in their potential to warm Earth's atmosphere over the course of 100 years. The use of 100-year GWP values is consistent with the California Air Resources Board (CARB) and EPA GHG accounting methods.

3.2 DATA REVIEW

The general approach for developing the GHG emissions inventory involved the collection of total activity and/or emissions data for Kern county for the year 2022 for each relevant GHG emissions source and then apportioning that data to individual jurisdictions and sectors using appropriate attribution metrics. These metrics include the City of Maricopa's contribution to total countywide population, commercial building floor space, and agricultural land acreage. In some cases, such as for landfilled solid waste and industrial facilities, jurisdiction-specific data were available from publicly available resources.

The primary data sources used to compile activity and emissions data for all of Kern county are listed in Table 3.

Table 3 Data Sources for Countywide Activity and Emissions Data

GHG Emission Source	Data Source(s)
Mobile On-road	CARB EMFAC2021 on-road emission inventory model (CARB 2022a)
Mobile Off-road	CARB OFFROAD2021 off-road emission inventory model (CARB 2022b)
Stationary Energy	CEC energy database (CEC 2023), EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases
Electricity	CEC energy database (CEC 2022), Pacific Gas & Electric Co (PG&E)
Imported Water	Water Association of Kern County
Agriculture	CDFA's fertilizing materials tonnage report (CDFA 2025)
Other Industrial Sources	EPA FLIGHT database (EPA 2023)

Notes: CARB = California Air Resources Board; ; CDFA = California's Department of Food & Agriculture CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

Attribution metrics were used to apportion countywide activity and/or emissions data to individual jurisdictions by the appropriate GHG emissions sector. These attribution metrics include:

- ▶ population share for allocating activity associated with the residential sector (US Census Bureau 2025),
- ▶ commercial building floor space share for activity associated with the commercial/institutional sector (Open Energy Data Initiative 2020), and
- ▶ farmland, grazing land, and other agricultural land cover types share for the agricultural sector (DOC 2022).

These attribution metrics and the associated values for each jurisdiction in Kern county are shown in Table 4 below.

Table 4 Attribution Metrics Used to Apportion Countywide Activities and GHG Emissions

Jurisdiction	Population	Population %	Agricultural Land Acreage	Agricultural Land Acreage %	Commercial Building Floor Space in Square Footage	Commercial Building Floor Space in Square Footage %
Maricopa	19,613	2.2%	1,487	0.1%	1,400	0.9%
Bakersfield	404,321	44.6%	41,684	1.5%	79,800	50.7%
California City	15,002	1.7%	112	0.0%	1,000	0.6%
Delano	50,498	5.6%	4,141	0.2%	5,800	3.7%
Maricopa	1,217	0.1%	558	0.0%	—	0.0%
McFarland	13,971	1.5%	2,754	0.1%	600	0.4%
Ridgecrest	28,118	3.1%	62	0.0%	4,000	2.5%
Shafter	20,162	2.2%	19,419	0.7%	10,700	6.8%
Taft	7,414	0.8%	4,507	0.2%	1,000	0.6%
Tehachapi	12,855	1.4%	2,764	0.1%	1,700	1.1%
Wasco	26,317	2.9%	3,421	0.1%	1,800	1.1%
Unincorporated County	307,395	33.9%	2,666,205	97.1%	49,700	31.6%
Kern County Total	906,883	100%	2,747,115	100%	157,500	100%

Note: Population and agricultural land acreage data reflect conditions in 2022. The most recent data available for commercial building floor space was from 2019, which was used as the attribution metric in this analysis. Because the calculations relied on percentage shares rather than absolute floor space values, using 2019 data was considered appropriate for consistency across jurisdictions.

Sources: US Census Bureau 2025; DOC 2022; Open Energy Data Initiative 2020; analysis conducted by Ascent in 2025.

For the wastewater and solid waste emissions sources, as well as the industrial emissions sector, data and information were collected at the jurisdiction level to calculate associated GHG emissions.

For wastewater, jurisdiction-specific data were obtained from a variety of sources, including any publicly available data about wastewater treatment plant operations. When such data were not publicly available, default values from the EPA Local GHG Inventory Tool and the Local Governments for Sustainability U.S. *Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* were used to fill data gaps.

For solid waste, jurisdiction-specific disposal data were sourced from the California Department of Resources Recycling and Recovery (CalRecycle), specifically from the Jurisdiction Disposal and Beneficial Reuse by Destination database.

For the industrial emissions sector, jurisdiction-specific emissions data were also obtained directly from the EPA FLIGHT and CARB MRR databases, which report facility-level emissions for large industrial sources.

Data sources for jurisdiction-specific activity and emissions data are shown in Table 5 below.

Table 5 Data Sources for Jurisdiction-Specific Activity and Emissions Data

GHG Emission Source/Sector	Data Source(s)
Wastewater	ICLEI (ICLEI 2019)
Solid Waste	CalRecycle's Jurisdiction Disposal and Beneficial Reuse by Destination database (CalRecycle 2025), EPA FLIGHT database (EPA 2024)
Industrial Sector	EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases

Notes: ICLEI = Local Governments for Sustainability; CalRecycle = California Department of Resources Recycling and Recovery; CARB = California Air Resources Board; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

3.3 INVENTORY METHODS BY GHG EMISSIONS SOURCE

This section details the data and methods used to calculate GHG emissions in the 2022 inventory, organized by emissions source. It presents the corresponding data inputs into the EPA Local GHG Inventory Tool, any data processing that was performed, and the resulting emissions estimates by source and sector for the City of Maricopa. All calculations of GHG emissions use the IPCC AR5 GWP values to convert GHG emissions results to CO₂e.

3.3.1 Mobile On-road

The Mobile On-road 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." The estimation of these emissions relies on EMFAC2021, a statewide mobile source emissions inventory model developed by CARB. EMFAC2021 was used instead of the EPA Local GHG Inventory Tool to calculate mobile on-road GHG emissions because EMFAC2021 provides GHG emissions estimates that more closely represent the vehicle fleet operating on roadways in Kern County. The EPA Local GHG Inventory Tool utilizes national fuel efficiency averages for a select number of vehicle types to calculate GHG emissions, whereas EMFAC2021 considers fuel efficiency by vehicle type and model, providing more accurate estimates of fuel consumption and GHG emissions.

To calculate emissions for the 2022 inventory year, total countywide vehicle miles traveled (VMT) were first obtained from EMFAC2021. These VMT figures were then allocated to emission sectors defined by the EPA's Local GHG Inventory Tool based on vehicle class, specifically, the residential and commercial/institutional sectors. For the purposes of sector-specific emissions calculations, light-duty vehicles were attributed to the residential sector, as they primarily reflect personal vehicle use by residents. In contrast, medium- and heavy-duty trucks were attributed to the commercial/institutional sector, as these vehicle types are more commonly associated with goods movement, service fleets, and business operations. Sector-specific VMT totals were then apportioned to each jurisdiction based on appropriate attribution metrics: population share for residential VMT and commercial building square footage share for commercial/institutional VMT.

EMFAC2021 was also used to generate countywide GHG emissions factors for the two sectors, expressed in MTCO₂e per vehicle mile traveled. These factors accounted for all vehicle classes, model years, speeds, and fuel types. The sector-specific factors were derived by dividing total countywide emissions of CO₂, CH₄, and N₂O (converted to CO₂e using the appropriate GWP) by the corresponding sector-specific countywide total VMT, with emissions and VMT categorized into the residential and commercial/institutional sectors based on vehicle class.

Finally, each jurisdiction's total Mobile On-road emissions by sector were calculated by multiplying the jurisdiction's sector-specific VMT by the respective countywide sector-specific MTCO₂e per VMT emissions factors. Table 6 presents the City of Maricopa's total Mobile On-road VMT, associated sector-specific GHG emissions factors, and the resulting total GHG emissions by sector.

Table 6 City of Maricopa Mobile On-road Data Inputs and Results

Vehicle Sector	Total Activity (VMT)	GHG Emissions Factor (MTCO ₂ e/VMT)	GHG Emissions (MTCO ₂ e)
Residential	9,761,379	0.00035	50,606
Commercial/Institutional	—	0.0011	36,381

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: CARB 2022a; analysis conducted by Ascent in 2025.

3.3.2 Mobile Off-road

Emissions from Mobile Off-road sources result from the combustion of fuel in various types of off-road vehicles and equipment (e.g. agricultural tractors, construction equipment). Emissions data for these sources were obtained from CARB's OFFROAD2021 model, which provides detailed estimates for Kern county for the 2022 inventory year. The data include, but are not limited to, information on equipment categories, fuel types, and the amount of fuel consumed.

Using the off-road vehicle categories in OFFROAD2021, the emissions data were organized into two relevant sectors defined by the EPA Local GHG Inventory Tool: agricultural and commercial/institutional. Sector-specific off-road fuel consumption totals were then apportioned to each jurisdiction using appropriate attribution metrics. Specifically, the share of farmland, grazing land, and other agricultural land was used to allocate agricultural emissions, while the commercial building square footage share was used to distribute commercial/institutional emissions.

Finally, each jurisdiction's sector-specific off-road fuel consumption data were entered into the "Mobile-Data" sheet of the EPA Local GHG Inventory Tool to calculate Mobile Off-road emissions. The EPA Local GHG Inventory Tool includes emissions factors by fuel type. Table 7 presents the City of Maricopa's total Mobile Off-road fuel consumption by fuel type and the resulting total GHG emissions by sector.

Table 7 City of Maricopa Mobile Off-road Data Inputs and Results

Vehicle Sector	Diesel Consumption (gallons)	Gasoline Consumption (gallons)	Liquefied Natural Gas (LNG) Consumption (gallons)	Total Fuel Consumption (gallons)	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	32,018	14,008	773	46,799	465
Agricultural	2,955	55	—	3,009	32

Notes: GHG = greenhouse Gas; LNG = liquefied natural gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CARB 2022b, analysis conducted by Ascent in 2025.

3.3.3 Stationary Energy

The stationary energy source of GHG emissions includes natural gas combustion in residential, commercial/institutional and industrial uses. Residential uses primarily consume natural gas for space and water heating, and cooking. Commercial/institutional uses may include space heating and cooling, cooking in restaurants, and smaller boilers or generators. Industrial uses are often process-specific uses tied to manufacturing or heavy operations such as process heating, steam generation, and boiler systems. Propane fuel usage was not included in the stationary energy-related calculations as propane usage data for these various uses was not available at the same level of detail or consistency as other stationary energy data sources at the county scale.

RESIDENTIAL AND COMMERCIAL/INSTITUTIONAL

Total countywide natural gas usage data for the 2022 inventory year was obtained from the CEC Energy Reports: Gas Consumption by County, which categorizes usage into residential and non-residential sectors. Residential natural gas consumption was allocated to each jurisdiction based on its share of the county's population.

To isolate commercial/institutional usage, countywide industrial natural gas consumption, sourced from the EPA FLIGHT database and CARB MRR database, was subtracted from the CEC total non-residential usage. The resulting commercial/institutional natural gas usage was then apportioned to each jurisdiction using commercial building floor space share as the attribution metric.

Finally, each jurisdiction's residential and commercial/institutional natural gas usage data were entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate residential and commercial/institutional stationary energy emissions. Table 8 below shows the City of Maricopa's total stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions in residential and commercial/institutional sectors.

Table 8 City of Maricopa Residential and Commercial/Institutional Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Residential	12,817	705
Commercial/Institutional	—	—

Notes: mcf = thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

INDUSTRIAL

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the City of Maricopa. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

For the City of Maricopa, the databases showed that no large industrial facilities are located within its geographic boundary, therefore, there is no reported industrial stationary energy associated activity or GHG emissions for the City of Maricopa.

3.3.4 Electricity

The electricity source addresses energy-related indirect GHG emissions resulting from the consumption of grid-supplied electricity within the City of Maricopa's boundary. Consumption of grid-supplied electricity is considered an "indirect" GHG emissions source, because GHG emissions occur at the source of electricity generation, which is usually outside of a jurisdiction's boundary. The location-based method was used to calculate electricity GHG emissions, which uses regional grid-average emission factors. In the United States, these factors are provided by the EPA's Emissions & Generation Resource Integrated Database (eGRID). Specifically, emission factors for the CAMX eGRID subregion were applied, as this subregion encompasses the geographic area of Kern county.

Total electricity usage data for Kern county in 2022 was obtained from CEC Energy Reports: Electricity by County, which categorized usage into residential and non-residential sectors (CEC 2023). Electricity usage data for the City of Bakersfield, which was also separated into residential and non-residential categories, was acquired directly from the Pacific Gas and Electric Company (PG&E). To estimate electricity usage for the rest of the county (i.e., all jurisdictions excluding Bakersfield), the City of Bakersfield's electricity data was subtracted from the total Kern county data.

Residential electricity usage outside of Bakersfield was apportioned to each jurisdiction based on its share of the county's total population. For non-residential electricity usage, estimates were further categorized into industrial and commercial/institutional sectors using attribution metrics derived from natural gas consumption data previously calculated under stationary energy. In 2022, 93.1 percent of the county's stationary natural gas combustion was attributed to industrial use and 6.9 percent to commercial/institutional use. These same ratios were applied to the county's total non-residential electricity usage, under the assumption that the sectoral split in electricity usage mirrors that of natural gas usage. This assumption was validated using available industrial electricity and natural gas usage data in PG&E's service territory, from the CEC Energy Reports. The electricity-to-gas ratio, expressed as gigawatt-hour per million therms, was calculated by dividing total industrial electricity usage by industrial natural gas consumption for the service territory. The resulting value closely aligns with the assumptions applied in this here, supporting its validity.

The City of Maricopa's share of commercial building square footage was used to attribute commercial/institutional electricity usage. Industrial electricity usage was attributed based on the proportion of countywide industrial natural gas within the City of Maricopa. No industrial facilities exist in the City of Maricopa; therefore, no industrial electricity usage is attributed to the City of Maricopa. Finally, the sector-specific electricity usage data for each jurisdiction was entered into the "Electricity-Data" sheet of the EPA Local GHG Inventory Tool to calculate associated GHG emissions.

Table 9 below shows the City of Maricopa's electricity activity data and the associated GHG emissions by emission sectors.

Table 9 City of Maricopa Electricity Energy Data Inputs and Results

Sector	Total Activity (kWh of Electricity Consumed)	GHG Emissions (MTCO ₂ e)
Residential	4,551,867	1,031
Commercial/Institutional	—	—
Industrial	—	—

Notes: kWh = kilowatt-hour; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; PG&E 2025; analysis conducted by Ascent in 2025.

3.3.5 Imported Water

The water source category captures GHG emissions from energy use associated with the conveyance, treatment, and distribution of water within a jurisdiction. In Kern county, the WAKC reports that approximately 166,000 acre-feet of water are used annually for municipal and industrial purposes, and 2,294,000 acre-feet for agricultural purposes.

In addition to local surface water, Kern county draws water from several sources. Among these, only water supplied through the State Water Project (SWP) and the federal Central Valley Project (CVP) is considered imported, and therefore potentially results in GHG emissions due to long-distance conveyance. All other sources are classified as local. It was assumed that energy used for extracting, conveying, treating, and distributing local water is captured under the emissions estimates for stationary energy and electricity, since these activities occur within the county. In addition, upon further review, it was also determined that the federal CVP does not consume energy for water delivery to Kern County, as water is primarily conveyed using gravity (Friant Water Authority 2019). As a result, only the SWP, which accounts for 26 percent of the county's water supply, contributes to GHG emissions. Table 10 provides a summary of the water sources in Kern county and their contribution to the total water supply.

Table 10 Kern County Water Sources

Source	Percentage
Kern River	20%
State Water Project (California Aqueduct)	26%
Federal Central Valley Project (Friant-Kern Canal)	12%
Local Streams and Other Sources (Poso Creek, Kern River, etc.)	6%

Source	Percentage
Groundwater	36%
Total	100%

Source: WAKC n.d.

Water use in Kern County is characterized into municipal and industrial, and agricultural sectors in data obtained from WAKC. It is assumed that water included in “municipal” uses is delivered to both commercial and residential customers. However, sufficient data was not available to disaggregate the water consumption between industrial, commercial, and residential customers. For the purpose of this GHG emissions inventory, all non-agricultural water consumption was categorized under the commercial/institutional sector.

To allocate sector-specific water usage to individual jurisdictions, the following attribution metrics were used:

- ▶ Agricultural water use was apportioned based on each jurisdiction’s share of farmland, grazing land, and other agricultural land.
- ▶ Commercial/institutional water use was distributed according to the share of commercial building square footage in each jurisdiction.

These apportioned figures were then entered into the “Imported Water” sheet of the EPA Local GHG Inventory Tool, applying a universal 26 percent imported water rate, to estimate the associated GHG emissions from water conveyance and use. Table 11 presents the City of Maricopa’s activity data related to imported water, including the percentage of total water supply that is imported and the associated GHG emissions.

Table 11 City of Maricopa Imported Water Energy Data Inputs and Results

Sector	Total Activity (Gallons of Water)	Percentage of Water Imported	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	18,872,951	26%	24
Agricultural	39,500,060		50

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: WAKC n.d.; analysis conducted by Ascent in 2025.

3.3.6 Wastewater

The wastewater source accounts for GHG emissions resulting from the treatment of sewage. To support this analysis, a review of publicly available wastewater treatment characteristics was conducted to collect the data required for completing the “Wastewater-Control” tab of the EPA’s Local GHG Inventory Tool. The data sources and corresponding assumptions for the City of Maricopa’s wastewater treatment systems are summarized in Table 12. Where jurisdiction-specific data were not publicly available, the default input values provided by the EPA tool were used.

To estimate GHG emissions, population data for each jurisdiction were subsequently entered into the “Wastewater-Entry” tab of the tool. The resulting emissions estimates are also presented in Table 12, alongside the data sources and assumptions used.

Table 12 City of Maricopa Wastewater Treatment Assumptions

Wastewater Process/Treatment Type	Conditions Assumed	Data Source	GHG Emissions (MTCO ₂ e)
Population served by septic systems	5 percent of the city’s population	ICLEI’s default proportion of population that utilizes septic tanks for an urban area (Box WW.11(alt).2).	478
One or more wastewater treatment plants (WWTPs) where wastewater is treated in aerobic or anaerobic conditions	Anerobic	No public information is available. The default value is anerobic.	

Wastewater Process/Treatment Type	Conditions Assumed	Data Source	GHG Emissions (MTCO ₂ e)
One or more WWTPs conduct or do not conduct nitrification/denitrification	No nitrification/denitrification	No public information is available. The default value is no nitrification/denitrification.	

Notes: WWTP = wastewater treatment plant; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; ICLEI = Local Governments for Sustainability.

Sources: ICLEI 2019; analysis conducted by Ascent in 2025.

3.3.7 Solid Waste

Community-generated solid waste emissions are primarily associated with the decomposition of solid waste in landfills. There are two methods for accounting for GHG emissions associated with waste disposal:

- ▶ Waste generation method – Accounts for the total GHG emissions that would be generated over time as municipal solid waste (MSW) that is sent to a landfill in only the inventory year decomposes.
- ▶ Waste-in-place method – Accounts for the total GHG emissions generated in a given year at a specific landfill location by the decomposition of all MSW previously disposed at the landfill.

Generally, there is some risk of double counting GHG emissions when combining both of these methods, as a portion of the emissions accounted for using the waste generation method may occur at an in-boundary landfill that has emissions reported using the waste-in-place method. However, the scale of the overlapping GHG emissions between the two methods would be expected as very small in comparison to total emission using either accounting method.

WASTE GENERATION

Landfill tonnage data for 2022 was obtained from CalRecycle’s Jurisdiction Disposal and Beneficial Reuse by Destination database. This data was entered into the EPA’s Waste Reduction Model (WARM Tool) as “mixed MSW” to estimate waste generation emissions. The default national average values were used in the WARM Tool, except for Question 7, where the k value was set to “dry” based on the county’s annual precipitation (less than 20 inches) (NCEI 2025). The WARM output was then imported into the EPA Local GHG Inventory Tool’s “Waste Production” tab, with solid-waste associated emissions attributed to the residential sector by default.

The total activity for solid waste disposal and the resulting waste generation GHG emissions results from the WARM Tool are provided in Table 13.

Table 13 City of Maricopa Waste Generation Data Inputs and Results

Sector	Total Activity (tons of MSW disposed)	GHG Emissions (MTCO ₂ e) (WARM Output)
Residential	651	188

Notes: MSW = mixed municipal solid waste; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; WARM = Waste Reduction Model.

Source: CalRecycle 2025; analysis conducted by Ascent in 2025.

WASTE-IN-PLACE

EPA’s FLIGHT database was reviewed to determine emissions from landfills located within the City of Maricopa’s geopolitical boundary, which would provide emissions data for any landfills that generated emissions greater than 25,000 MTCO₂e in 2022. No reporting landfills were identified for the City of Maricopa.

3.3.8 Agriculture

The agriculture emissions source captures GHG emissions generated from fertilizer application.

FERTILIZER APPLICATION

Fertilizer application results in GHG emissions primarily due to the release of N₂O, a potent GHG with a global warming potential nearly 300 times greater than CO₂. When nitrogen-based fertilizers are applied to soil, a portion of the nitrogen undergoes microbial processes (nitrification and denitrification), which convert it into N₂O. These emissions can occur directly from the soil or indirectly through leaching and runoff.

The total tonnage of nitrogen in synthetic fertilizers applied in Kern county during the 2022 inventory year was obtained from CDFA's fertilizing materials tonnage report. This countywide total was then apportioned to individual jurisdictions based on each jurisdiction's proportional share of farmland, grazing land, and other agricultural land. Only data for synthetic fertilizers was publicly available for calculation, although other organic or manure-based fertilizers may be used.

The resulting tonnage of nitrogen in synthetic fertilizers estimated for the City of Maricopa was entered into the "Agriculture & Land Management" sheet of the EPA's Local GHG Inventory Tool to calculate the associated emissions. Table 14 provides the estimated total tons of nitrogen applied and resulting GHG emissions.

Table 14 City of Maricopa Fertilizer Application Data Inputs and Results

Sector	Total Activity (tons of nitrogen applied)	GHG Emissions (MTCO ₂ e)
Agricultural	8	61

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CDFA 2025; analysis conducted by Ascent in 2025.

4 GREENHOUSE GAS EMISSIONS FORECAST METHODS

This section provides the methods and data used to project future GHG emissions under a BAU scenario, as well as the calculations of reductions from adopted legislation and regulations under an ABAU scenario.

The BAU GHG emissions forecasts assess how emissions generated by community activities will change over time without further State, federal, regional, or local action. The BAU scenario forecast accounts for the changes in population and employment that can influence communitywide GHG emissions. The ABAU scenario forecast includes adopted policies and regulations at the State and federal levels that would affect emissions without any local action, such as regulatory requirements to increase vehicle fuel efficiency and increase renewable energy sources in grid electricity portfolios. These forecasts provide the City of Maricopa with information needed to understand specific GHG emissions sources with the greatest opportunities for reduction with future plans, projects, or programs. It is important to note that the ABAU forecasts only account for emissions reductions associated with adopted policies and regulations; they do not account for proposed and/or unadopted GHG reduction actions established by regional, State, and federal agencies or executive orders outside of adopted legislation and regulations.

The GHG emissions forecasts project GHG emissions for the years 2030, 2040, and 2045 to align with key regulatory timelines for the State. Two key legislative actions establish statewide GHG reduction targets for the years 2030 and 2045, including:

- ▶ Senate Bill (SB) 32 of 2016, which sets a statewide GHG reduction target for the year 2030, and
- ▶ Assembly Bill 1279 of 2022, which sets a statewide GHG reduction target for the year 2045.

The forecast years selected do not necessarily align with the targets established by adopted legislation, but they do provide an analysis of emissions that aligns with the relevant horizon years. The year 2040 was also included in the analysis as an interim year between the 2030 and 2045 forecast years.

4.1 GROWTH PROJECTIONS

GHG emissions forecasts were developed based on projected changes in Kern county’s demographics, specifically population, employment, and service population (defined as residents plus employees), between 2022 and 2045. These projections were obtained from the Regional Growth Forecast and Demographic Forecast prepared by the Kern COG (Kern COG 2024). It is assumed that the incorporated cities and the unincorporated county will experience demographic growth at the same rate as the county overall, as jurisdiction-specific growth projections were not available at the time of this analysis.

Between 2022 and 2045, Kern county’s population and employment are projected to increase by approximately 11.1 and 15.5 percent, respectively. The service population is expected to grow by 12.4 percent. These growth factors were applied to forecast GHG emissions for the years 2030, 2040, and 2045 across various emissions sources included in the inventory. The values used for population, employment, and service population used to project future emissions are provided in Table 15.

Table 15 Kern County Demographics and Calculated Growth Rates for Future Emissions Forecasts

Calculation Factor	2022	2030	2040	2045
Population				
Total Kern County	906,883	949,134	994,167	1,007,627
Kern County Growth from 2022		4.7%	9.6%	11.1%
Employment				
Total Kern County	358,961	369,427	399,432	414,652
Kern County Growth from 2022		2.9%	11.3%	15.5%
Service Population				
Total Kern County	1,265,844	1,318,561	1,393,598	1,422,279
Kern County Growth from 2022		4.2%	10.1%	12.4%

Source: US Census Bureau 2025; Kern COG 2024; analysis conducted by Ascent in 2025.

Additional details on how growth factors were applied to individual sources are provided in the following sections. It is important to note that agricultural emissions, including those from fertilizer application, as well as livestock enteric fermentation and manure management, are assumed to remain constant throughout the forecast period, with no projected increase in activity levels. Agricultural activities are difficult to project in any detail, with production intensities, number of livestock, and crop types being highly susceptible to global markets and local climate patterns. As such, projections of agriculture GHG emissions-generating activities are not attempted.

4.2 BUSINESS-AS-USUAL SCENARIO FORECAST

The BAU forecast represents a projection of future GHG emissions based solely on expected demographic and economic growth (e.g., population, employment, and service population) between 2022 and 2045. It does not account for the potential impacts of future policies, programs, or actions that may reduce emissions, such as energy efficiency improvements, renewable energy adoption, or transportation electrification.

In the BAU scenario, GHG emissions factors are held constant at the levels used in the 2022 GHG inventory, meaning the carbon intensity of electricity, fuels, and other activities is assumed not to change over time. As a result, any changes in future emissions are driven entirely by growth in activity levels, not by improvements in emissions performance.

4.2.1 Business-As-Usual Scenario Forecast Results

Table 16 presents the projected activity data for the City of Maricopa across all forecast years, organized by emissions source and sector. Table 16 also indicates which sources and sectors used population, employment, or service population as a growth metric.

Table 16 City of Maricopa BAU Scenario Projected Activity Data for All Forecast Years

Source	Sector	Growth Metric	Units	2030	2040	2045
Stationary Energy	Residential	Population	scf	13,414	14,050	14,240
Stationary Energy	Commercial/Institutional	Employment	scf	—	—	—
Stationary Energy	Industrial	Employment	scf	—	—	—
Electricity	Residential	Population	kWh	4,763,934	4,989,965	5,057,525
Electricity	Commercial/Institutional	Employment	kWh	—	—	—
Electricity	Industrial	Employment	kWh	—	—	—
Other Industrial	Industrial	Employment	MTCO ₂ e	—	—	—
Agriculture – Fertilizer Application	Agricultural ¹	N/A	ton	8	8	8
Solid Waste	Residential	Population	ton	682	714	724
Wastewater	Commercial/Institutional	Service Population	MTCO ₂ e	498	526	537
Imported Water	Commercial/Institutional	Service Population	Gallon	19,658,932	20,777,690	21,205,303
Imported Water	Agricultural ¹	N/A	Gallon	39,500,060	39,500,060	39,500,060
Mobile On-road	Residential	Population	VMT	10,216,152	10,700,870	10,845,751
Mobile On-road	Commercial/Institutional	Employment	VMT	—	—	—
Mobile Off-road	Commercial/Institutional	Employment	MTCO ₂ e	478	517	537
Mobile Off-road	Agricultural ¹	N/A	MTCO ₂ e	32	32	32

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; scf = standard cubic foot.

¹ Activity levels for the agricultural sector are assumed to remain constant over the forecast period; therefore, growth metrics are listed as “N/A.”

Source: Analysis conducted by Ascent in 2025.

Table 17 below presents the projected GHG emissions for the City of Maricopa across all forecast years, also organized by emissions source and sector.

Table 17 City of Maricopa BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	734	769	779
Stationary Energy	Commercial/Institutional	MTCO ₂ e	—	—	—
Stationary Energy	Industrial	MTCO ₂ e	—	—	—
Electricity	Residential	MTCO ₂ e	1,079	1,130	1,145
Electricity	Commercial/Institutional	MTCO ₂ e	—	—	—
Electricity	Industrial	MTCO ₂ e	—	—	—
Other Industrial	Industrial	MTCO ₂ e	—	—	—

Source	Sector	Units	2030	2040	2045
Agriculture – Fertilizer Application	Agricultural	MTCO ₂ e	61	61	61
Solid Waste	Residential	MTCO ₂ e	197	206	209
Wastewater	Commercial/Institutional	MTCO ₂ e	498	526	537
Imported Water	Commercial/Institutional	MTCO ₂ e	25	26	27
Imported Water	Agricultural	MTCO ₂ e	50	50	50
Mobile On-road	Residential	MTCO ₂ e	3,286	3,442	3,489
Mobile On-road	Commercial/Institutional	MTCO ₂ e	—	—	—
Mobile Off-road	Commercial/Institutional	MTCO ₂ e	478	517	537
Mobile Off-road	Agricultural	MTCO ₂ e	32	32	32

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

4.3 LEGISLATIVE-ADJUSTED BUSINESS-AS-USUAL SCENARIO FORECAST

ABAU emissions forecasts were prepared using the same demographic data that were used for the BAU forecasts, while also accounting for State and federal policies and regulations that would affect local emissions. These forecasts provide the City of Maricopa with a more robust understanding of future community emissions based on the GHG reduction efforts at the state and federal level. A summary of applicable legislative reductions is provided in Table 18.

Table 18 Legislative Reductions Summary

Source	Legislative Reduction	Description	Sources Applied
State	Renewable Energy and Zero-Carbon Electricity Requirements [SB 1020 and SB 100]	Requires California energy utilities to procure 60 percent of electricity from eligible renewable and zero-carbon sources by 2030, 95 percent by 2040, and 100 percent by 2045.	Electricity, Imported Water
State	California's Building Energy Efficiency Standards (2019 and 2022 Title 24, Part 6)	Requires all new buildings in California to comply with energy efficiency standards established by CEC. Accounts for the energy efficiency gains in new residential and nonresidential buildings.	Stationary Energy, Electricity
State	Advanced Clean Car I Regulation	Establishes GHG emission reduction standards for model years 2017 through 2025 that are more stringent than federal CAFE standards.	Mobile On-road
State	Truck and Bus Regulation	Requires diesel trucks and buses that operate in California to be upgraded to reduce GHG emissions.	Mobile On-road
Federal	Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles	Establishes fuel efficiency standards for medium- and heavy-duty engines and vehicles.	Mobile On-road

Notes: CAFE = Corporate Average Fuel Economy; CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; SUV = sports utility vehicle; SB = Senate Bill.

4.3.1 Title 24 Adjustments

Future energy use was adjusted to reflect increased emissions-intensity stringency under California's Building Energy Efficiency Standards (California Code of Regulations Title 24 Part 6, hereafter referred to as "Title 24"). Although Title 24 applies to both new residential and nonresidential construction, for the purposes of this forecast, adjustments were applied only to residential construction for reasons described below.

This approach accounts for uncertainties in energy consumption patterns and end uses in nonresidential buildings, and uncertainty in the non-residential building types that would be constructed in the future. Title 24 primarily

regulates energy efficiency in building envelopes and lighting systems. This is expected to substantially reduce energy consumption for building types where the primary end uses of energy are lighting and heating, ventilation, and air conditioning, such as new office, institutional, and hotel buildings. However, Title 24 may not significantly affect other high-energy-consuming uses in nonresidential facilities, such as process loads or specialized equipment. As such, limiting adjustments to residential construction provides a more conservative and reliable estimate of future energy-related GHG emissions.

The 2019 Title 24 standards apply to projects constructed after January 1, 2020, while the 2022 standards apply after January 1, 2023. The 2025 Title 24 will go into effect statewide in January of 2026; however, detailed data on the changes in building-level energy consumption between the 2025 code and previous code cycles was not available at the time of this analysis. To estimate changes in future energy consumption under the 2022 standards, electricity and natural gas adjustment factors were calculated based on differences in average residential energy use between buildings built to the 2019 and 2022 standards. These factors were derived from CEC's data specific to the 2019 and 2022 standards and climate zone-based energy usage rates. For the City of Maricopa, Climate Zone 13 was used in the analysis.

These adjustment factors were then applied to the ABAU forecasts of energy consumption activity for both stationary energy and electricity use to reflect the impact of legislative energy efficiency improvements on future development. The adjustment factors, presented in Table 19, show the percentage change in energy use for buildings built to 2022 standards relative to those built to 2019 standards. Positive values indicate an anticipated increase in energy use, while negative values indicate an anticipated decrease in energy use.

As shown in Table 19:

- ▶ ABAU electricity activity is projected to be higher than BAU in each forecast year due to positive adjustment factors.
- ▶ ABAU stationary energy activity is projected to be lower than BAU due to negative adjustment factors.

Importantly, these adjustments were applied only to energy use growth occurring after the 2022 baseline, reflecting new development that would be subject to the 2022 Title 24, or a later cycle of standards. In addition, it is important to note that although average electricity use in new residential buildings is anticipated to rise under 2022 Title 24 (due to an increase in electrical demand associated with electric appliances installed instead of natural gas appliances), emissions from new residential buildings are expected to be lower than they would be under 2019 Title 24 as a result of overall lower building emissions intensities (due to lower emissions factors associated with electricity compared to natural gas).

Table 19 Stationary Energy and Electricity Adjustment Factors and Activity Forecast Results for Residential Buildings

Energy Type	Forecast Scenario	Adjustment Factor	Activity Units	2022	2030	2040	2045
Electricity	BAU	—	kWh	4,551,867	4,763,934	4,989,965	5,057,525
Electricity	ABAU	+12%	kWh	4,551,867	4,789,295	5,042,356	5,117,996
Stationary Energy (Natural Gas)	BAU	—	mcf	12,817	13,414	14,050	14,240
Stationary Energy (Natural Gas)	ABAU	-29%	mcf	12,817	13,240	13,691	13,826

Notes: BAU = Business-as-Usual; ABAU = legislative-adjusted BAU; mcf = one thousand cubic feet; kWh = kilowatt-hour.

Source: Analysis conducted by Ascent in 2025.

4.3.2 Senate Bill 100 and Senate Bill 1020 Adjustments

SB 100 requires that 100 percent of retail electricity sales in California come from renewable and zero-carbon resources by 2045. This legislation builds upon the state’s existing Renewables Portfolio Standard (RPS) by increasing the required percentage of RPS-eligible renewable electricity over time. SB 1020 builds on SB 100 by introducing interim targets for GHG-free electricity for the years 2035 and 2040. As shown in Table 20, SB 100 and SB 1020 require utility providers to supply electricity that is 60 percent GHG-free by 2030, 95 percent by 2040, and 100 percent by 2045. The emissions sources affected by these adjustments include electricity and imported water, both of which are estimated based on the carbon intensity of the electricity grid.

To estimate future GHG emissions factors, the 2022 GHG-free electricity percentage and GHG emissions factors for the CAMX eGRID subregion were first obtained from the EPA’s eGRID database. Using these 2022 values as a baseline, emissions factors for the forecast years (2030, 2040, and 2045) were calculated based on the GHG-free electricity targets established by SB 100 and SB 1020.

Table 20 below demonstrates these GHG-free electricity percentage baseline values and targets, as well as the baseline and calculated emissions factors for the forecast years. Given 2045’s 100 percent GHG-free electricity percentage target, the emissions factor for 2045 is 0. In contrast to the ABAU forecast, the CAMX eGRID emissions factors under the BAU scenario are assumed to remain constant at their 2022 baseline values throughout the forecast years.

Table 20 CAMX eGRID Electricity GHG Emissions Factors Adjusted for SB100 and SB1020

Calculation Factor	Units	2022	2030	2040	2045
SB 100 and SB 1020 GHG-free electricity percentage targets	Percent GHG-free	N/A	60%	95%	100%
CAMX eGRID GHG-free electricity percentage baseline and targets	Percent GHG-free	50%	60%	95%	100%
CAMX eGRID baseline and interpolated emissions factors	MTCO ₂ e/MWh	0.2265	0.1819	0.0227	0

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MWh = megawatt-hour; N/A = Not Applicable.

Source: Analysis conducted by Ascent in 2025.

4.3.3 On-road Vehicle Emissions Standards

State and federal regulations are expected to significantly reduce on-road GHG emissions by requiring improvements in vehicle fuel efficiency and accelerating the transition to zero-emission vehicles (ZEVs). The ABAU forecast for the Mobile On-road source takes into consideration the following State and federal regulations:

- ▶ Innovative Clean Transit Regulation, which requires all California public transit agencies to begin phasing in zero-emission buses (ZEB) starting in 2023 and transition to 100 percent ZEB fleets by 2040 and
- ▶ Advanced Clean Trucks Regulation, which requires truck and van manufacturers to sell a growing share of ZEVs beginning in model year 2024.

All these regulations are reflected in EMFAC2021’s emissions data for the forecast years (2030, 2040 and 2045), which serve as the basis for the Mobile On-road source’s ABAU forecast. In addition to these regulations, EMFAC2021’s data also takes into consideration future increases in light-duty ZEV sales, which would be influenced by California’s Advanced Clean Cars I regulation.

Accordingly, EMFAC2021’s VMT and emissions estimates for forecast years were used to calculate Mobile On-road emissions under the legislative adjustment scenario. As with the inventory methodology, sector-specific emissions factors for each forecast year were calculated by dividing sector-specific VMT by sector-specific emissions for each forecast year. These emissions factors were then multiplied by projected future VMT, which were scaled by relevant activity growth factors (population for the residential sector and employment for the commercial/institutional sector)

to estimate future emissions. The baseline and projected future emissions factors calculated using EMFAC2021 are shown in Table 21.

In contrast, under the BAU scenario, Mobile On-road emissions factors are held constant at their 2022 baseline values for all forecast years, reflecting no change in vehicle efficiency or fleet composition.

Table 21 Mobile On-road Baseline and Projected GHG Emissions Factors

Sector	Units	2022	2030	2040	2045
Commercial Institutional	MTCO ₂ e/VMT	0.0010	0.00090	0.00081	0.00081
Residential	MTCO ₂ e/VMT	0.00032	0.00026	0.00023	0.00023

Notes: MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: Analysis conducted by Ascent in 2025.

4.3.4 Legislative-Adjusted Business-as-Usual Scenario Forecast Results

Table 22 presents the projected GHG emissions for the City of Maricopa across all forecast years under the ABAU scenario, organized by emissions source and sector. Emissions sources and sectors not impacted by legislative adjustments are excluded from this table, as their projected GHG emissions are assumed to remain unchanged from the BAU scenario. The full results for projected GHG emissions for the City of Maricopa across all forecast years under both the BAU and ABAU scenarios, organized by emissions source and sector, can be found in Table 2.

Table 22 City of Maricopa Legislative-Adjusted BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	724	749	756
Electricity	Residential	MTCO ₂ e	871	115	—
Imported Water	Commercial/Institutional	MTCO ₂ e	20	3	—
Imported Water	Agricultural	MTCO ₂ e	40	5	—
Mobile On-road	Residential	MTCO ₂ e	2,672	2,484	2,475
Mobile On-road	Commercial/Institutional	MTCO ₂ e	—	—	—

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

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WAKC. See Water Association of Kern County.

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Greenhouse Gas Emissions Inventory and Forecast for the City of McFarland

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June 2025

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LIST OF ABBREVIATIONS

ABAU	legislative-adjusted BAU
AR5	Fifth Assessment Report
BAU	business-as-usual
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CH ₄	methane
CO ₂	carbon dioxide
CVP	Central Valley Project
eGRID	Emissions & Generation Resource Integrated Database
EPA Local GHG Inventory Tool	EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1
EPA	US Environmental Protection Agency
GHG	greenhouse gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
Kern COG	Kern Council of Governments
MRR	Mandatory Greenhouse Gas Reporting Regulation
MSW	municipal solid waste
MTCO _{2e}	metric tons of carbon dioxide equivalent
N ₂ O	nitrous oxide
PG&E	Pacific Gas and Electric Company
RPS	Renewables Portfolio Standard
SB	Senate Bill
SWP	State Water Project
VMT	vehicle miles traveled
WARM Tool	Waste Reduction Model
ZEB	zero-emission buses
ZEV	zero-emission vehicle

1 INTRODUCTION

This report contains the methods and results for a greenhouse gas (GHG) emissions inventory and GHG emissions forecast for the City of McFarland. A GHG emissions inventory provides estimates of emissions generated within a defined geographic boundary during a single year. It identifies the sectors, sources, and activities that produce these emissions and their relative contribution, while also providing a baseline to forecast future emissions trends. A GHG emissions forecast evaluates how GHG emissions may change in the future due to growth and the effects of adopted state and federal legislation and regulations. This information can be used for various purposes, including monitoring GHG emissions trends over time, or as the technical basis for planning efforts to reduce GHG emissions, such as a general plan or greenhouse gas reduction plan.

This report was developed as part of a grant provided to the City of Bakersfield by the US Environmental Protection Agency (EPA) as part of the Climate Pollution Reduction Grants program. The grant was provided to support climate pollution reduction planning in the Bakersfield Metropolitan Statistical Area, which includes the entirety of Kern county. Under this grant, funding was allocated to produce GHG emissions inventories and forecasts for each of the 12 jurisdictions in Kern county, including the City of Bakersfield, unincorporated Kern County, and all incorporated cities. These GHG emissions inventories and forecasts will be provided to the subject jurisdiction, the San Joaquin Valley Air Pollution Control District, and Kern Council of Governments (Kern COG).

The GHG emissions inventory and forecast are intended to provide an accounting of GHG emissions generating activities within the City of McFarland geographical boundary for the year 2022, and projections of future emissions based on countywide growth patterns and the effects of adopted state and federal legislation and regulations. This report is accompanied by an Excel-based tool used to develop the GHG emissions inventory, the EPA *Local Greenhouse Gas Inventory Tool: Community Module version 2025.1* (the EPA Local GHG Inventory Tool). The GHG emissions inventory uses only publicly available data sets, many of which provide countywide estimates of GHG emissions generating activity, such as mobile on-road travel, energy consumption, and fertilizer use. This countywide data was scaled down to the jurisdiction level based on various attribution metrics, including population, commercial building floor space, and acres of agricultural use. GHG emissions were then forecasted using countywide growth projections for vehicle travel, population, and employment.

Because countywide data was used and scaled using attribution metrics, rather than jurisdiction-specific data, the GHG emissions inventory and forecast are intended to provide a general scale of GHG emissions for City of McFarland's contribution to countywide GHG emissions and serve as a starting point for more detailed GHG emissions analyses. The Excel-based tool can be updated with more locally specific and operational data that can be obtained from relevant departments and direct requests to utility providers. GHG emissions forecasts can be replicated using more locally specific growth projections for population and employment. The results can also be used to set local GHG reduction targets and develop and quantify locally specific measures for reducing GHG emissions. Sufficient detail is provided in this report to ensure that the analyses are replicable, and data inputs can be replaced with more detailed data, if desired.

2 SUMMARY RESULTS

This section presents the results of the GHG emissions inventory and forecast for the City of McFarland, providing a comprehensive overview of historical (2022 as the inventory year) and projected (2030, 2040, and 2045 as the forecast years) emissions. The results are organized by emissions sources, including stationary energy, electricity, Mobile On-road, wastewater, solid waste, and others, as well as by sectors, including residential, commercial/institutional, industrial, and agricultural.

This breakdown enables an understanding of the emissions sources and sectors that contribute most significantly to the City of McFarland's overall emissions. Section 3 of this report provides additional context and methodology related to each emissions source and sector, including key assumptions, data sources, and allocation methods used in the inventory and forecast development.

2.1 2022 GREENHOUSE GAS EMISSIONS INVENTORY RESULTS

Table 1 below shows the 2022 GHG emissions inventory results for the City of McFarland, categorized by emissions sources and sectors. Figure 1 shows the inventory categorized by emission sources, while Figure 2 shows the inventory categorized by emission sectors.

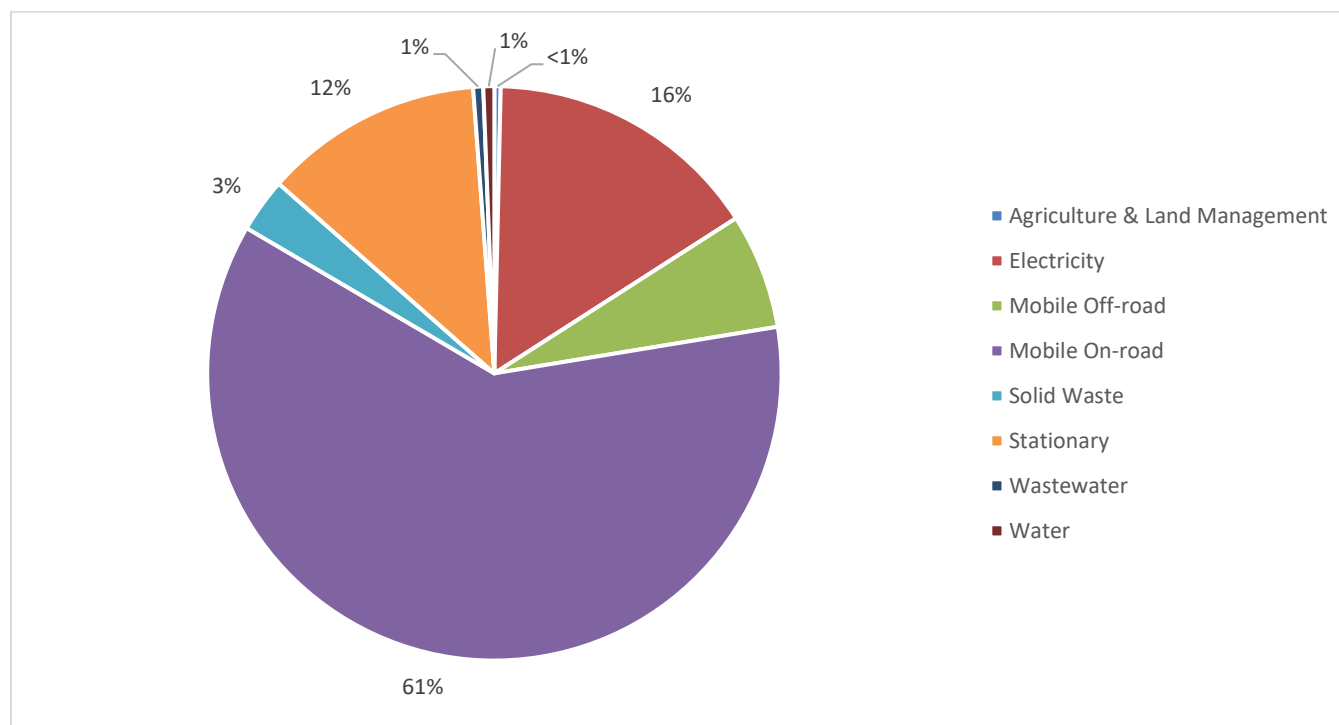
Table 1 City of McFarland 2022 GHG Emissions Inventory Results (MTCO₂e)

Emissions Sources	Emissions Sectors				
	Agricultural	Commercial/Institutional	Industrial	Residential	Total
Agriculture & Land Management	299	—	—	—	299
Electricity	—	1,330	—	11,836	13,166
Mobile Off-road	156	5,334	—	—	5,490
Mobile On-road	—	15,592	—	36,048	51,640
Solid Waste	—	—	—	2,573	2,573
Stationary Energy	—	2,344	—	8,090	10,434
Wastewater	—	478	—	—	478
Water	247	275	—	—	522
Total	703	25,354	—	58,547	84,604

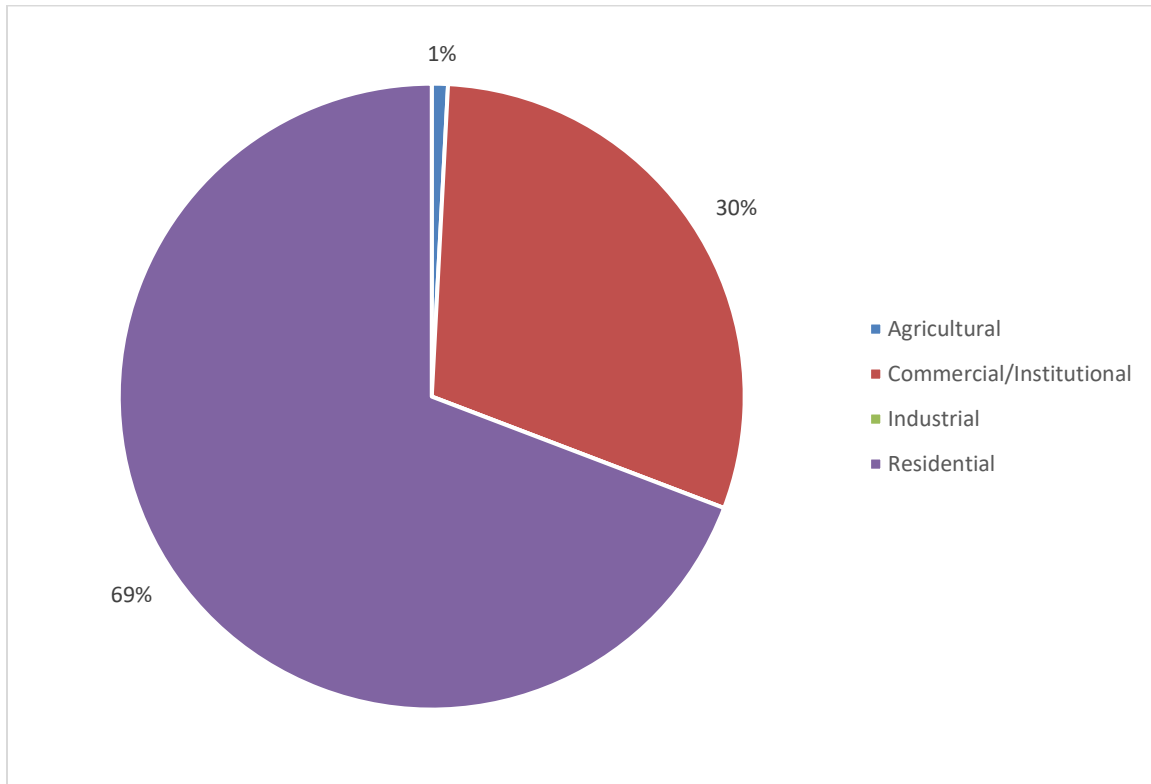
Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 1 City of McFarland 2022 GHG Emissions Inventory by Emissions Sources



Source: Analysis conducted by Ascent in 2025.

Figure 2 City of McFarland 2022 GHG Emissions Inventory by Emissions Sectors

Note: The City of McFarland had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure.

Source: Analysis conducted by Ascent in 2025.

2.2 GREENHOUSE GAS EMISSIONS FORECAST RESULTS

Table 2 below shows the projected future GHG emissions for the City of McFarland for the forecast years 2030, 2040 and 2045 under both a business-as-usual (BAU) scenario, as well as a legislative-adjusted BAU (ABAU) scenario, broken down by both emissions sources and sector. The BAU GHG emissions forecasts estimate how community-generated emissions would change over time without additional actions at the State, federal, regional, or local levels, based solely on projected population and employment growth. The ABAU forecasts incorporate the effects of adopted State and federal policies, such as vehicle fuel efficiency standards and increased renewable energy in the electricity grid, but assume no additional local measures.

Table 2 City of McFarland Greenhouse Gas Emissions Forecast for 2030, 2040 and 2045 by Emissions Source and Sector (MTCO₂e)

Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Stationary Energy	Residential	8,425	8,316	8,824	8,599	8,944	8,684
Stationary Energy	Commercial/Institutional	2,401	2,401	2,596	2,596	2,694	2,694
Stationary Energy	Industrial	—	—	—	—	—	—
Electricity	Residential	12,386	10,002	12,974	1,316	13,149	—
Electricity	Commercial/Institutional	1,369	1,099	1,480	149	1,536	—
Electricity	Industrial	—	—	—	—	—	—
Other Industrial	Industrial	—	—	—	—	—	—

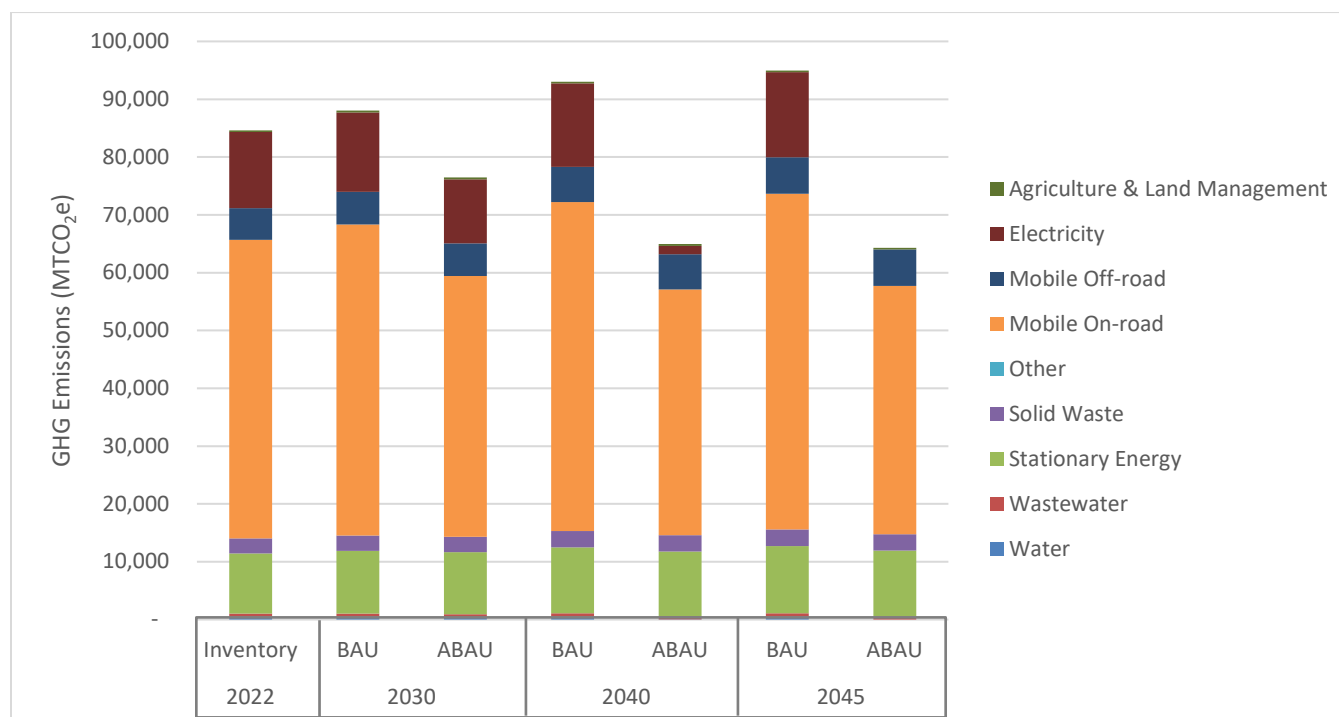
Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Agriculture – Fertilizer Application	Agricultural	299	299	299	299	299	299
Solid Waste	Residential	2,693	2,693	2,821	2,821	2,859	2,859
Wastewater	Commercial/Institutional	498	498	526	526	537	537
Imported Water	Commercial/Institutional	286	230	303	30	309	—
Imported Water	Agricultural	247	199	247	25	247	—
Mobile On-road	Residential	37,728	30,675	39,518	28,516	40,053	28,408
Mobile On-road	Commercial/Institutional	16,047	14,397	17,350	13,965	18,011	14,503
Mobile Off-road	Commercial/Institutional	5,490	5,490	5,936	5,936	6,162	6,162
Mobile Off-road	Agricultural	156	156	156	156	156	156

Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 3 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of McFarland's 2022 GHG emissions inventory for comparison, all categorized by emissions sources.

Figure 3 City of McFarland 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sources (MTCO_{2e})

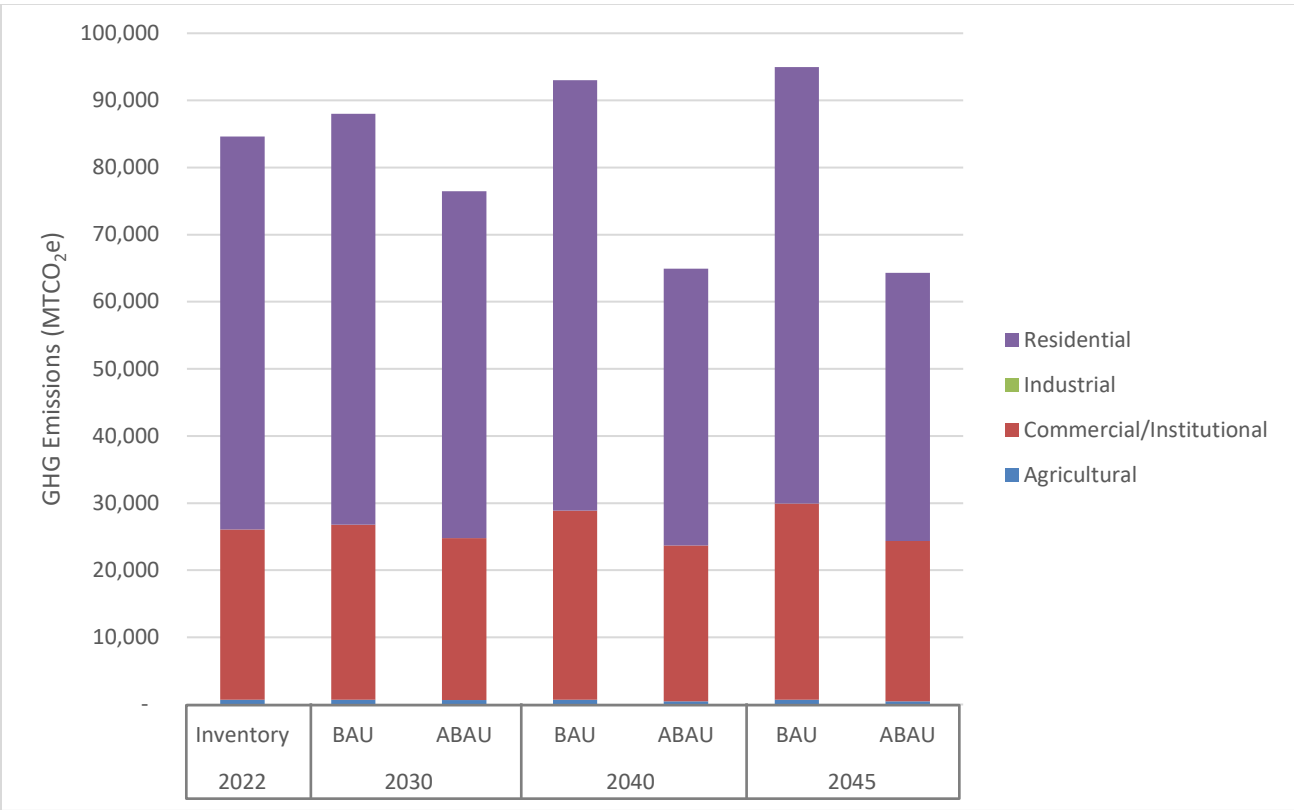


Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 4 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of McFarland's 2022 GHG emissions inventory for comparison, all categorized by emissions sectors.

Figure 4 City of McFarland 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sectors (MTCO₂e)



Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent. The City of McFarland had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure. Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

3 GREENHOUSE GAS EMISSIONS INVENTORY METHODS

This section of the report details the methods used to develop the GHG emissions inventory for the City of McFarland. It includes descriptions of the data sources and data processing, and the inputs and outputs for the GHG emissions calculations. The methods are organized by GHG emissions sources (stationary energy, electricity, etc.) for the City of McFarland, based on the EPA Local GHG Inventory Tool.

The EPA Local GHG Inventory Tool was primarily used for GHG emissions calculations. Activity data (e.g., energy consumed, tons of waste landfilled, etc.) inputs for the City of McFarland were entered into the tool and parameters were set to represent local conditions (e.g., annual electricity consumption data was imported into the tool as the input to calculate City of McFarland’s GHG emissions associated with electricity, and the appropriate electricity grid was selected to represent local conditions). GHG emissions from on-road transportation were calculated externally to the EPA Local GHG Inventory Tool, due to data format inconsistencies. All other GHG emissions sources were calculated within, or entered into the tool. The tool also categorizes GHG emissions into different sectors: residential, commercial/institutional, industrial, and agricultural. Industrial and agricultural sectors were only used when explicitly differentiated in the available datasets. In all other cases, sector categorization followed the classifications provided by the EPA Local GHG Inventory Tool or as defined by the underlying data sources.

This report only documents data processing and calculations that were performed outside of the EPA Local GHG Inventory Tool and provides the GHG emissions outputs from the tool; it does not expand on the calculation methods

within the tool. Documentation for the EPA Local GHG Inventory Tool can be found on the EPA website at: <https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool>.

3.1 GREENHOUSE GASES AND GLOBAL WARMING POTENTIAL

GHG emissions other than carbon dioxide (CO₂) 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). CO₂ has a GWP factor of one, while all other GHGs have GWP factors measured in multiples of one relative to the GWP of CO₂. This conversion of non-CO₂ gases to one unit enables the reporting of all emissions in terms of carbon dioxide equivalent (CO₂e), 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 (MTCO₂e). For this emissions inventory and forecast, the three primary and most abundant GHGs were accounted for: CO₂, methane (CH₄) and nitrous oxide (N₂O).

Consistent with the best available science, the inventory uses GWP factors published in the Fifth Assessment Report (AR5) from Intergovernmental Panel on Climate Change (IPCC), where CH₄ and N₂O have GWP factors of 28 and 265, respectively (IPCC 2014). These values represent the GWP of GHG on a 100-year time horizon. This means that CH₄ is approximately 28 times stronger than CO₂ and N₂O is 265 times stronger than CO₂ in their potential to warm Earth's atmosphere over the course of 100 years. The use of 100-year GWP values is consistent with the California Air Resources Board (CARB) and EPA GHG accounting methods.

3.2 DATA REVIEW

The general approach for developing the GHG emissions inventory involved the collection of total activity and/or emissions data for Kern county for the year 2022 for each relevant GHG emissions source and then apportioning that data to individual jurisdictions and sectors using appropriate attribution metrics. These metrics include the City of McFarland's contribution to total countywide population, commercial building floor space, and agricultural land acreage. In some cases, such as for landfilled solid waste and industrial facilities, jurisdiction-specific data were available from publicly available resources.

The primary data sources used to compile activity and emissions data for all of Kern county are listed in Table 3.

Table 3 Data Sources for Countywide Activity and Emissions Data

GHG Emission Source	Data Source(s)
Mobile On-road	CARB EMFAC2021 on-road emission inventory model (CARB 2022a)
Mobile Off-road	CARB OFFROAD2021 off-road emission inventory model (CARB 2022b)
Stationary Energy	CEC energy database (CEC 2023), EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases
Electricity	CEC energy database (CEC 2022), Pacific Gas & Electric Co (PG&E)
Imported Water	Water Association of Kern County
Agriculture	CDFA's fertilizing materials tonnage report (CDFA 2025)
Other Industrial Sources	EPA FLIGHT database (EPA 2023)

Notes: CARB = California Air Resources Board; ; CDFA = California's Department of Food & Agriculture CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

Attribution metrics were used to apportion countywide activity and/or emissions data to individual jurisdictions by the appropriate GHG emissions sector. These attribution metrics include:

- population share for allocating activity associated with the residential sector (US Census Bureau 2025),

- ▶ commercial building floor space share for activity associated with the commercial/institutional sector (Open Energy Data Initiative 2020), and
- ▶ farmland, grazing land, and other agricultural land cover types share for the agricultural sector (DOC 2022).

These attribution metrics and the associated values for each jurisdiction in Kern county are shown in Table 4 below.

Table 4 Attribution Metrics Used to Apportion Countywide Activities and GHG Emissions

Jurisdiction	Population	Population %	Agricultural Land Acreage	Agricultural Land Acreage %	Commercial Building Floor Space in Square Footage	Commercial Building Floor Space in Square Footage %
McFarland	19,613	2.2%	1,487	0.1%	1,400	0.9%
Bakersfield	404,321	44.6%	41,684	1.5%	79,800	50.7%
California City	15,002	1.7%	112	0.0%	1,000	0.6%
Delano	50,498	5.6%	4,141	0.2%	5,800	3.7%
Maricopa	1,217	0.1%	558	0.0%	—	0.0%
McFarland	13,971	1.5%	2,754	0.1%	600	0.4%
Ridgecrest	28,118	3.1%	62	0.0%	4,000	2.5%
Shafter	20,162	2.2%	19,419	0.7%	10,700	6.8%
Taft	7,414	0.8%	4,507	0.2%	1,000	0.6%
Tehachapi	12,855	1.4%	2,764	0.1%	1,700	1.1%
Wasco	26,317	2.9%	3,421	0.1%	1,800	1.1%
Unincorporated County	307,395	33.9%	2,666,205	97.1%	49,700	31.6%
Kern County Total	906,883	100%	2,747,115	100%	157,500	100%

Note: Population and agricultural land acreage data reflect conditions in 2022. The most recent data available for commercial building floor space was from 2019, which was used as the attribution metric in this analysis. Because the calculations relied on percentage shares rather than absolute floor space values, using 2019 data was considered appropriate for consistency across jurisdictions.

Sources: US Census Bureau 2025; DOC 2022; Open Energy Data Initiative 2020; analysis conducted by Ascent in 2025.

For the wastewater and solid waste emissions sources, as well as the industrial emissions sector, data and information were collected at the jurisdiction level to calculate associated GHG emissions.

For wastewater, jurisdiction-specific data were obtained from a variety of sources, including any publicly available data about wastewater treatment plant operations. When such data were not publicly available, default values from the EPA Local GHG Inventory Tool and the Local Governments for Sustainability *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* were used to fill data gaps.

For solid waste, jurisdiction-specific disposal data were sourced from the California Department of Resources Recycling and Recovery (CalRecycle), specifically from the Jurisdiction Disposal and Beneficial Reuse by Destination database.

For the industrial emissions sector, jurisdiction-specific emissions data were also obtained directly from the EPA FLIGHT and CARB MRR databases, which report facility-level emissions for large industrial sources.

Data sources for jurisdiction-specific activity and emissions data are shown in Table 5 below.

Table 5 Data Sources for Jurisdiction-Specific Activity and Emissions Data

GHG Emission Source/Sector	Data Source(s)
Wastewater	ICLEI (ICLEI 2019)
Solid Waste	CalRecycle's Jurisdiction Disposal and Beneficial Reuse by Destination database (CalRecycle 2025), EPA FLIGHT database (EPA 2023)

GHG Emission Source/Sector	Data Source(s)
Industrial Sector	EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases

Notes: ICLEI = Local Governments for Sustainability; CalRecycle = California Department of Resources Recycling and Recovery; CARB = California Air Resources Board; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

3.3 INVENTORY METHODS BY GHG EMISSIONS SOURCE

This section details the data and methods used to calculate GHG emissions in the 2022 inventory, organized by emissions source. It presents the corresponding data inputs into the EPA Local GHG Inventory Tool, any data processing that was performed, and the resulting emissions estimates by source and sector for the City of McFarland. All calculations of GHG emissions use the IPCC AR5 GWP values to convert GHG emissions results to CO₂e.

3.3.1 Mobile On-road

The Mobile On-road 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." The estimation of these emissions relies on EMFAC2021, a statewide mobile source emissions inventory model developed by CARB. EMFAC2021 was used instead of the EPA Local GHG Inventory Tool to calculate mobile on-road GHG emissions because EMFAC2021 provides GHG emissions estimates that more closely represent the vehicle fleet operating on roadways in Kern County. The EPA Local GHG Inventory Tool utilizes national fuel efficiency averages for a select number of vehicle types to calculate GHG emissions, whereas EMFAC2021 considers fuel efficiency by vehicle type and model, providing more accurate estimates of fuel consumption and GHG emissions.

To calculate emissions for the 2022 inventory year, total countywide vehicle miles traveled (VMT) were first obtained from EMFAC2021. These VMT figures were then allocated to emission sectors defined by the EPA's Local GHG Inventory Tool based on vehicle class, specifically, the residential and commercial/institutional sectors. For the purposes of sector-specific emissions calculations, light-duty vehicles were attributed to the residential sector, as they primarily reflect personal vehicle use by residents. In contrast, medium- and heavy-duty trucks were attributed to the commercial/institutional sector, as these vehicle types are more commonly associated with goods movement, service fleets, and business operations. Sector-specific VMT totals were then apportioned to each jurisdiction based on appropriate attribution metrics: population share for residential VMT and commercial building square footage share for commercial/institutional VMT.

EMFAC2021 was also used to generate countywide GHG emissions factors for the two sectors, expressed in MTCO₂e per vehicle mile traveled. These factors accounted for all vehicle classes, model years, speeds, and fuel types. The sector-specific factors were derived by dividing total countywide emissions of CO₂, CH₄, and N₂O (converted to CO₂e using the appropriate GWP) by the corresponding sector-specific countywide total VMT, with emissions and VMT categorized into the residential and commercial/institutional sectors based on vehicle class.

Finally, each jurisdiction's total Mobile On-road emissions by sector were calculated by multiplying the jurisdiction's sector-specific VMT by the respective countywide sector-specific MTCO₂e per VMT emissions factors. Table 6 presents the City of McFarland's total Mobile On-road VMT, associated sector-specific GHG emissions factors, and the resulting total GHG emissions by sector.

Table 6 City of McFarland Mobile On-road Data Inputs and Results

Vehicle Sector	Total Activity (VMT)	GHG Emissions Factor (MTCO ₂ e/VMT)	GHG Emissions (MTCO ₂ e)
Residential	112,059,351	0.00035	50,606
Commercial/Institutional	15,559,920	0.0011	36,381

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: CARB 2022a; analysis conducted by Ascent in 2025.

3.3.2 Mobile Off-road

Emissions from Mobile Off-road sources result from the combustion of fuel in various types of off-road vehicles and equipment (e.g. agricultural tractors, construction equipment). Emissions data for these sources were obtained from CARB's OFFROAD2021 model, which provides detailed estimates for Kern county for the 2022 inventory year. The data include, but are not limited to, information on equipment categories, fuel types, and the amount of fuel consumed.

Using the off-road vehicle categories in OFFROAD2021, the emissions data were organized into two relevant sectors defined by the EPA Local GHG Inventory Tool: agricultural and commercial/institutional. Sector-specific off-road fuel consumption totals were then apportioned to each jurisdiction using appropriate attribution metrics. Specifically, the share of farmland, grazing land, and other agricultural land was used to allocate agricultural emissions, while the commercial building square footage share was used to distribute commercial/institutional emissions.

Finally, each jurisdiction's sector-specific off-road fuel consumption data were entered into the "Mobile-Data" sheet of the EPA Local GHG Inventory Tool to calculate Mobile Off-road emissions. The EPA Local GHG Inventory Tool includes emissions factors by fuel type. Table 7 presents the City of McFarland's total Mobile Off-road fuel consumption by fuel type and the resulting total GHG emissions by sector.

Table 7 City of McFarland Mobile Off-road Data Inputs and Results

Vehicle Sector	Diesel Consumption (gallons)	Gasoline Consumption (gallons)	Liquefied Natural Gas (LNG) Consumption (gallons)	Total Fuel Consumption (gallons)	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	515,991	225,753	12,458	754,203	7,489
Agricultural	7,870	145	—	8,016	84

Notes: GHG = greenhouse Gas; LNG = liquefied natural gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CARB 2022b, analysis conducted by Ascent in 2025.

3.3.3 Stationary Energy

The stationary energy source of GHG emissions includes natural gas combustion in residential, commercial/institutional and industrial uses. Residential uses primarily consume natural gas for space and water heating, and cooking. Commercial/institutional uses may include space heating and cooling, cooking in restaurants, and smaller boilers or generators. Industrial uses are often process-specific uses tied to manufacturing or heavy operations such as process heating, steam generation, and boiler systems. Propane fuel usage was not included in the stationary energy-related calculations as propane usage data for these various uses was not available at the same level of detail or consistency as other stationary energy data sources at the county scale.

RESIDENTIAL AND COMMERCIAL/INSTITUTIONAL

Total countywide natural gas usage data for the 2022 inventory year was obtained from the CEC Energy Reports: Gas Consumption by County, which categorizes usage into residential and non-residential sectors. Residential natural gas consumption was allocated to each jurisdiction based on its share of the county's population.

To isolate commercial/institutional usage, countywide industrial natural gas consumption, sourced from the EPA FLIGHT database and CARB MRR database, was subtracted from the CEC total non-residential usage. The resulting commercial/institutional natural gas usage was then apportioned to each jurisdiction using commercial building floor space share as the attribution metric.

Finally, each jurisdiction's residential and commercial/institutional natural gas usage data were entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate residential and commercial/institutional stationary energy emissions. Table 8 below shows the City of McFarland's total stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions in residential and commercial/institutional sectors.

Table 8 City of McFarland Residential and Commercial/Institutional Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Residential	206,550	11,357
Commercial/Institutional	99,479	5,470

Notes: mcf = thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

INDUSTRIAL

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the City of McFarland. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

For the City of McFarland, the databases showed that no large industrial facilities are located within its geographic boundary, therefore, there is no reported industrial stationary energy associated activity or GHG emissions for the City of McFarland.

3.3.4 Electricity

The electricity source addresses energy-related indirect GHG emissions resulting from the consumption of grid-supplied electricity within the City of McFarland's boundary. Consumption of grid-supplied electricity is considered an "indirect" GHG emissions source, because GHG emissions occur at the source of electricity generation, which is usually outside of a jurisdiction's boundary. The location-based method was used to calculate electricity GHG emissions, which uses regional grid-average emission factors. In the United States, these factors are provided by the EPA's Emissions & Generation Resource Integrated Database (eGRID). Specifically, emission factors for the CAMX eGRID subregion were applied, as this subregion encompasses the geographic area of Kern county.

Total electricity usage data for Kern county in 2022 was obtained from CEC Energy Reports: Electricity by County, which categorized usage into residential and non-residential sectors (CEC 2023). Electricity usage data for the City of Bakersfield, which was also separated into residential and non-residential categories, was acquired directly from the Pacific Gas and Electric Company (PG&E). To estimate electricity usage for the rest of the county (i.e., all jurisdictions excluding Bakersfield), the City of Bakersfield's electricity data was subtracted from the total Kern county data.

Residential electricity usage outside of Bakersfield was apportioned to each jurisdiction based on its share of the county's total population. For non-residential electricity usage, estimates were further categorized into industrial and commercial/institutional sectors using attribution metrics derived from natural gas consumption data previously calculated under stationary energy. In 2022, 93.1 percent of the county's stationary natural gas combustion was attributed to industrial use and 6.9 percent to commercial/institutional use. These same ratios were applied to the county's total non-residential electricity usage, under the assumption that the sectoral split in electricity usage mirrors that of natural gas usage. This assumption was validated using available industrial electricity and natural gas usage data in PG&E's service territory, from the CEC Energy Reports. The electricity-to-gas ratio, expressed as gigawatt-hour per million therms, was calculated by dividing total industrial electricity usage by industrial natural gas consumption for the service territory. The resulting value closely aligns with the assumptions applied in this here, supporting its validity.

The City of McFarland's share of commercial building square footage was used to attribute commercial/institutional electricity usage. Industrial electricity usage was attributed based on the proportion of countywide industrial natural gas within the City of McFarland. No industrial facilities exist in the City of McFarland; therefore, no industrial electricity usage is attributed to the City of McFarland. Finally, the sector-specific electricity usage data for each

jurisdiction was entered into the “Electricity-Data” sheet of the EPA Local GHG Inventory Tool to calculate associated GHG emissions.

Table 9 below shows the City of McFarland’s electricity activity data and the associated GHG emissions by emission sectors.

Table 9 City of McFarland Electricity Energy Data Inputs and Results

Sector	Total Activity (kWh of Electricity Consumed)	GHG Emissions (MTCO ₂ e)
Residential	52,254,836	11,836
Commercial/Institutional	5,872,794	1,330
Industrial	—	—

Notes: kWh = kilowatt-hour; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; PG&E 2025; analysis conducted by Ascent in 2025.

3.3.5 Imported Water

The water source category captures GHG emissions from energy use associated with the conveyance, treatment, and distribution of water within a jurisdiction. In Kern county, the WAKC reports that approximately 166,000 acre-feet of water are used annually for municipal and industrial purposes, and 2,294,000 acre-feet for agricultural purposes.

In addition to local surface water, Kern county draws water from several sources. Among these, only water supplied through the State Water Project (SWP) and the federal Central Valley Project (CVP) is considered imported, and therefore potentially results in GHG emissions due to long-distance conveyance. All other sources are classified as local. It was assumed that energy used for extracting, conveying, treating, and distributing local water is captured under the emissions estimates for stationary energy and electricity, since these activities occur within the county. In addition, upon further review, it was also determined that the federal CVP does not consume energy for water delivery to Kern County, as water is primarily conveyed using gravity (Friant Water Authority 2019). As a result, only the SWP, which accounts for 26 percent of the county’s water supply, contributes to GHG emissions. Table 10 provides a summary of the water sources in Kern county and their contribution to the total water supply.

Table 10 Kern County Water Sources

Source	Percentage
Kern River	20%
State Water Project (California Aqueduct)	26%
Federal Central Valley Project (Friant-Kern Canal)	12%
Local Streams and Other Sources (Poso Creek, Kern River, etc.)	6%
Groundwater	36%
Total	100%

Source: WAKC n.d.

Water use in Kern County is characterized into municipal and industrial, and agricultural sectors in data obtained from WAKC. It is assumed that water included in “municipal” uses is delivered to both commercial and residential customers. However, sufficient data was not available to disaggregate the water consumption between industrial, commercial, and residential customers. For the purpose of this GHG emissions inventory, all non-agricultural water consumption was categorized under the commercial/institutional sector.

To allocate sector-specific water usage to individual jurisdictions, the following attribution metrics were used:

- Agricultural water use was apportioned based on each jurisdiction’s share of farmland, grazing land, and other agricultural land.

- Commercial/institutional water use was distributed according to the share of commercial building square footage in each jurisdiction.

These apportioned figures were then entered into the “Imported Water” sheet of the EPA Local GHG Inventory Tool, applying a universal 26 percent imported water rate, to estimate the associated GHG emissions from water conveyance and use. Table 11 presents the City of McFarland’s activity data related to imported water, including the percentage of total water supply that is imported and the associated GHG emissions.

Table 11 City of McFarland Imported Water Energy Data Inputs and Results

Sector	Total Activity (Gallons of Water)	Percentage of Water Imported	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	216,658,996	26%	275
Agricultural	194,868,899		247

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: WAKC n.d.; analysis conducted by Ascent in 2025.

3.3.6 Wastewater

The wastewater source accounts for GHG emissions resulting from the treatment of sewage. To support this analysis, a review of publicly available wastewater treatment characteristics was conducted to collect the data required for completing the “Wastewater-Control” tab of the EPA’s Local GHG Inventory Tool. The data sources and corresponding assumptions for the City of McFarland’s wastewater treatment systems are summarized in Table 12. Where jurisdiction-specific data were not publicly available, the default input values provided by the EPA tool were used.

To estimate GHG emissions, population data for each jurisdiction were subsequently entered into the “Wastewater-Entry” tab of the tool. The resulting emissions estimates are also presented in Table 12, alongside the data sources and assumptions used.

Table 12 City of McFarland Wastewater Treatment Assumptions

Wastewater Process/Treatment Type	Conditions Assumed	Data Source	GHG Emissions (MTCO ₂ e)
Population served by septic systems	5 percent of the city’s population	ICLEI’s default proportion of population that utilizes septic tanks for an urban area (Box WW.11(alt).2).	478
One or more wastewater treatment plants (WWTPs) where wastewater is treated in aerobic or anaerobic conditions	Aerobic	Obtained from the City’s website.	
One or more WWTPs conduct or do not conduct nitrification/denitrification	No nitrification/denitrification	No public information is available. The default value is no nitrification/denitrification.	

Notes: WWTP = wastewater treatment plant; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; ICLEI = Local Governments for Sustainability.

Sources: ICLEI 2019; analysis conducted by Ascent in 2025.

3.3.7 Solid Waste

Community-generated solid waste emissions are primarily associated with the decomposition of solid waste in landfills. There are two methods for accounting for GHG emissions associated with waste disposal:

- Waste generation method – Accounts for the total GHG emissions that would be generated over time as municipal solid waste (MSW) that is sent to a landfill in only the inventory year decomposes.

- **Waste-in-place method** – Accounts for the total GHG emissions generated in a given year at a specific landfill location by the decomposition of all MSW previously disposed at the landfill.

Generally, there is some risk of double counting GHG emissions when combining both of these methods, as a portion of the emissions accounted for using the waste generation method may occur at an in-boundary landfill that has emissions reported using the waste-in-place method. However, the scale of the overlapping GHG emissions between the two methods would be expected as very small in comparison to total emission using either accounting method.

WASTE GENERATION

Landfill tonnage data for 2022 was obtained from CalRecycle’s Jurisdiction Disposal and Beneficial Reuse by Destination database. This data was entered into the EPA’s Waste Reduction Model (WARM Tool) as “mixed MSW” to estimate waste generation emissions. The default national average values were used in the WARM Tool, except for Question 7, where the k value was set to “dry” based on the county’s annual precipitation (less than 20 inches) (NCEI 2025). The WARM output was then imported into the EPA Local GHG Inventory Tool’s “Waste Production” tab, with solid-waste associated emissions attributed to the residential sector by default.

The total activity for solid waste disposal and the resulting waste generation GHG emissions results from the WARM Tool are provided in Table 13.

Table 13 City of McFarland Waste Generation Data Inputs and Results

Sector	Total Activity (tons of MSW disposed)	GHG Emissions (MTCO ₂ e) (WARM Output)
Residential	8,915	2,573

Notes: MSW = mixed municipal solid waste; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; WARM = Waste Reduction Model.

Source: CalRecycle 2025; analysis conducted by Ascent in 2025.

WASTE-IN-PLACE

EPA’s FLIGHT database was reviewed to determine emissions from landfills located within the City of McFarland’s geopolitical boundary, which would provide emissions data for any landfills that generated emissions greater than 25,000 MTCO₂e in 2022. No reporting landfills were identified for the City of McFarland.

3.3.8 Agriculture

The agriculture emissions source captures GHG emissions generated from fertilizer application.

FERTILIZER APPLICATION

Fertilizer application results in GHG emissions primarily due to the release of N₂O, a potent GHG with a global warming potential nearly 300 times greater than CO₂. When nitrogen-based fertilizers are applied to soil, a portion of the nitrogen undergoes microbial processes (nitrification and denitrification), which convert it into N₂O. These emissions can occur directly from the soil or indirectly through leaching and runoff

The total tonnage of nitrogen in synthetic fertilizers applied in Kern county during the 2022 inventory year was obtained from CDFA’s fertilizing materials tonnage report. This countywide total was then apportioned to individual jurisdictions based on each jurisdiction’s proportional share of farmland, grazing land, and other agricultural land. Only data for synthetic fertilizers was publicly available for calculation, although other organic or manure-based fertilizers may be used.

The resulting tonnage of nitrogen in synthetic fertilizers estimated for the City of McFarland was entered into the “Agriculture & Land Management” sheet of the EPA’s Local GHG Inventory Tool to calculate the associated emissions. Table 14 provides the estimated total tons of nitrogen applied and resulting GHG emissions.

Table 14 City of McFarland Fertilizer Application Data Inputs and Results

Sector	Total Activity (tons of nitrogen applied)	GHG Emissions (MTCO ₂ e)
Agricultural	42	299

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CDFA 2025; analysis conducted by Ascent in 2025.

4 GREENHOUSE GAS EMISSIONS FORECAST METHODS

This section provides the methods and data used to project future GHG emissions under a BAU scenario, as well as the calculations of reductions from adopted legislation and regulations under an ABAU scenario.

The BAU GHG emissions forecasts assess how emissions generated by community activities will change over time without further State, federal, regional, or local action. The BAU scenario forecast accounts for the changes in population and employment that can influence communitywide GHG emissions. The ABAU scenario forecast includes adopted policies and regulations at the State and federal levels that would affect emissions without any local action, such as regulatory requirements to increase vehicle fuel efficiency and increase renewable energy sources in grid electricity portfolios. These forecasts provide the City of McFarland with information needed to understand specific GHG emissions sources with the greatest opportunities for reduction with future plans, projects, or programs. It is important to note that the ABAU forecasts only account for emissions reductions associated with adopted policies and regulations; they do not account for proposed and/or unadopted GHG reduction actions established by regional, State, and federal agencies or executive orders outside of adopted legislation and regulations.

The GHG emissions forecasts project GHG emissions for the years 2030, 2040, and 2045 to align with key regulatory timelines for the State. Two key legislative actions establish statewide GHG reduction targets for the years 2030 and 2045, including:

- ▶ Senate Bill (SB) 32 of 2016, which sets a statewide GHG reduction target for the year 2030, and
- ▶ Assembly Bill 1279 of 2022, which sets a statewide GHG reduction target for the year 2045.

The forecast years selected do not necessarily align with the targets established by adopted legislation, but they do provide an analysis of emissions that aligns with the relevant horizon years. The year 2040 was also included in the analysis as an interim year between the 2030 and 2045 forecast years.

4.1 GROWTH PROJECTIONS

GHG emissions forecasts were developed based on projected changes in Kern county's demographics, specifically population, employment, and service population (defined as residents plus employees), between 2022 and 2045. These projections were obtained from the Regional Growth Forecast and Demographic Forecast prepared by the Kern COG (Kern COG 2024). It is assumed that the incorporated cities and the unincorporated county will experience demographic growth at the same rate as the county overall, as jurisdiction-specific growth projections were not available at the time of this analysis.

Between 2022 and 2045, Kern county's population and employment are projected to increase by approximately 11.1 and 15.5 percent, respectively. The service population is expected to grow by 12.4 percent. These growth factors were applied to forecast GHG emissions for the years 2030, 2040, and 2045 across various emissions sources included in the inventory. The values used for population, employment, and service population used to project future emissions are provided in Table 15.

Table 15 Kern County Demographics and Calculated Growth Rates for Future Emissions Forecasts

Calculation Factor	2022	2030	2040	2045
Population				
Total Kern County	906,883	949,134	994,167	1,007,627
Kern County Growth from 2022		4.7%	9.6%	11.1%
Employment				
Total Kern County	358,961	369,427	399,432	414,652
Kern County Growth from 2022		2.9%	11.3%	15.5%
Service Population				
Total Kern County	1,265,844	1,318,561	1,393,598	1,422,279
Kern County Growth from 2022		4.2%	10.1%	12.4%

Source: US Census Bureau 2025; Kern COG 2024; analysis conducted by Ascent in 2025.

Additional details on how growth factors were applied to individual sources are provided in the following sections. It is important to note that agricultural emissions, including those from fertilizer application, as well as livestock enteric fermentation and manure management, are assumed to remain constant throughout the forecast period, with no projected increase in activity levels. Agricultural activities are difficult to project in any detail, with production intensities, number of livestock, and crop types being highly susceptible to global markets and local climate patterns. As such, projections of agriculture GHG emissions-generating activities are not attempted.

4.2 BUSINESS-AS-USUAL SCENARIO FORECAST

The BAU forecast represents a projection of future GHG emissions based solely on expected demographic and economic growth (e.g., population, employment, and service population) between 2022 and 2045. It does not account for the potential impacts of future policies, programs, or actions that may reduce emissions, such as energy efficiency improvements, renewable energy adoption, or transportation electrification.

In the BAU scenario, GHG emissions factors are held constant at the levels used in the 2022 GHG inventory, meaning the carbon intensity of electricity, fuels, and other activities is assumed not to change over time. As a result, any changes in future emissions are driven entirely by growth in activity levels, not by improvements in emissions performance.

4.2.1 Business-As-Usual Scenario Forecast Results

Table 16 presents the projected activity data for the City of McFarland across all forecast years, organized by emissions source and sector. Table 16 also indicates which sources and sectors used population, employment, or service population as a growth metric.

Table 16 City of McFarland BAU Scenario Projected Activity Data for All Forecast Years

Source	Sector	Growth Metric	Units	2030	2040	2045
Stationary Energy	Residential	Population	scf	153,987	161,293	163,477
Stationary Energy	Commercial/Institutional	Employment	scf	43,877	47,441	49,248
Stationary Energy	Industrial	Employment	scf	—	—	—
Electricity	Residential	Population	kWh	54,689,338	57,284,140	58,059,720
Electricity	Commercial/Institutional	Employment	kWh	6,044,030	6,534,918	6,783,935
Electricity	Industrial	Employment	kWh	—	—	—
Other Industrial	Industrial	Employment	MTCO ₂ e	—	—	—

Source	Sector	Growth Metric	Units	2030	2040	2045
Agriculture – Fertilizer Application	Agricultural ¹	N/A	ton	42	42	42
Solid Waste	Residential	Population	ton	9,331	9,773	9,906
Wastewater	Commercial/Institutional	Service Population	MTCO ₂ e	498	526	537
Imported Water	Commercial/Institutional	Service Population	Gallon	225,681,953	238,525,150	243,434,091
Imported Water	Agricultural ¹	N/A	Gallon	194,868,899	194,868,899	194,868,899
Mobile On-road	Residential	Population	VMT	117,280,087	122,844,583	124,507,797
Mobile On-road	Commercial/Institutional	Employment	VMT	16,013,608	17,314,211	17,973,980
Mobile Off-road	Commercial/Institutional	Employment	MTCO ₂ e	5,490	5,936	6,162
Mobile Off-road	Agricultural ¹	N/A	MTCO ₂ e	156	156	156

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; scf = standard cubic foot.

¹ Activity levels for the agricultural sector are assumed to remain constant over the forecast period; therefore, growth metrics are listed as “N/A.”

Source: Analysis conducted by Ascent in 2025.

Table 17 below presents the projected GHG emissions for the City of McFarland across all forecast years, also organized by emissions source and sector.

Table 17 City of McFarland BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	8,425	8,824	8,944
Stationary Energy	Commercial/Institutional	MTCO ₂ e	2,401	2,596	2,694
Stationary Energy	Industrial	MTCO ₂ e	—	—	—
Electricity	Residential	MTCO ₂ e	12,386	12,974	13,149
Electricity	Commercial/Institutional	MTCO ₂ e	1,369	1,480	1,536
Electricity	Industrial	MTCO ₂ e	—	—	—
Other Industrial	Industrial	MTCO ₂ e	—	—	—
Agriculture – Fertilizer Application	Agricultural	MTCO ₂ e	299	299	299
Solid Waste	Residential	MTCO ₂ e	2,693	2,821	2,859
Wastewater	Commercial/Institutional	MTCO ₂ e	498	526	537
Imported Water	Commercial/Institutional	MTCO ₂ e	286	303	309
Imported Water	Agricultural	MTCO ₂ e	247	247	247
Mobile On-road	Residential	MTCO ₂ e	37,728	39,518	40,053
Mobile On-road	Commercial/Institutional	MTCO ₂ e	16,047	17,350	18,011
Mobile Off-road	Commercial/Institutional	MTCO ₂ e	5,490	5,936	6,162
Mobile Off-road	Agricultural	MTCO ₂ e	156	156	156

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

4.3 LEGISLATIVE-ADJUSTED BUSINESS-AS-USUAL SCENARIO FORECAST

ABAU emissions forecasts were prepared using the same demographic data that were used for the BAU forecasts, while also accounting for State and federal policies and regulations that would affect local emissions. These forecasts provide the City of McFarland with a more robust understanding of future community emissions based on the GHG reduction efforts at the state and federal level. A summary of applicable legislative reductions is provided in Table 18.

Table 18 Legislative Reductions Summary

Source	Legislative Reduction	Description	Sources Applied
State	Renewable Energy and Zero-Carbon Electricity Requirements [SB 1020 and SB 100]	Requires California energy utilities to procure 60 percent of electricity from eligible renewable and zero-carbon sources by 2030, 95 percent by 2040, and 100 percent by 2045.	Electricity, Imported Water
State	California's Building Energy Efficiency Standards (2019 and 2022 Title 24, Part 6)	Requires all new buildings in California to comply with energy efficiency standards established by CEC. Accounts for the energy efficiency gains in new residential and nonresidential buildings.	Stationary Energy, Electricity
State	Advanced Clean Car I Regulation	Establishes GHG emission reduction standards for model years 2017 through 2025 that are more stringent than federal CAFE standards.	Mobile On-road
State	Truck and Bus Regulation	Requires diesel trucks and buses that operate in California to be upgraded to reduce GHG emissions.	Mobile On-road
Federal	Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles	Establishes fuel efficiency standards for medium- and heavy-duty engines and vehicles.	Mobile On-road

Notes: CAFE = Corporate Average Fuel Economy; CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; SUV = sports utility vehicle; SB = Senate Bill.

4.3.1 Title 24 Adjustments

Future energy use was adjusted to reflect increased emissions-intensity stringency under California's Building Energy Efficiency Standards (California Code of Regulations Title 24 Part 6, hereafter referred to as "Title 24"). Although Title 24 applies to both new residential and nonresidential construction, for the purposes of this forecast, adjustments were applied only to residential construction for reasons described below.

This approach accounts for uncertainties in energy consumption patterns and end uses in nonresidential buildings, and uncertainty in the non-residential building types that would be constructed in the future. Title 24 primarily regulates energy efficiency in building envelopes and lighting systems. This is expected to substantially reduce energy consumption for building types where the primary end uses of energy are lighting and heating, ventilation, and air conditioning, such as new office, institutional, and hotel buildings. However, Title 24 may not significantly affect other high-energy-consuming uses in nonresidential facilities, such as process loads or specialized equipment. As such, limiting adjustments to residential construction provides a more conservative and reliable estimate of future energy-related GHG emissions.

The 2019 Title 24 standards apply to projects constructed after January 1, 2020, while the 2022 standards apply after January 1, 2023. The 2025 Title 24 will go into effect statewide in January of 2026; however, detailed data on the changes in building-level energy consumption between the 2025 code and previous code cycles was not available at the time of this analysis. To estimate changes in future energy consumption under the 2022 standards, electricity and natural gas adjustment factors were calculated based on differences in average residential energy use between buildings built to the 2019 and 2022 standards. These factors were derived from CEC's data specific to the 2019 and 2022 standards and climate zone-based energy usage rates. For the City of McFarland, Climate Zone 13 was used in the analysis.

These adjustment factors were then applied to the ABAU forecasts of energy consumption activity for both stationary energy and electricity use to reflect the impact of legislative energy efficiency improvements on future development.

The adjustment factors, presented in Table 19, show the percentage change in energy use for buildings built to 2022 standards relative to those built to 2019 standards. Positive values indicate an anticipated increase in energy use, while negative values indicate an anticipated decrease in energy use.

As shown in Table 19:

- ▶ ABAU electricity activity is projected to be higher than BAU in each forecast year due to positive adjustment factors.
- ▶ ABAU stationary energy activity is projected to be lower than BAU due to negative adjustment factors.

Importantly, these adjustments were applied only to energy use growth occurring after the 2022 baseline, reflecting new development that would be subject to the 2022 Title 24, or a later cycle of standards. In addition, it is important to note that although average electricity use in new residential buildings is anticipated to rise under 2022 Title 24 (due to an increase in electrical demand associated with electric appliances installed instead of natural gas appliances), emissions from new residential buildings are expected to be lower than they would be under 2019 Title 24 as a result of overall lower building emissions intensities (due to lower emissions factors associated with electricity compared to natural gas).

Table 19 Stationary Energy and Electricity Adjustment Factors and Activity Forecast Results for Residential Buildings

Energy Type	Forecast Scenario	Adjustment Factor	Activity Units	2022	2030	2040	2045
Electricity	BAU	—	kWh	52,254,836	54,689,338	57,284,140	58,059,720
Electricity	ABAU	+12%	kWh	52,254,836	54,980,477	57,885,587	58,753,918
Stationary Energy (Natural Gas)	BAU	—	mcf	147,132	153,987	161,293	163,477
Stationary Energy (Natural Gas)	ABAU	-29%	mcf	147,132	151,992	157,172	158,720

Notes: BAU = Business-as-Usual; ABAU = legislative-adjusted BAU; mcf = one thousand cubic feet; kWh = kilowatt-hour.

Source: Analysis conducted by Ascent in 2025.

4.3.2 Senate Bill 100 and Senate Bill 1020 Adjustments

SB 100 requires that 100 percent of retail electricity sales in California come from renewable and zero-carbon resources by 2045. This legislation builds upon the state's existing Renewables Portfolio Standard (RPS) by increasing the required percentage of RPS-eligible renewable electricity over time. SB 1020 builds on SB 100 by introducing interim targets for GHG-free electricity for the years 2035 and 2040. As shown in Table 20, SB 100 and SB 1020 require utility providers to supply electricity that is 60 percent GHG-free by 2030, 95 percent by 2040, and 100 percent by 2045. The emissions sources affected by these adjustments include electricity and imported water, both of which are estimated based on the carbon intensity of the electricity grid.

To estimate future GHG emissions factors, the 2022 GHG-free electricity percentage and GHG emissions factors for the CAMX eGRID subregion were first obtained from the EPA's eGRID database. Using these 2022 values as a baseline, emissions factors for the forecast years (2030, 2040, and 2045) were calculated based on the GHG-free electricity targets established by SB 100 and SB 1020.

Table 20 below demonstrates these GHG-free electricity percentage baseline values and targets, as well as the baseline and calculated emissions factors for the forecast years. Given 2045's 100 percent GHG-free electricity percentage target, the emissions factor for 2045 is 0. In contrast to the ABAU forecast, the CAMX eGRID emissions factors under the BAU scenario are assumed to remain constant at their 2022 baseline values throughout the forecast years.

Table 20 CAMX eGRID Electricity GHG Emissions Factors Adjusted for SB100 and SB1020

Calculation Factor	Units	2022	2030	2040	2045
SB 100 and SB 1020 GHG-free electricity percentage targets	Percent GHG-free	N/A	60%	95%	100%
CAMX eGRID GHG-free electricity percentage baseline and targets	Percent GHG-free	50%	60%	95%	100%
CAMX eGRID baseline and interpolated emissions factors	MTCO ₂ e/MWh	0.2265	0.1819	0.0227	0

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MWh = megawatt-hour; N/A = Not Applicable.

Source: Analysis conducted by Ascent in 2025.

4.3.3 On-road Vehicle Emissions Standards

State and federal regulations are expected to significantly reduce on-road GHG emissions by requiring improvements in vehicle fuel efficiency and accelerating the transition to zero-emission vehicles (ZEVs). The ABAU forecast for the Mobile On-road source takes into consideration the following State and federal regulations:

- ▶ Innovative Clean Transit Regulation, which requires all California public transit agencies to begin phasing in zero-emission buses (ZEB) starting in 2023 and transition to 100 percent ZEB fleets by 2040 and
- ▶ Advanced Clean Trucks Regulation, which requires truck and van manufacturers to sell a growing share of ZEVs beginning in model year 2024.

All these regulations are reflected in EMFAC2021's emissions data for the forecast years (2030, 2040 and 2045), which serve as the basis for the Mobile On-road source's ABAU forecast. In addition to these regulations, EMFAC2021's data also takes into consideration future increases in light-duty ZEV sales, which would be influenced by California's Advanced Clean Cars I regulation.

Accordingly, EMFAC2021's VMT and emissions estimates for forecast years were used to calculate Mobile On-road emissions under the legislative adjustment scenario. As with the inventory methodology, sector-specific emissions factors for each forecast year were calculated by dividing sector-specific VMT by sector-specific emissions for each forecast year. These emissions factors were then multiplied by projected future VMT, which were scaled by relevant activity growth factors (population for the residential sector and employment for the commercial/institutional sector) to estimate future emissions. The baseline and projected future emissions factors calculated using EMFAC2021 are shown in Table 21.

In contrast, under the BAU scenario, Mobile On-road emissions factors are held constant at their 2022 baseline values for all forecast years, reflecting no change in vehicle efficiency or fleet composition.

Table 21 Mobile On-road Baseline and Projected GHG Emissions Factors

Sector	Units	2022	2030	2040	2045
Commercial Institutional	MTCO ₂ e/VMT	0.0010	0.00090	0.00081	0.00081
Residential	MTCO ₂ e/VMT	0.00032	0.00026	0.00023	0.00023

Notes: MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: Analysis conducted by Ascent in 2025.

4.3.4 Legislative-Adjusted Business-as-Usual Scenario Forecast Results

Table 22 presents the projected GHG emissions for the City of McFarland across all forecast years under the ABAU scenario, organized by emissions source and sector. Emissions sources and sectors not impacted by legislative

adjustments are excluded from this table, as their projected GHG emissions are assumed to remain unchanged from the BAU scenario. The full results for projected GHG emissions for the City of McFarland across all forecast years under both the BAU and ABAU scenarios, organized by emissions source and sector, can be found in Table 2.

Table 22 City of McFarland Legislative-Adjusted BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	8,316	8,599	8,684
Electricity	Residential	MTCO ₂ e	10,002	1,316	—
Imported Water	Commercial/Institutional	MTCO ₂ e	230	30	—
Imported Water	Agricultural	MTCO ₂ e	199	25	—
Mobile On-road	Residential	MTCO ₂ e	30,675	28,516	28,408
Mobile On-road	Commercial/Institutional	MTCO ₂ e	14,397	13,965	14,503

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

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Greenhouse Gas Emissions Inventory and Forecast for the City of Ridgecrest

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June 2025

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LIST OF ABBREVIATIONS

ABAU	legislative-adjusted BAU
AR5	Fifth Assessment Report
BAU	business-as-usual
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CH ₄	methane
CO ₂	carbon dioxide
CVP	Central Valley Project
eGRID	Emissions & Generation Resource Integrated Database
EPA Local GHG Inventory Tool	EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1
EPA	US Environmental Protection Agency
GHG	greenhouse gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
Kern COG	Kern Council of Governments
MRR	Mandatory Greenhouse Gas Reporting Regulation
MSW	municipal solid waste
MTCO _{2e}	metric tons of carbon dioxide equivalent
N ₂ O	nitrous oxide
PG&E	Pacific Gas and Electric Company
RPS	Renewables Portfolio Standard
SB	Senate Bill
SWP	State Water Project
VMT	vehicle miles traveled
WARM Tool	Waste Reduction Model
ZEB	zero-emission buses
ZEV	zero-emission vehicle

1 INTRODUCTION

This report contains the methods and results for a greenhouse gas (GHG) emissions inventory and GHG emissions forecast for the City of Ridgecrest. A GHG emissions inventory provides estimates of emissions generated within a defined geographic boundary during a single year. It identifies the sectors, sources, and activities that produce these emissions and their relative contribution, while also providing a baseline to forecast future emissions trends. A GHG emissions forecast evaluates how GHG emissions may change in the future due to growth and the effects of adopted state and federal legislation and regulations. This information can be used for various purposes, including monitoring GHG emissions trends over time, or as the technical basis for planning efforts to reduce GHG emissions, such as a general plan or greenhouse gas reduction plan.

This report was developed as part of a grant provided to the City of Bakersfield by the US Environmental Protection Agency (EPA) as part of the Climate Pollution Reduction Grants program. The grant was provided to support climate pollution reduction planning in the Bakersfield Metropolitan Statistical Area, which includes the entirety of Kern county. Under this grant, funding was allocated to produce GHG emissions inventories and forecasts for each of the 12 jurisdictions in Kern county, including the City of Bakersfield, unincorporated Kern County, and all incorporated cities. These GHG emissions inventories and forecasts will be provided to the subject jurisdiction, the San Joaquin Valley Air Pollution Control District, and Kern Council of Governments (Kern COG).

The GHG emissions inventory and forecast are intended to provide an accounting of GHG emissions generating activities within the City of Ridgecrest geographical boundary for the year 2022, and projections of future emissions based on countywide growth patterns and the effects of adopted state and federal legislation and regulations. This report is accompanied by an Excel-based tool used to develop the GHG emissions inventory, the EPA *Local Greenhouse Gas Inventory Tool: Community Module version 2025.1* (the EPA Local GHG Inventory Tool). The GHG emissions inventory uses only publicly available data sets, many of which provide countywide estimates of GHG emissions generating activity, such as mobile on-road travel, energy consumption, and fertilizer use. This countywide data was scaled down to the jurisdiction level based on various attribution metrics, including population, commercial building floor space, and acres of agricultural use. GHG emissions were then forecasted using countywide growth projections for vehicle travel, population, and employment.

Because countywide data was used and scaled using attribution metrics, rather than jurisdiction-specific data, the GHG emissions inventory and forecast are intended to provide a general scale of GHG emissions for City of Ridgecrest's contribution to countywide GHG emissions and serve as a starting point for more detailed GHG emissions analyses. The Excel-based tool can be updated with more locally specific and operational data that can be obtained from relevant departments and direct requests to utility providers. GHG emissions forecasts can be replicated using more locally specific growth projections for population and employment. The results can also be used to set local GHG reduction targets and develop and quantify locally specific measures for reducing GHG emissions. Sufficient detail is provided in this report to ensure that the analyses are replicable, and data inputs can be replaced with more detailed data, if desired.

2 SUMMARY RESULTS

This section presents the results of the GHG emissions inventory and forecast for the City of Ridgecrest, providing a comprehensive overview of historical (2022 as the inventory year) and projected (2030, 2040, and 2045 as the forecast years) emissions. The results are organized by emissions sources, including stationary energy, electricity, Mobile On-road, wastewater, solid waste, and others, as well as by sectors, including residential, commercial/institutional, industrial, and agricultural.

This breakdown enables an understanding of the emissions sources and sectors that contribute most significantly to the City of Ridgecrest's overall emissions. Section 3 of this report provides additional context and methodology related to each emissions source and sector, including key assumptions, data sources, and allocation methods used in the inventory and forecast development.

2.1 2022 GREENHOUSE GAS EMISSIONS INVENTORY RESULTS

Table 1 below shows the 2022 GHG emissions inventory results for the City of Ridgecrest, categorized by emissions sources and sectors. Figure 1 shows the inventory categorized by emission sources, while Figure 2 shows the inventory categorized by emission sectors.

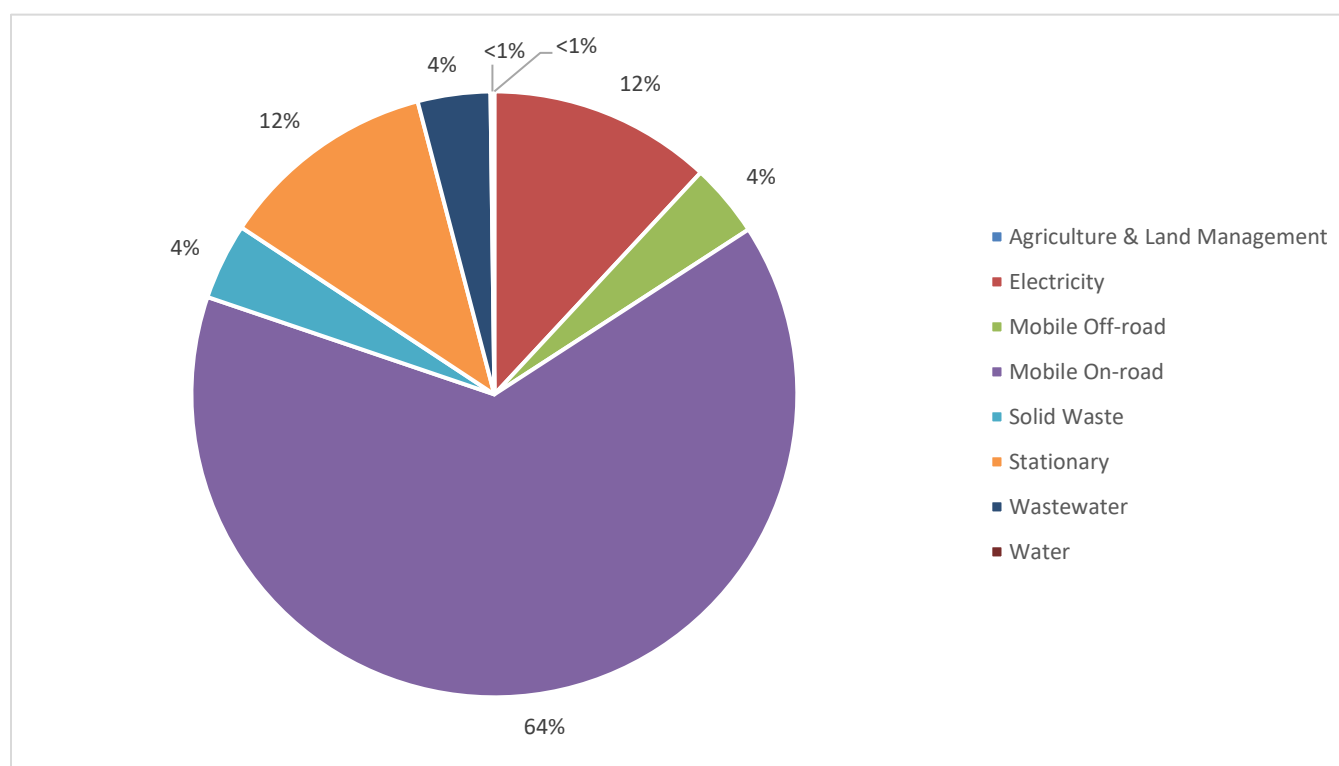
Table 1 City of Ridgecrest 2022 GHG Emissions Inventory Results (MTCO₂e)

Emissions Sources	Emissions Sectors				
	Agricultural	Commercial/Institutional	Industrial	Residential	Total
Agriculture & Land Management	7	—	—	—	7
Electricity	—	8,868	—	23,820	32,688
Mobile Off-road	4	10,736	—	—	10,740
Mobile On-road	—	103,946	—	72,551	176,497
Solid Waste	—	—	—	11,183	11,183
Stationary Energy	—	15,628	—	16,282	31,911
Wastewater	—	10,620	—	—	10,620
Water	6	554	—	—	559
Total	16	150,352	—	123,836	274,205

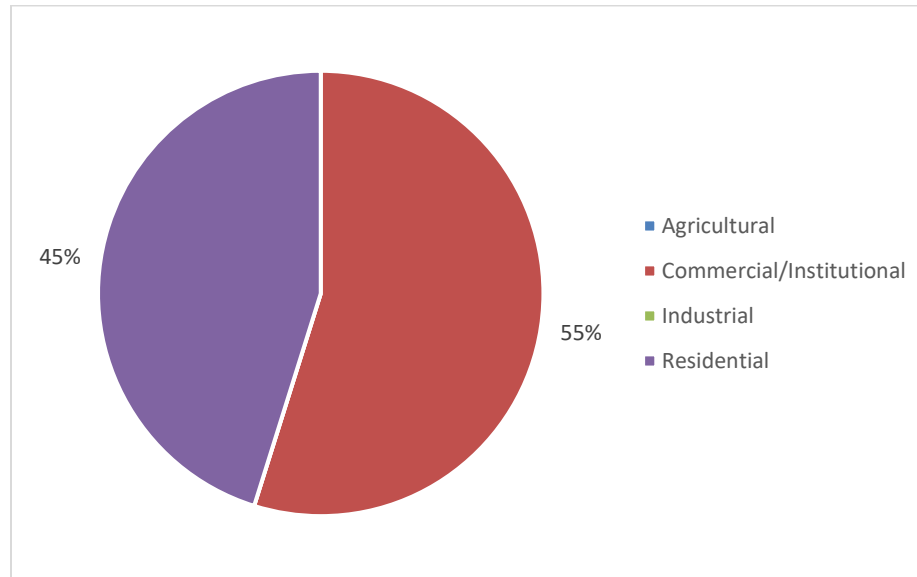
Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 1 City of Ridgecrest 2022 GHG Emissions Inventory by Emissions Sources



Source: Analysis conducted by Ascent in 2025.

Figure 2 City of Ridgecrest 2022 GHG Emissions Inventory by Emissions Sectors

Note: The City of Ridgecrest had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure. Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

2.2 GREENHOUSE GAS EMISSIONS FORECAST RESULTS

Table 2 below shows the projected future GHG emissions for the City of Ridgecrest for the forecast years 2030, 2040 and 2045 under both a business-as-usual (BAU) scenario, as well as a legislative-adjusted BAU (ABAU) scenario, broken down by both emissions sources and sector. The BAU GHG emissions forecasts estimate how community-generated emissions would change over time without additional actions at the State, federal, regional, or local levels, based solely on projected population and employment growth. The ABAU forecasts incorporate the effects of adopted State and federal policies, such as vehicle fuel efficiency standards and increased renewable energy in the electricity grid, but assume no additional local measures.

Table 2 City of Ridgecrest Greenhouse Gas Emissions Forecast for 2030, 2040 and 2045 by Emissions Source and Sector (MTCO_{2e})

Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Stationary Energy	Residential	16,956	16,736	17,760	17,306	18,001	17,477
Stationary Energy	Commercial/Institutional	16,004	16,004	17,303	17,303	17,963	17,963
Stationary Energy	Industrial	—	—	—	—	—	—
Electricity	Residential	24,928	20,129	26,111	2,649	26,464	—
Electricity	Commercial/Institutional	9,126	7,330	9,867	991	10,243	—
Electricity	Industrial	—	—	—	—	—	—
Other Industrial	Industrial	—	—	—	—	—	—
Agriculture – Fertilizer Application	Agricultural	7	7	7	7	7	7
Solid Waste	Residential	11,703	11,703	12,259	12,259	12,425	12,425
Wastewater	Commercial/Institutional	11,501	11,501	12,155	12,155	12,405	12,405
Imported Water	Commercial/Institutional	577	463	609	61	622	—

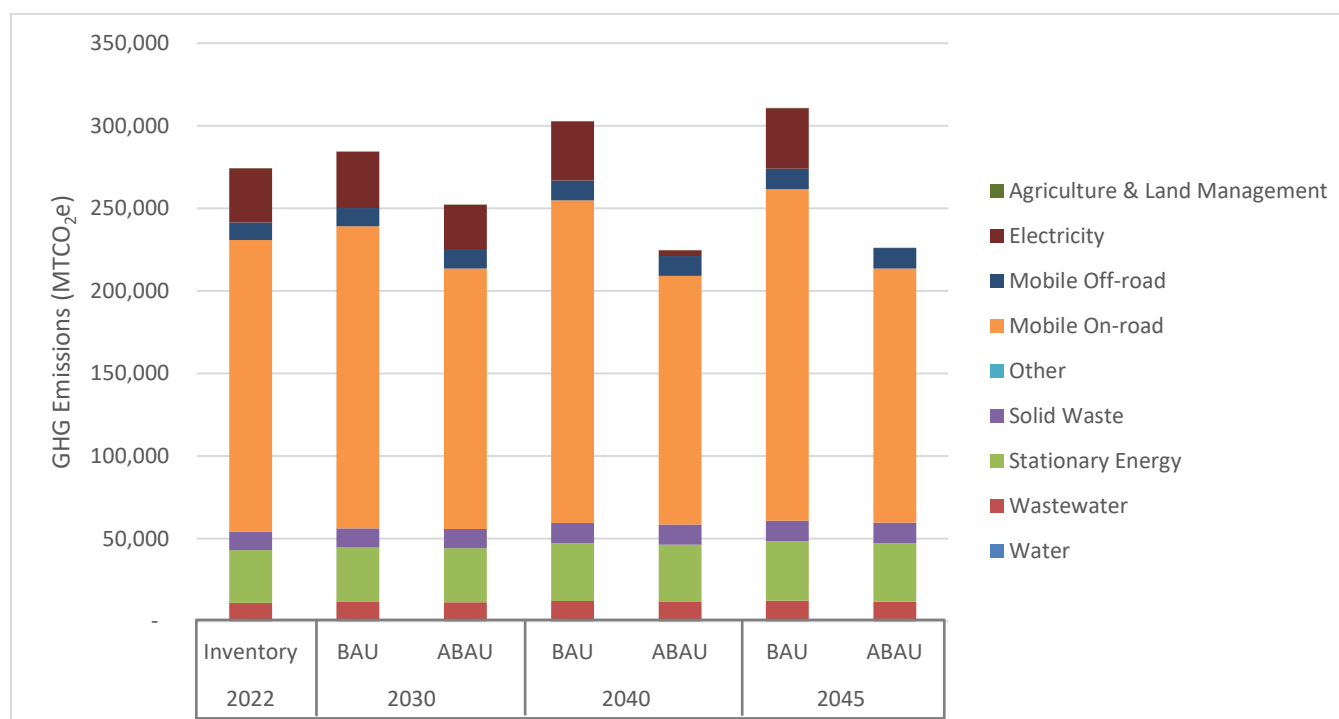
Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Imported Water	Agricultural	6	4	6	1	6	—
Mobile On-road	Residential	75,931	61,736	79,533	57,392	80,610	57,173
Mobile On-road	Commercial/Institutional	106,977	95,978	115,665	93,098	120,073	96,684
Mobile Off-road	Commercial/Institutional	11,049	11,049	11,947	11,947	12,402	12,402
Mobile Off-road	Agricultural	4	4	4	4	4	4

Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 3 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Ridgecrest's 2022 GHG emissions inventory for comparison, all categorized by emissions sources.

Figure 3 City of Ridgecrest 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sources (MTCO_{2e})

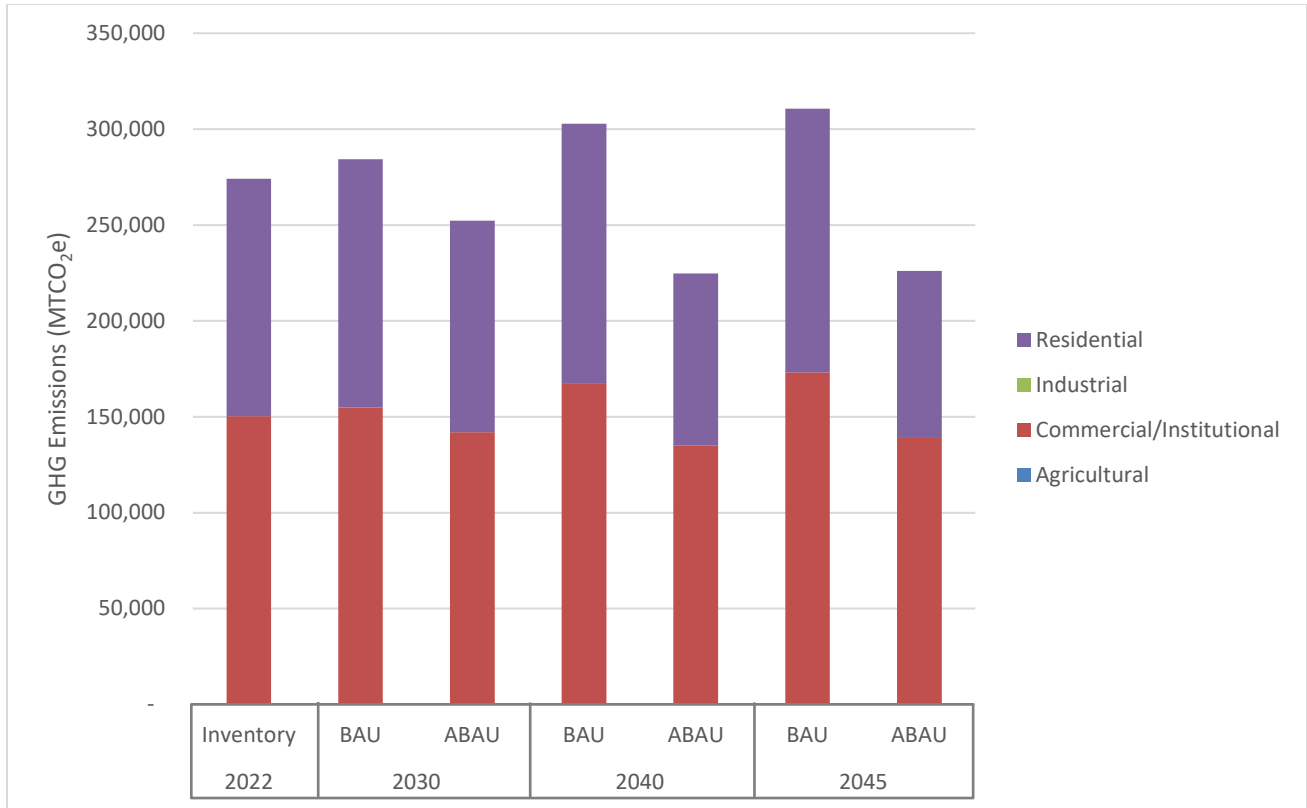


Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 4 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Ridgecrest's 2022 GHG emissions inventory for comparison, all categorized by emissions sectors.

Figure 4 City of Ridgecrest 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sectors (MTCO₂e)



Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent. The City of Ridgecrest had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure. Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

3 GREENHOUSE GAS EMISSIONS INVENTORY METHODS

This section of the report details the methods used to develop the GHG emissions inventory for the City of Ridgecrest. It includes descriptions of the data sources and data processing, and the inputs and outputs for the GHG emissions calculations. The methods are organized by GHG emissions sources (stationary energy, electricity, etc.) for the City of Ridgecrest, based on the EPA Local GHG Inventory Tool.

The EPA Local GHG Inventory Tool was primarily used for GHG emissions calculations. Activity data (e.g., energy consumed, tons of waste landfilled, etc.) inputs for the City of Ridgecrest were entered into the tool and parameters were set to represent local conditions (e.g., annual electricity consumption data was imported into the tool as the input to calculate City of Ridgecrest’s GHG emissions associated with electricity, and the appropriate electricity grid was selected to represent local conditions). GHG emissions from on-road transportation were calculated externally to the EPA Local GHG Inventory Tool, due to data format inconsistencies. All other GHG emissions sources were calculated within, or entered into the tool. The tool also categorizes GHG emissions into different sectors: residential, commercial/institutional, industrial, and agricultural. Industrial and agricultural sectors were only used when explicitly differentiated in the available datasets. In all other cases, sector categorization followed the classifications provided by the EPA Local GHG Inventory Tool or as defined by the underlying data sources.

This report only documents data processing and calculations that were performed outside of the EPA Local GHG Inventory Tool and provides the GHG emissions outputs from the tool; it does not expand on the calculation methods

within the tool. Documentation for the EPA Local GHG Inventory Tool can be found on the EPA website at: <https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool>.

3.1 GREENHOUSE GASES AND GLOBAL WARMING POTENTIAL

GHG emissions other than carbon dioxide (CO₂) 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). CO₂ has a GWP factor of one, while all other GHGs have GWP factors measured in multiples of one relative to the GWP of CO₂. This conversion of non-CO₂ gases to one unit enables the reporting of all emissions in terms of carbon dioxide equivalent (CO₂e), 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 (MTCO₂e). For this emissions inventory and forecast, the three primary and most abundant GHGs were accounted for: CO₂, methane (CH₄) and nitrous oxide (N₂O).

Consistent with the best available science, the inventory uses GWP factors published in the Fifth Assessment Report (AR5) from Intergovernmental Panel on Climate Change (IPCC), where CH₄ and N₂O have GWP factors of 28 and 265, respectively (IPCC 2014). These values represent the GWP of GHG on a 100-year time horizon. This means that CH₄ is approximately 28 times stronger than CO₂ and N₂O is 265 times stronger than CO₂ in their potential to warm Earth's atmosphere over the course of 100 years. The use of 100-year GWP values is consistent with the California Air Resources Board (CARB) and EPA GHG accounting methods.

3.2 DATA REVIEW

The general approach for developing the GHG emissions inventory involved the collection of total activity and/or emissions data for Kern county for the year 2022 for each relevant GHG emissions source and then apportioning that data to individual jurisdictions and sectors using appropriate attribution metrics. These metrics include the City of Ridgecrest's contribution to total countywide population, commercial building floor space, and agricultural land acreage. In some cases, such as for landfilled solid waste and industrial facilities, jurisdiction-specific data were available from publicly available resources.

The primary data sources used to compile activity and emissions data for all of Kern county are listed in Table 3.

Table 3 Data Sources for Countywide Activity and Emissions Data

GHG Emission Source	Data Source(s)
Mobile On-road	CARB EMFAC2021 on-road emission inventory model (CARB 2022a)
Mobile Off-road	CARB OFFROAD2021 off-road emission inventory model (CARB 2022b)
Stationary Energy	CEC energy database (CEC 2023), EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases
Electricity	CEC energy database (CEC 2022), Pacific Gas & Electric Co (PG&E)
Imported Water	Water Association of Kern County
Agriculture	CDFA's fertilizing materials tonnage report (CDFA 2025)
Other Industrial Sources	EPA FLIGHT database (EPA 2023)

Notes: CARB = California Air Resources Board; ; CDFA = California's Department of Food & Agriculture CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

Attribution metrics were used to apportion countywide activity and/or emissions data to individual jurisdictions by the appropriate GHG emissions sector. These attribution metrics include:

- population share for allocating activity associated with the residential sector (US Census Bureau 2025),

- ▶ commercial building floor space share for activity associated with the commercial/institutional sector (Open Energy Data Initiative 2020), and
- ▶ farmland, grazing land, and other agricultural land cover types share for the agricultural sector (DOC 2022).

These attribution metrics and the associated values for each jurisdiction in Kern county are shown in Table 4 below.

Table 4 Attribution Metrics Used to Apportion Countywide Activities and GHG Emissions

Jurisdiction	Population	Population %	Agricultural Land Acreage	Agricultural Land Acreage %	Commercial Building Floor Space in Square Footage	Commercial Building Floor Space in Square Footage %
Ridgecrest	19,613	2.2%	1,487	0.1%	1,400	0.9%
Bakersfield	404,321	44.6%	41,684	1.5%	79,800	50.7%
California City	15,002	1.7%	112	0.0%	1,000	0.6%
Delano	50,498	5.6%	4,141	0.2%	5,800	3.7%
Maricopa	1,217	0.1%	558	0.0%	—	0.0%
McFarland	13,971	1.5%	2,754	0.1%	600	0.4%
Ridgecrest	28,118	3.1%	62	0.0%	4,000	2.5%
Shafter	20,162	2.2%	19,419	0.7%	10,700	6.8%
Taft	7,414	0.8%	4,507	0.2%	1,000	0.6%
Tehachapi	12,855	1.4%	2,764	0.1%	1,700	1.1%
Wasco	26,317	2.9%	3,421	0.1%	1,800	1.1%
Unincorporated County	307,395	33.9%	2,666,205	97.1%	49,700	31.6%
Kern County Total	906,883	100%	2,747,115	100%	157,500	100%

Note: Population and agricultural land acreage data reflect conditions in 2022. The most recent data available for commercial building floor space was from 2019, which was used as the attribution metric in this analysis. Because the calculations relied on percentage shares rather than absolute floor space values, using 2019 data was considered appropriate for consistency across jurisdictions.

Sources: US Census Bureau 2025; DOC 2022; Open Energy Data Initiative 2020; analysis conducted by Ascent in 2025.

For the wastewater and solid waste emissions sources, as well as the industrial emissions sector, data and information were collected at the jurisdiction level to calculate associated GHG emissions.

For wastewater, jurisdiction-specific data were obtained from a variety of sources, including any publicly available data about wastewater treatment plant operations. When such data were not publicly available, default values from the EPA Local GHG Inventory Tool and the Local Governments for Sustainability *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* were used to fill data gaps.

For solid waste, jurisdiction-specific disposal data were sourced from the California Department of Resources Recycling and Recovery (CalRecycle), specifically from the Jurisdiction Disposal and Beneficial Reuse by Destination database.

For the industrial emissions sector, jurisdiction-specific emissions data were also obtained directly from the EPA FLIGHT and CARB MRR databases, which report facility-level emissions for large industrial sources.

Data sources for jurisdiction-specific activity and emissions data are shown in Table 5 below.

Table 5 Data Sources for Jurisdiction-Specific Activity and Emissions Data

GHG Emission Source/Sector	Data Source(s)
Wastewater	ICLEI (ICLEI 2019)
Solid Waste	CalRecycle's Jurisdiction Disposal and Beneficial Reuse by Destination database (CalRecycle 2025), EPA FLIGHT database (EPA 2023)

GHG Emission Source/Sector	Data Source(s)
Industrial Sector	EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases

Notes: ICLEI = Local Governments for Sustainability; CalRecycle = California Department of Resources Recycling and Recovery; CARB = California Air Resources Board; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

3.3 INVENTORY METHODS BY GHG EMISSIONS SOURCE

This section details the data and methods used to calculate GHG emissions in the 2022 inventory, organized by emissions source. It presents the corresponding data inputs into the EPA Local GHG Inventory Tool, any data processing that was performed, and the resulting emissions estimates by source and sector for the City of Ridgecrest. All calculations of GHG emissions use the IPCC AR5 GWP values to convert GHG emissions results to CO₂e.

3.3.1 Mobile On-road

The Mobile On-road 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." The estimation of these emissions relies on EMFAC2021, a statewide mobile source emissions inventory model developed by CARB. EMFAC2021 was used instead of the EPA Local GHG Inventory Tool to calculate mobile on-road GHG emissions because EMFAC2021 provides GHG emissions estimates that more closely represent the vehicle fleet operating on roadways in Kern County. The EPA Local GHG Inventory Tool utilizes national fuel efficiency averages for a select number of vehicle types to calculate GHG emissions, whereas EMFAC2021 considers fuel efficiency by vehicle type and model, providing more accurate estimates of fuel consumption and GHG emissions.

To calculate emissions for the 2022 inventory year, total countywide vehicle miles traveled (VMT) were first obtained from EMFAC2021. These VMT figures were then allocated to emission sectors defined by the EPA's Local GHG Inventory Tool based on vehicle class, specifically, the residential and commercial/institutional sectors. For the purposes of sector-specific emissions calculations, light-duty vehicles were attributed to the residential sector, as they primarily reflect personal vehicle use by residents. In contrast, medium- and heavy-duty trucks were attributed to the commercial/institutional sector, as these vehicle types are more commonly associated with goods movement, service fleets, and business operations. Sector-specific VMT totals were then apportioned to each jurisdiction based on appropriate attribution metrics: population share for residential VMT and commercial building square footage share for commercial/institutional VMT.

EMFAC2021 was also used to generate countywide GHG emissions factors for the two sectors, expressed in MTCO₂e per vehicle mile traveled. These factors accounted for all vehicle classes, model years, speeds, and fuel types. The sector-specific factors were derived by dividing total countywide emissions of CO₂, CH₄, and N₂O (converted to CO₂e using the appropriate GWP) by the corresponding sector-specific countywide total VMT, with emissions and VMT categorized into the residential and commercial/institutional sectors based on vehicle class.

Finally, each jurisdiction's total Mobile On-road emissions by sector were calculated by multiplying the jurisdiction's sector-specific VMT by the respective countywide sector-specific MTCO₂e per VMT emissions factors. Table 6 presents the City of Ridgecrest's total Mobile On-road VMT, associated sector-specific GHG emissions factors, and the resulting total GHG emissions by sector.

Table 6 City of Ridgecrest Mobile On-road Data Inputs and Results

Vehicle Sector	Total Activity (VMT)	GHG Emissions Factor (MTCO ₂ e/VMT)	GHG Emissions (MTCO ₂ e)
Residential	225,530,371	0.00035	72,551
Commercial/Institutional	103,732,797	0.0011	103,946

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: CARB 2022a; analysis conducted by Ascent in 2025.

3.3.2 Mobile Off-road

Emissions from Mobile Off-road sources result from the combustion of fuel in various types of off-road vehicles and equipment (e.g. agricultural tractors, construction equipment). Emissions data for these sources were obtained from CARB's OFFROAD2021 model, which provides detailed estimates for Kern county for the 2022 inventory year. The data include, but are not limited to, information on equipment categories, fuel types, and the amount of fuel consumed.

Using the off-road vehicle categories in OFFROAD2021, the emissions data were organized into two relevant sectors defined by the EPA Local GHG Inventory Tool: agricultural and commercial/institutional. Sector-specific off-road fuel consumption totals were then apportioned to each jurisdiction using appropriate attribution metrics. Specifically, the share of farmland, grazing land, and other agricultural land was used to allocate agricultural emissions, while the commercial building square footage share was used to distribute commercial/institutional emissions.

Finally, each jurisdiction's sector-specific off-road fuel consumption data were entered into the "Mobile-Data" sheet of the EPA Local GHG Inventory Tool to calculate Mobile Off-road emissions. The EPA Local GHG Inventory Tool includes emissions factors by fuel type. Table 7 presents the City of Ridgecrest's total Mobile Off-road fuel consumption by fuel type and the resulting total GHG emissions by sector.

Table 7 City of Ridgecrest Mobile Off-road Data Inputs and Results

Vehicle Sector	Diesel Consumption (gallons)	Gasoline Consumption (gallons)	Liquefied Natural Gas (LNG) Consumption (gallons)	Total Fuel Consumption (gallons)	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	739,747	323,649	17,860	1,081,257	10,736
Agricultural	329	6	—	335	4

Notes: GHG = greenhouse Gas; LNG = liquefied natural gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CARB 2022b, analysis conducted by Ascent in 2025.

3.3.3 Stationary Energy

The stationary energy source of GHG emissions includes natural gas combustion in residential, commercial/institutional and industrial uses. Residential uses primarily consume natural gas for space and water heating, and cooking. Commercial/institutional uses may include space heating and cooling, cooking in restaurants, and smaller boilers or generators. Industrial uses are often process-specific uses tied to manufacturing or heavy operations such as process heating, steam generation, and boiler systems. Propane fuel usage was not included in the stationary energy-related calculations as propane usage data for these various uses was not available at the same level of detail or consistency as other stationary energy data sources at the county scale.

RESIDENTIAL AND COMMERCIAL/INSTITUTIONAL

Total countywide natural gas usage data for the 2022 inventory year was obtained from the CEC Energy Reports: Gas Consumption by County, which categorizes usage into residential and non-residential sectors. Residential natural gas consumption was allocated to each jurisdiction based on its share of the county's population.

To isolate commercial/institutional usage, countywide industrial natural gas consumption, sourced from the EPA FLIGHT database and CARB MRR database, was subtracted from the CEC total non-residential usage. The resulting commercial/institutional natural gas usage was then apportioned to each jurisdiction using commercial building floor space share as the attribution metric.

Finally, each jurisdiction's residential and commercial/institutional natural gas usage data were entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate residential and commercial/institutional stationary energy emissions. Table 8 below shows the City of Ridgecrest's total stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions in residential and commercial/institutional sectors.

Table 8 City of Ridgecrest Residential and Commercial/Institutional Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Residential	296,118	16,282
Commercial/Institutional	284,226	15,628

Notes: mcf = thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

INDUSTRIAL

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the City of Ridgecrest. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

For the City of Ridgecrest, the databases showed that no large industrial facilities are located within its geographic boundary, therefore, there is no reported industrial stationary energy associated activity or GHG emissions for the City of Ridgecrest.

3.3.4 Electricity

The electricity source addresses energy-related indirect GHG emissions resulting from the consumption of grid-supplied electricity within the City of Ridgecrest's boundary. Consumption of grid-supplied electricity is considered an "indirect" GHG emissions source, because GHG emissions occur at the source of electricity generation, which is usually outside of a jurisdiction's boundary. The location-based method was used to calculate electricity GHG emissions, which uses regional grid-average emission factors. In the United States, these factors are provided by the EPA's Emissions & Generation Resource Integrated Database (eGRID). Specifically, emission factors for the CAMX eGRID subregion were applied, as this subregion encompasses the geographic area of Kern county.

Total electricity usage data for Kern county in 2022 was obtained from CEC Energy Reports: Electricity by County, which categorized usage into residential and non-residential sectors (CEC 2023). Electricity usage data for the City of Bakersfield, which was also separated into residential and non-residential categories, was acquired directly from the Pacific Gas and Electric Company (PG&E). To estimate electricity usage for the rest of the county (i.e., all jurisdictions excluding Bakersfield), the City of Bakersfield's electricity data was subtracted from the total Kern county data.

Residential electricity usage outside of Bakersfield was apportioned to each jurisdiction based on its share of the county's total population. For non-residential electricity usage, estimates were further categorized into industrial and commercial/institutional sectors using attribution metrics derived from natural gas consumption data previously calculated under stationary energy. In 2022, 93.1 percent of the county's stationary natural gas combustion was attributed to industrial use and 6.9 percent to commercial/institutional use. These same ratios were applied to the county's total non-residential electricity usage, under the assumption that the sectoral split in electricity usage mirrors that of natural gas usage. This assumption was validated using available industrial electricity and natural gas usage data in PG&E's service territory, from the CEC Energy Reports. The electricity-to-gas ratio, expressed as gigawatt-hour per million therms, was calculated by dividing total industrial electricity usage by industrial natural gas consumption for the service territory. The resulting value closely aligns with the assumptions applied in this here, supporting its validity.

The City of Ridgecrest's share of commercial building square footage was used to attribute commercial/institutional electricity usage. Industrial electricity usage was attributed based on the proportion of countywide industrial natural gas within the City of Ridgecrest. No industrial facilities exist in the City of Ridgecrest; therefore, no industrial electricity usage is attributed to the City of Ridgecrest. Finally, the sector-specific electricity usage data for each jurisdiction was entered into the "Electricity-Data" sheet of the EPA Local GHG Inventory Tool to calculate associated GHG emissions.

Table 9 below shows the City of Ridgecrest's electricity activity data and the associated GHG emissions by emission sectors.

Table 9 City of Ridgecrest Electricity Energy Data Inputs and Results

Sector	Total Activity (kWh of Electricity Consumed)	GHG Emissions (MTCO ₂ e)
Residential	105,167,953	23,820
Commercial/Institutional	39,151,959	8,868
Industrial	—	—

Notes: kWh = kilowatt-hour; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; PG&E 2025; analysis conducted by Ascent in 2025.

3.3.5 Imported Water

The water source category captures GHG emissions from energy use associated with the conveyance, treatment, and distribution of water within a jurisdiction. In Kern county, the WAKC reports that approximately 166,000 acre-feet of water are used annually for municipal and industrial purposes, and 2,294,000 acre-feet for agricultural purposes.

In addition to local surface water, Kern county draws water from several sources. Among these, only water supplied through the State Water Project (SWP) and the federal Central Valley Project (CVP) is considered imported, and therefore potentially results in GHG emissions due to long-distance conveyance. All other sources are classified as local. It was assumed that energy used for extracting, conveying, treating, and distributing local water is captured under the emissions estimates for stationary energy and electricity, since these activities occur within the county. In addition, upon further review, it was also determined that the federal CVP does not consume energy for water delivery to Kern County, as water is primarily conveyed using gravity (Friant Water Authority 2019). As a result, only the SWP, which accounts for 26 percent of the county's water supply, contributes to GHG emissions. Table 10 provides a summary of the water sources in Kern county and their contribution to the total water supply.

Table 10 Kern County Water Sources

Source	Percentage
Kern River	20%
State Water Project (California Aqueduct)	26%
Federal Central Valley Project (Friant-Kern Canal)	12%
Local Streams and Other Sources (Poso Creek, Kern River, etc.)	6%
Groundwater	36%
Total	100%

Source: WAKC n.d.

Water use in Kern County is characterized into municipal and industrial, and agricultural sectors in data obtained from WAKC. It is assumed that water included in "municipal" uses is delivered to both commercial and residential customers. However, sufficient data was not available to disaggregate the water consumption between industrial, commercial, and residential customers. For the purpose of this GHG emissions inventory, all non-agricultural water consumption was categorized under the commercial/institutional sector.

To allocate sector-specific water usage to individual jurisdictions, the following attribution metrics were used:

- ▶ Agricultural water use was apportioned based on each jurisdiction's share of farmland, grazing land, and other agricultural land.
- ▶ Commercial/institutional water use was distributed according to the share of commercial building square footage in each jurisdiction.

These apportioned figures were then entered into the “Imported Water” sheet of the EPA Local GHG Inventory Tool, applying a universal 26 percent imported water rate, to estimate the associated GHG emissions from water conveyance and use. Table 11 presents the City of Ridgecrest’s activity data related to imported water, including the percentage of total water supply that is imported and the associated GHG emissions.

Table 11 City of Ridgecrest Imported Water Energy Data Inputs and Results

Sector	Total Activity (Gallons of Water)	Percentage of Water Imported	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	436,047,358	26%	554
Agricultural	4,392,864		6

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: WAKC n.d.; analysis conducted by Ascent in 2025.

3.3.6 Wastewater

The wastewater source accounts for GHG emissions resulting from the treatment of sewage. To support this analysis, a review of publicly available wastewater treatment characteristics was conducted to collect the data required for completing the “Wastewater-Control” tab of the EPA’s Local GHG Inventory Tool. The data sources and corresponding assumptions for the City of Ridgecrest’s wastewater treatment systems are summarized in Table 12. Where jurisdiction-specific data were not publicly available, the default input values provided by the EPA tool were used.

To estimate GHG emissions, population data for each jurisdiction were subsequently entered into the “Wastewater-Entry” tab of the tool. The resulting emissions estimates are also presented in Table 12, alongside the data sources and assumptions used.

Table 12 City of Ridgecrest Wastewater Treatment Assumptions

Wastewater Process/Treatment Type	Conditions Assumed	Data Source	GHG Emissions (MTCO ₂ e)
Population served by septic systems	5 percent of the city’s population	ICLEI’s default proportion of population that utilizes septic tanks for an urban area (Box WW.11(alt).2).	11,041
One or more wastewater treatment plants (WWTPs) where wastewater is treated in aerobic or anaerobic conditions	Anerobic	No public information is available. The default value is anerobic.	
One or more WWTPs conduct or do not conduct nitrification/denitrification	No nitrification/denitrification	No public information is available. The default value is no nitrification/denitrification.	

Notes: WWTP = wastewater treatment plant; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; ICLEI = Local Governments for Sustainability.

Sources: ICLEI 2019; Stantec 2019; analysis conducted by Ascent in 2025.

3.3.7 Solid Waste

Community-generated solid waste emissions are primarily associated with the decomposition of solid waste in landfills. There are two methods for accounting for GHG emissions associated with waste disposal:

- ▶ Waste generation method – Accounts for the total GHG emissions that would be generated over time as municipal solid waste (MSW) that is sent to a landfill in only the inventory year decomposes.
- ▶ Waste-in-place method – Accounts for the total GHG emissions generated in a given year at a specific landfill location by the decomposition of all MSW previously disposed at the landfill.

Generally, there is some risk of double counting GHG emissions when combining both of these methods, as a portion of the emissions accounted for using the waste generation method may occur at an in-boundary landfill that has emissions reported using the waste-in-place method. However, the scale of the overlapping GHG emissions between the two methods would be expected as very small in comparison to total emission using either accounting method.

WASTE GENERATION

Landfill tonnage data for 2022 was obtained from CalRecycle’s Jurisdiction Disposal and Beneficial Reuse by Destination database. This data was entered into the EPA’s Waste Reduction Model (WARM Tool) as “mixed MSW” to estimate waste generation emissions. The default national average values were used in the WARM Tool, except for Question 7, where the k value was set to “dry” based on the county’s annual precipitation (less than 20 inches) (NCEI 2025). The WARM output was then imported into the EPA Local GHG Inventory Tool’s “Waste Production” tab, with solid-waste associated emissions attributed to the residential sector by default.

The total activity for solid waste disposal and the resulting waste generation GHG emissions results from the WARM Tool are provided in Table 13.

Table 13 City of Ridgecrest Waste Generation Data Inputs and Results

Sector	Total Activity (tons of MSW disposed)	GHG Emissions (MTCO ₂ e) (WARM Output)
Residential	38,746	11,183

Notes: MSW = mixed municipal solid waste; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; WARM = Waste Reduction Model.

Source: CalRecycle 2025; analysis conducted by Ascent in 2025.

WASTE-IN-PLACE

EPA’s FLIGHT database was reviewed to determine emissions from landfills located within the City of Ridgecrest’s geopolitical boundary, which would provide emissions data for any landfills that generated emissions greater than 25,000 MTCO₂e in 2022. No reporting landfills were identified for the City of Ridgecrest.

3.3.8 Agriculture

The agriculture emissions source captures GHG emissions generated from fertilizer application.

FERTILIZER APPLICATION

Fertilizer application results in GHG emissions primarily due to the release of N₂O, a potent GHG with a global warming potential nearly 300 times greater than CO₂. When nitrogen-based fertilizers are applied to soil, a portion of the nitrogen undergoes microbial processes (nitrification and denitrification), which convert it into N₂O. These emissions can occur directly from the soil or indirectly through leaching and runoff

The total tonnage of nitrogen in synthetic fertilizers applied in Kern county during the 2022 inventory year was obtained from CDFA’s fertilizing materials tonnage report. This countywide total was then apportioned to individual jurisdictions based on each jurisdiction’s proportional share of farmland, grazing land, and other agricultural land. Only data for synthetic fertilizers was publicly available for calculation, although other organic or manure-based fertilizers may be used.

The resulting tonnage of nitrogen in synthetic fertilizers estimated for the City of Ridgecrest was entered into the “Agriculture & Land Management” sheet of the EPA’s Local GHG Inventory Tool to calculate the associated emissions. Table 14 provides the estimated total tons of nitrogen applied and resulting GHG emissions.

Table 14 City of Ridgecrest Fertilizer Application Data Inputs and Results

Sector	Total Activity (tons of nitrogen applied)	GHG Emissions (MTCO ₂ e)
Agricultural	1	7

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CDFA 2025; analysis conducted by Ascent in 2025.

4 GREENHOUSE GAS EMISSIONS FORECAST METHODS

This section provides the methods and data used to project future GHG emissions under a BAU scenario, as well as the calculations of reductions from adopted legislation and regulations under an ABAU scenario.

The BAU GHG emissions forecasts assess how emissions generated by community activities will change over time without further State, federal, regional, or local action. The BAU scenario forecast accounts for the changes in population and employment that can influence communitywide GHG emissions. The ABAU scenario forecast includes adopted policies and regulations at the State and federal levels that would affect emissions without any local action, such as regulatory requirements to increase vehicle fuel efficiency and increase renewable energy sources in grid electricity portfolios. These forecasts provide the City of Ridgecrest with information needed to understand specific GHG emissions sources with the greatest opportunities for reduction with future plans, projects, or programs. It is important to note that the ABAU forecasts only account for emissions reductions associated with adopted policies and regulations; they do not account for proposed and/or unadopted GHG reduction actions established by regional, State, and federal agencies or executive orders outside of adopted legislation and regulations.

The GHG emissions forecasts project GHG emissions for the years 2030, 2040, and 2045 to align with key regulatory timelines for the State. Two key legislative actions establish statewide GHG reduction targets for the years 2030 and 2045, including:

- ▶ Senate Bill (SB) 32 of 2016, which sets a statewide GHG reduction target for the year 2030, and
- ▶ Assembly Bill 1279 of 2022, which sets a statewide GHG reduction target for the year 2045.

The forecast years selected do not necessarily align with the targets established by adopted legislation, but they do provide an analysis of emissions that aligns with the relevant horizon years. The year 2040 was also included in the analysis as an interim year between the 2030 and 2045 forecast years.

4.1 GROWTH PROJECTIONS

GHG emissions forecasts were developed based on projected changes in Kern county's demographics, specifically population, employment, and service population (defined as residents plus employees), between 2022 and 2045. These projections were obtained from the Regional Growth Forecast and Demographic Forecast prepared by the Kern COG (Kern COG 2024). It is assumed that the incorporated cities and the unincorporated county will experience demographic growth at the same rate as the county overall, as jurisdiction-specific growth projections were not available at the time of this analysis.

Between 2022 and 2045, Kern county's population and employment are projected to increase by approximately 11.1 and 15.5 percent, respectively. The service population is expected to grow by 12.4 percent. These growth factors were applied to forecast GHG emissions for the years 2030, 2040, and 2045 across various emissions sources included in the inventory. The values used for population, employment, and service population used to project future emissions are provided in Table 15.

Table 15 Kern County Demographics and Calculated Growth Rates for Future Emissions Forecasts

Calculation Factor	2022	2030	2040	2045
Population				
Total Kern County	906,883	949,134	994,167	1,007,627
Kern County Growth from 2022		4.7%	9.6%	11.1%
Employment				
Total Kern County	358,961	369,427	399,432	414,652
Kern County Growth from 2022		2.9%	11.3%	15.5%
Service Population				
Total Kern County	1,265,844	1,318,561	1,393,598	1,422,279
Kern County Growth from 2022		4.2%	10.1%	12.4%

Source: US Census Bureau 2025; Kern COG 2024; analysis conducted by Ascent in 2025.

Additional details on how growth factors were applied to individual sources are provided in the following sections. It is important to note that agricultural emissions, including those from fertilizer application, as well as livestock enteric fermentation and manure management, are assumed to remain constant throughout the forecast period, with no projected increase in activity levels. Agricultural activities are difficult to project in any detail, with production intensities, number of livestock, and crop types being highly susceptible to global markets and local climate patterns. As such, projections of agriculture GHG emissions-generating activities are not attempted.

4.2 BUSINESS-AS-USUAL SCENARIO FORECAST

The BAU forecast represents a projection of future GHG emissions based solely on expected demographic and economic growth (e.g., population, employment, and service population) between 2022 and 2045. It does not account for the potential impacts of future policies, programs, or actions that may reduce emissions, such as energy efficiency improvements, renewable energy adoption, or transportation electrification.

In the BAU scenario, GHG emissions factors are held constant at the levels used in the 2022 GHG inventory, meaning the carbon intensity of electricity, fuels, and other activities is assumed not to change over time. As a result, any changes in future emissions are driven entirely by growth in activity levels, not by improvements in emissions performance.

4.2.1 Business-As-Usual Scenario Forecast Results

Table 16 presents the projected activity data for the City of Ridgecrest across all forecast years, organized by emissions source and sector. Table 16 also indicates which sources and sectors used population, employment, or service population as a growth metric.

Table 16 City of Ridgecrest BAU Scenario Projected Activity Data for All Forecast Years

Source	Sector	Growth Metric	Units	2030	2040	2045
Stationary Energy	Residential	Population	scf	309,914	324,618	329,014
Stationary Energy	Commercial/Institutional	Employment	scf	292,513	316,270	328,322
Stationary Energy	Industrial	Employment	scf	—	—	—
Electricity	Residential	Population	kWh	110,067,626	115,289,918	116,850,849
Electricity	Commercial/Institutional	Employment	kWh	40,293,532	43,566,119	45,226,233
Electricity	Industrial	Employment	kWh	—	—	—
Other Industrial	Industrial	Employment	MTCO ₂ e	—	—	—

Source	Sector	Growth Metric	Units	2030	2040	2045
Agriculture – Fertilizer Application	Agricultural ¹	N/A	ton	1	1	1
Solid Waste	Residential	Population	ton	40,551	42,475	43,050
Wastewater	Commercial/Institutional	Service Population	MTCO ₂ e	11,501	12,155	12,405
Imported Water	Commercial/Institutional	Service Population	Gallon	454,206,939	480,055,126	489,934,848
Imported Water	Agricultural ¹	N/A	Gallon	4,392,864	4,392,864	4,392,864
Mobile On-road	Residential	Population	VMT	236,037,613	247,236,703	250,584,085
Mobile On-road	Commercial/Institutional	Employment	VMT	106,757,384	115,428,077	119,826,536
Mobile Off-road	Commercial/Institutional	Employment	MTCO ₂ e	11,049	11,947	12,402
Mobile Off-road	Agricultural ¹	N/A	MTCO ₂ e	4	4	4

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; scf = standard cubic foot.

¹ Activity levels for the agricultural sector are assumed to remain constant over the forecast period; therefore, growth metrics are listed as “N/A.”

Source: Analysis conducted by Ascent in 2025.

Table 17 below presents the projected GHG emissions for the City of Ridgecrest across all forecast years, also organized by emissions source and sector.

Table 17 City of Ridgecrest BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	16,956	17,760	18,001
Stationary Energy	Commercial/Institutional	MTCO ₂ e	16,004	17,303	17,963
Stationary Energy	Industrial	MTCO ₂ e	—	—	—
Electricity	Residential	MTCO ₂ e	24,928	26,111	26,464
Electricity	Commercial/Institutional	MTCO ₂ e	9,126	9,867	10,243
Electricity	Industrial	MTCO ₂ e	—	—	—
Other Industrial	Industrial	MTCO ₂ e	—	—	—
Agriculture – Fertilizer Application	Agricultural	MTCO ₂ e	7	7	7
Solid Waste	Residential	MTCO ₂ e	11,703	12,259	12,425
Wastewater	Commercial/Institutional	MTCO ₂ e	11,501	12,155	12,405
Imported Water	Commercial/Institutional	MTCO ₂ e	577	609	622
Imported Water	Agricultural	MTCO ₂ e	6	6	6
Mobile On-road	Residential	MTCO ₂ e	75,931	79,533	80,610
Mobile On-road	Commercial/Institutional	MTCO ₂ e	106,977	115,665	120,073
Mobile Off-road	Commercial/Institutional	MTCO ₂ e	11,049	11,947	12,402
Mobile Off-road	Agricultural	MTCO ₂ e	4	4	4

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

4.3 LEGISLATIVE-ADJUSTED BUSINESS-AS-USUAL SCENARIO FORECAST

ABAU emissions forecasts were prepared using the same demographic data that were used for the BAU forecasts, while also accounting for State and federal policies and regulations that would affect local emissions. These forecasts provide the City of Ridgecrest with a more robust understanding of future community emissions based on the GHG reduction efforts at the state and federal level. A summary of applicable legislative reductions is provided in Table 18.

Table 18 Legislative Reductions Summary

Source	Legislative Reduction	Description	Sources Applied
State	Renewable Energy and Zero-Carbon Electricity Requirements [SB 1020 and SB 100]	Requires California energy utilities to procure 60 percent of electricity from eligible renewable and zero-carbon sources by 2030, 95 percent by 2040, and 100 percent by 2045.	Electricity, Imported Water
State	California's Building Energy Efficiency Standards (2019 and 2022 Title 24, Part 6)	Requires all new buildings in California to comply with energy efficiency standards established by CEC. Accounts for the energy efficiency gains in new residential and nonresidential buildings.	Stationary Energy, Electricity
State	Advanced Clean Car I Regulation	Establishes GHG emission reduction standards for model years 2017 through 2025 that are more stringent than federal CAFE standards.	Mobile On-road
State	Truck and Bus Regulation	Requires diesel trucks and buses that operate in California to be upgraded to reduce GHG emissions.	Mobile On-road
Federal	Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles	Establishes fuel efficiency standards for medium- and heavy-duty engines and vehicles.	Mobile On-road

Notes: CAFE = Corporate Average Fuel Economy; CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; SUV = sports utility vehicle; SB = Senate Bill.

4.3.1 Title 24 Adjustments

Future energy use was adjusted to reflect increased emissions-intensity stringency under California's Building Energy Efficiency Standards (California Code of Regulations Title 24 Part 6, hereafter referred to as "Title 24"). Although Title 24 applies to both new residential and nonresidential construction, for the purposes of this forecast, adjustments were applied only to residential construction for reasons described below.

This approach accounts for uncertainties in energy consumption patterns and end uses in nonresidential buildings, and uncertainty in the non-residential building types that would be constructed in the future. Title 24 primarily regulates energy efficiency in building envelopes and lighting systems. This is expected to substantially reduce energy consumption for building types where the primary end uses of energy are lighting and heating, ventilation, and air conditioning, such as new office, institutional, and hotel buildings. However, Title 24 may not significantly affect other high-energy-consuming uses in nonresidential facilities, such as process loads or specialized equipment. As such, limiting adjustments to residential construction provides a more conservative and reliable estimate of future energy-related GHG emissions.

The 2019 Title 24 standards apply to projects constructed after January 1, 2020, while the 2022 standards apply after January 1, 2023. The 2025 Title 24 will go into effect statewide in January of 2026; however, detailed data on the changes in building-level energy consumption between the 2025 code and previous code cycles was not available at the time of this analysis. To estimate changes in future energy consumption under the 2022 standards, electricity and natural gas adjustment factors were calculated based on differences in average residential energy use between buildings built to the 2019 and 2022 standards. These factors were derived from CEC's data specific to the 2019 and 2022 standards and climate zone-based energy usage rates. For the City of Ridgecrest, Climate Zone 13 was used in the analysis.

These adjustment factors were then applied to the ABAU forecasts of energy consumption activity for both stationary energy and electricity use to reflect the impact of legislative energy efficiency improvements on future development.

The adjustment factors, presented in Table 19, show the percentage change in energy use for buildings built to 2022 standards relative to those built to 2019 standards. Positive values indicate an anticipated increase in energy use, while negative values indicate an anticipated decrease in energy use.

As shown in Table 19:

- ▶ ABAU electricity activity is projected to be higher than BAU in each forecast year due to positive adjustment factors.
- ▶ ABAU stationary energy activity is projected to be lower than BAU due to negative adjustment factors.

Importantly, these adjustments were applied only to energy use growth occurring after the 2022 baseline, reflecting new development that would be subject to the 2022 Title 24, or a later cycle of standards. In addition, it is important to note that although average electricity use in new residential buildings is anticipated to rise under 2022 Title 24 (due to an increase in electrical demand associated with electric appliances installed instead of natural gas appliances), emissions from new residential buildings are expected to be lower than they would be under 2019 Title 24 as a result of overall lower building emissions intensities (due to lower emissions factors associated with electricity compared to natural gas).

Table 19 Stationary Energy and Electricity Adjustment Factors and Activity Forecast Results for Residential Buildings

Energy Type	Forecast Scenario	Adjustment Factor	Activity Units	2022	2030	2040	2045
Electricity	BAU	—	kWh	105,167,953	110,067,626	115,289,918	116,850,849
Electricity	ABAU	+12%	kWh	105,167,953	110,653,571	116,500,389	118,247,990
Stationary Energy (Natural Gas)	BAU	—	mcf	296,118	309,914	324,618	329,014
Stationary Energy (Natural Gas)	ABAU	-29%	mcf	296,118	305,899	316,324	319,440

Notes: BAU = Business-as-Usual; ABAU = legislative-adjusted BAU; mcf = one thousand cubic feet; kWh = kilowatt-hour.

Source: Analysis conducted by Ascent in 2025.

4.3.2 Senate Bill 100 and Senate Bill 1020 Adjustments

SB 100 requires that 100 percent of retail electricity sales in California come from renewable and zero-carbon resources by 2045. This legislation builds upon the state's existing Renewables Portfolio Standard (RPS) by increasing the required percentage of RPS-eligible renewable electricity over time. SB 1020 builds on SB 100 by introducing interim targets for GHG-free electricity for the years 2035 and 2040. As shown in Table 20, SB 100 and SB 1020 require utility providers to supply electricity that is 60 percent GHG-free by 2030, 95 percent by 2040, and 100 percent by 2045. The emissions sources affected by these adjustments include electricity and imported water, both of which are estimated based on the carbon intensity of the electricity grid.

To estimate future GHG emissions factors, the 2022 GHG-free electricity percentage and GHG emissions factors for the CAMX eGRID subregion were first obtained from the EPA's eGRID database. Using these 2022 values as a baseline, emissions factors for the forecast years (2030, 2040, and 2045) were calculated based on the GHG-free electricity targets established by SB 100 and SB 1020.

Table 20 below demonstrates these GHG-free electricity percentage baseline values and targets, as well as the baseline and calculated emissions factors for the forecast years. Given 2045's 100 percent GHG-free electricity percentage target, the emissions factor for 2045 is 0. In contrast to the ABAU forecast, the CAMX eGRID emissions factors under the BAU scenario are assumed to remain constant at their 2022 baseline values throughout the forecast years.

Table 20 CAMX eGRID Electricity GHG Emissions Factors Adjusted for SB100 and SB1020

Calculation Factor	Units	2022	2030	2040	2045
SB 100 and SB 1020 GHG-free electricity percentage targets	Percent GHG-free	N/A	60%	95%	100%
CAMX eGRID GHG-free electricity percentage baseline and targets	Percent GHG-free	50%	60%	95%	100%
CAMX eGRID baseline and interpolated emissions factors	MTCO ₂ e/MWh	0.2265	0.1819	0.0227	0

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MWh = megawatt-hour; N/A = Not Applicable.

Source: Analysis conducted by Ascent in 2025.

4.3.3 On-road Vehicle Emissions Standards

State and federal regulations are expected to significantly reduce on-road GHG emissions by requiring improvements in vehicle fuel efficiency and accelerating the transition to zero-emission vehicles (ZEVs). The ABAU forecast for the Mobile On-road source takes into consideration the following State and federal regulations:

- ▶ Innovative Clean Transit Regulation, which requires all California public transit agencies to begin phasing in zero-emission buses (ZEB) starting in 2023 and transition to 100 percent ZEB fleets by 2040 and
- ▶ Advanced Clean Trucks Regulation, which requires truck and van manufacturers to sell a growing share of ZEVs beginning in model year 2024.

All these regulations are reflected in EMFAC2021's emissions data for the forecast years (2030, 2040 and 2045), which serve as the basis for the Mobile On-road source's ABAU forecast. In addition to these regulations, EMFAC2021's data also takes into consideration future increases in light-duty ZEV sales, which would be influenced by California's Advanced Clean Cars I regulation.

Accordingly, EMFAC2021's VMT and emissions estimates for forecast years were used to calculate Mobile On-road emissions under the legislative adjustment scenario. As with the inventory methodology, sector-specific emissions factors for each forecast year were calculated by dividing sector-specific VMT by sector-specific emissions for each forecast year. These emissions factors were then multiplied by projected future VMT, which were scaled by relevant activity growth factors (population for the residential sector and employment for the commercial/institutional sector) to estimate future emissions. The baseline and projected future emissions factors calculated using EMFAC2021 are shown in Table 21.

In contrast, under the BAU scenario, Mobile On-road emissions factors are held constant at their 2022 baseline values for all forecast years, reflecting no change in vehicle efficiency or fleet composition.

Table 21 Mobile On-road Baseline and Projected GHG Emissions Factors

Sector	Units	2022	2030	2040	2045
Commercial Institutional	MTCO ₂ e/VMT	0.0010	0.00090	0.00081	0.00081
Residential	MTCO ₂ e/VMT	0.00032	0.00026	0.00023	0.00023

Notes: MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: Analysis conducted by Ascent in 2025.

4.3.4 Legislative-Adjusted Business-as-Usual Scenario Forecast Results

Table 22 presents the projected GHG emissions for the City of Ridgecrest across all forecast years under the ABAU scenario, organized by emissions source and sector. Emissions sources and sectors not impacted by legislative

adjustments are excluded from this table, as their projected GHG emissions are assumed to remain unchanged from the BAU scenario. The full results for projected GHG emissions for the City of Ridgecrest across all forecast years under both the BAU and ABAU scenarios, organized by emissions source and sector, can be found in Table 2.

Table 22 City of Ridgecrest Legislative-Adjusted BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	16,736	17,306	17,477
Electricity	Residential	MTCO ₂ e	20,129	2,649	—
Imported Water	Commercial/Institutional	MTCO ₂ e	463	61	—
Imported Water	Agricultural	MTCO ₂ e	4	1	—
Mobile On-road	Residential	MTCO ₂ e	61,736	57,392	57,173
Mobile On-road	Commercial/Institutional	MTCO ₂ e	95,978	93,098	96,684

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

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Greenhouse Gas Emissions Inventory and Forecast for the City of Shafter

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LIST OF ABBREVIATIONS

ABAU	legislative-adjusted BAU
AR5	Fifth Assessment Report
BAU	business-as-usual
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CH ₄	methane
CO ₂	carbon dioxide
CVP	Central Valley Project
eGRID	Emissions & Generation Resource Integrated Database
EPA Local GHG Inventory Tool	EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1
EPA	US Environmental Protection Agency
GHG	greenhouse gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
Kern COG	Kern Council of Governments
MRR	Mandatory Greenhouse Gas Reporting Regulation
MSW	municipal solid waste
MTCO _{2e}	metric tons of carbon dioxide equivalent
N ₂ O	nitrous oxide
PG&E	Pacific Gas and Electric Company
RPS	Renewables Portfolio Standard
SB	Senate Bill
SWP	State Water Project
VMT	vehicle miles traveled
WARM Tool	Waste Reduction Model
ZEB	zero-emission buses
ZEV	zero-emission vehicle

1 INTRODUCTION

This report contains the methods and results for a greenhouse gas (GHG) emissions inventory and GHG emissions forecast for the City of Shafter. A GHG emissions inventory provides estimates of emissions generated within a defined geographic boundary during a single year. It identifies the sectors, sources, and activities that produce these emissions and their relative contribution, while also providing a baseline to forecast future emissions trends. A GHG emissions forecast evaluates how GHG emissions may change in the future due to growth and the effects of adopted state and federal legislation and regulations. This information can be used for various purposes, including monitoring GHG emissions trends over time, or as the technical basis for planning efforts to reduce GHG emissions, such as a general plan or greenhouse gas reduction plan.

This report was developed as part of a grant provided to the City of Bakersfield by the US Environmental Protection Agency (EPA) as part of the Climate Pollution Reduction Grants program. The grant was provided to support climate pollution reduction planning in the Bakersfield Metropolitan Statistical Area, which includes the entirety of Kern county. Under this grant, funding was allocated to produce GHG emissions inventories and forecasts for each of the 12 jurisdictions in Kern county, including the City of Bakersfield, unincorporated Kern County, and all incorporated cities. These GHG emissions inventories and forecasts will be provided to the subject jurisdiction, the San Joaquin Valley Air Pollution Control District, and Kern Council of Governments (Kern COG).

The GHG emissions inventory and forecast are intended to provide an accounting of GHG emissions generating activities within the City of Shafter geographical boundary for the year 2022, and projections of future emissions based on countywide growth patterns and the effects of adopted state and federal legislation and regulations. This report is accompanied by an Excel-based tool used to develop the GHG emissions inventory, the EPA *Local Greenhouse Gas Inventory Tool: Community Module version 2025.1* (the EPA Local GHG Inventory Tool). The GHG emissions inventory uses only publicly available data sets, many of which provide countywide estimates of GHG emissions generating activity, such as mobile on-road travel, energy consumption, and fertilizer use. This countywide data was scaled down to the jurisdiction level based on various attribution metrics, including population, commercial building floor space, and acres of agricultural use. GHG emissions were then forecasted using countywide growth projections for vehicle travel, population, and employment.

Because countywide data was used and scaled using attribution metrics, rather than jurisdiction-specific data, the GHG emissions inventory and forecast are intended to provide a general scale of GHG emissions for City of Shafter's contribution to countywide GHG emissions and serve as a starting point for more detailed GHG emissions analyses. The Excel-based tool can be updated with more locally specific and operational data that can be obtained from relevant departments and direct requests to utility providers. GHG emissions forecasts can be replicated using more locally specific growth projections for population and employment. The results can also be used to set local GHG reduction targets and develop and quantify locally specific measures for reducing GHG emissions. Sufficient detail is provided in this report to ensure that the analyses are replicable, and data inputs can be replaced with more detailed data, if desired.

2 SUMMARY RESULTS

This section presents the results of the GHG emissions inventory and forecast for the City of Shafter, providing a comprehensive overview of historical (2022 as the inventory year) and projected (2030, 2040, and 2045 as the forecast years) emissions. The results are organized by emissions sources, including stationary energy, electricity, Mobile On-road, wastewater, solid waste, and others, as well as by sectors, including residential, commercial/institutional, industrial, and agricultural.

This breakdown enables an understanding of the emissions sources and sectors that contribute most significantly to the City of Shafter's overall emissions. Section 3 of this report provides additional context and methodology related to each emissions source and sector, including key assumptions, data sources, and allocation methods used in the inventory and forecast development.

2.1 2022 GREENHOUSE GAS EMISSIONS INVENTORY RESULTS

Table 1 below shows the 2022 GHG emissions inventory results for the City of Shafter, categorized by emissions sources and sectors. Figure 1 shows the inventory categorized by emission sources, while Figure 2 shows the inventory categorized by emission sectors.

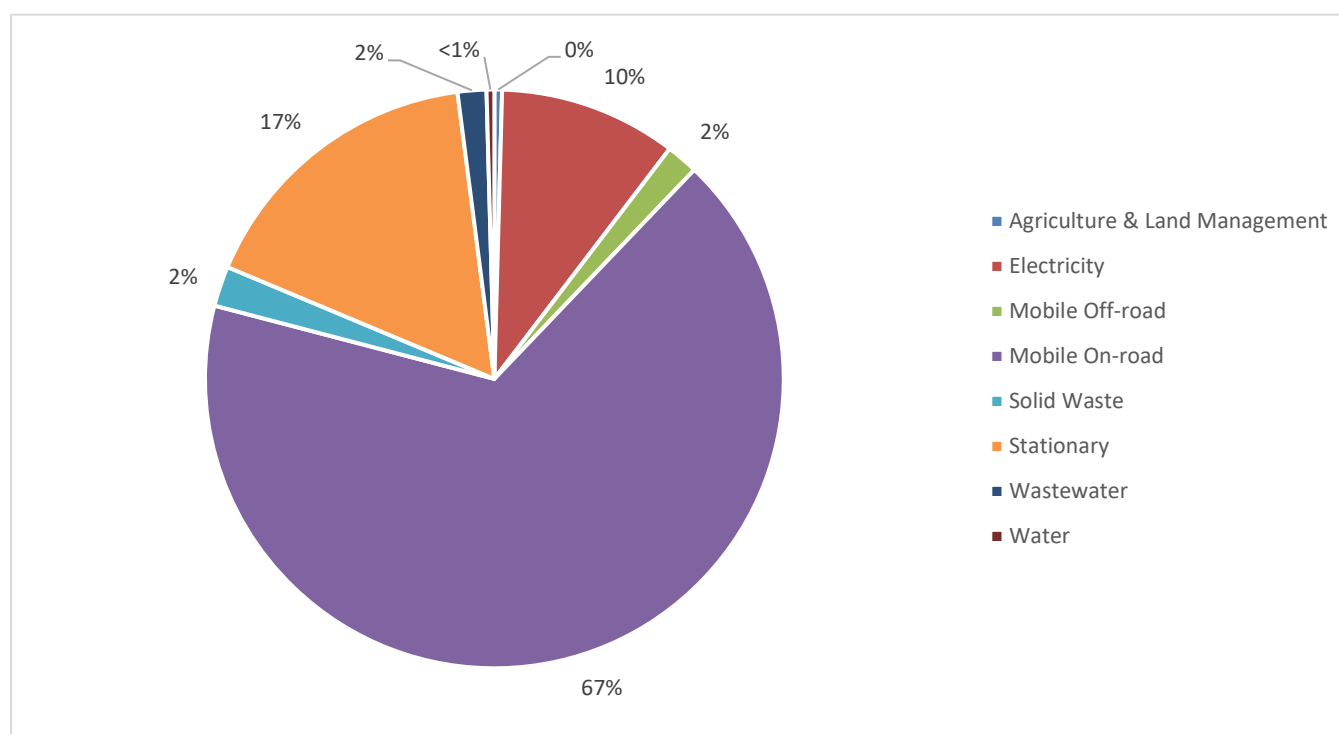
Table 1 City of Shafter 2022 GHG Emissions Inventory Results (MTCO₂e)

Emissions Sources	Emissions Sectors				
	Agricultural	Commercial/Institutional	Industrial	Residential	Total
Agriculture & Land Management	2,111	—	—	—	2,111
Electricity	—	23,721	8,179	17,080	48,980
Mobile Off-road	1,099	7,698	—	—	8,798
Mobile On-road	—	278,056	—	52,022	330,078
Solid Waste	—	—	—	11,050	11,050
Stationary Energy	—	41,806	28,600	11,675	82,081
Wastewater	—	7,917	—	—	7,917
Water	1,744	397	—	—	2,141
Total	4,955	359,596	36,778	91,828	493,156

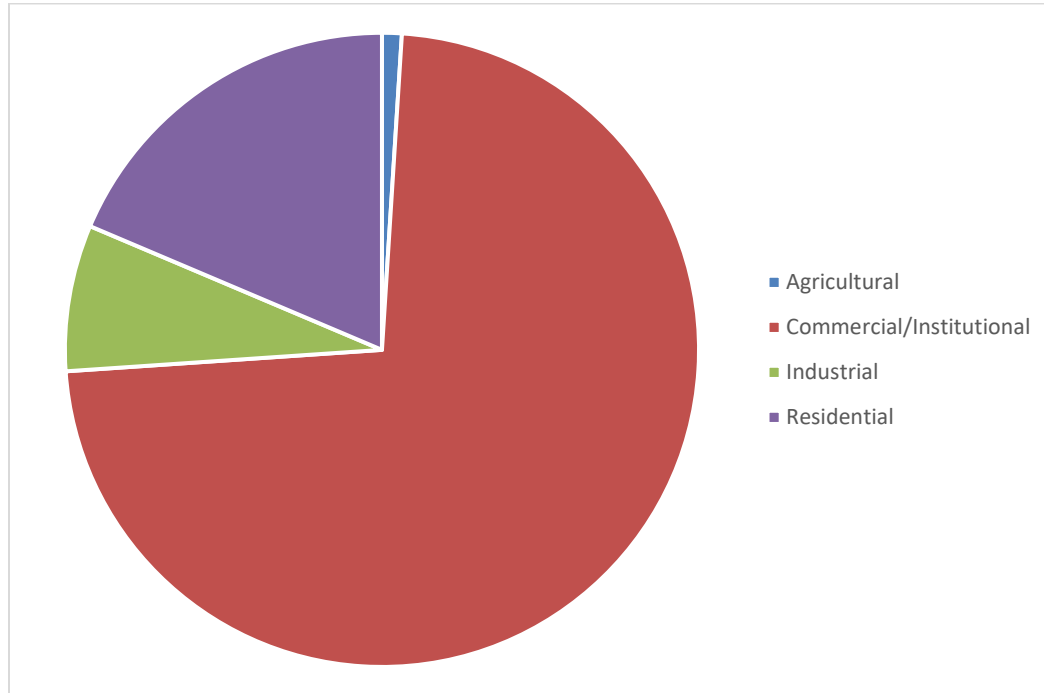
Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 1 City of Shafter 2022 GHG Emissions Inventory by Emissions Sources



Source: Analysis conducted by Ascent in 2025.

Figure 2 City of Shafter 2022 GHG Emissions Inventory by Emissions Sectors

Source: Analysis conducted by Ascent in 2025.

2.2 GREENHOUSE GAS EMISSIONS FORECAST RESULTS

Table 2 below shows the projected future GHG emissions for the City of Shafter for the forecast years 2030, 2040 and 2045 under both a business-as-usual (BAU) scenario, as well as a legislative-adjusted BAU (ABAU) scenario, broken down by both emissions sources and sector. The BAU GHG emissions forecasts estimate how community-generated emissions would change over time without additional actions at the State, federal, regional, or local levels, based solely on projected population and employment growth. The ABAU forecasts incorporate the effects of adopted State and federal policies, such as vehicle fuel efficiency standards and increased renewable energy in the electricity grid, but assume no additional local measures.

Table 2 City of Shafter Greenhouse Gas Emissions Forecast for 2030, 2040 and 2045 by Emissions Source and Sector (MTCO₂e)

Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Stationary Energy	Residential	12,158	12,000	12,735	12,409	12,907	12,532
Stationary Energy	Commercial/Institutional	42,809	42,809	46,286	46,286	48,050	48,050
Stationary Energy	Industrial	29,286	29,286	31,665	31,665	32,871	32,871
Electricity	Residential	17,875	14,434	18,723	1,900	18,976	—
Electricity	Commercial/Institutional	24,411	19,607	26,394	2,650	27,399	—
Electricity	Industrial	8,416	6,760	9,100	914	9,447	—
Other Industrial	Industrial	—	—	—	—	—	—
Agriculture – Fertilizer Application	Agricultural	2,111	2,111	2,111	2,111	2,111	2,111
Solid Waste	Residential	11,564	11,564	12,113	12,113	12,277	12,277
Wastewater	Commercial/Institutional	8,247	8,247	8,716	8,716	8,895	8,895

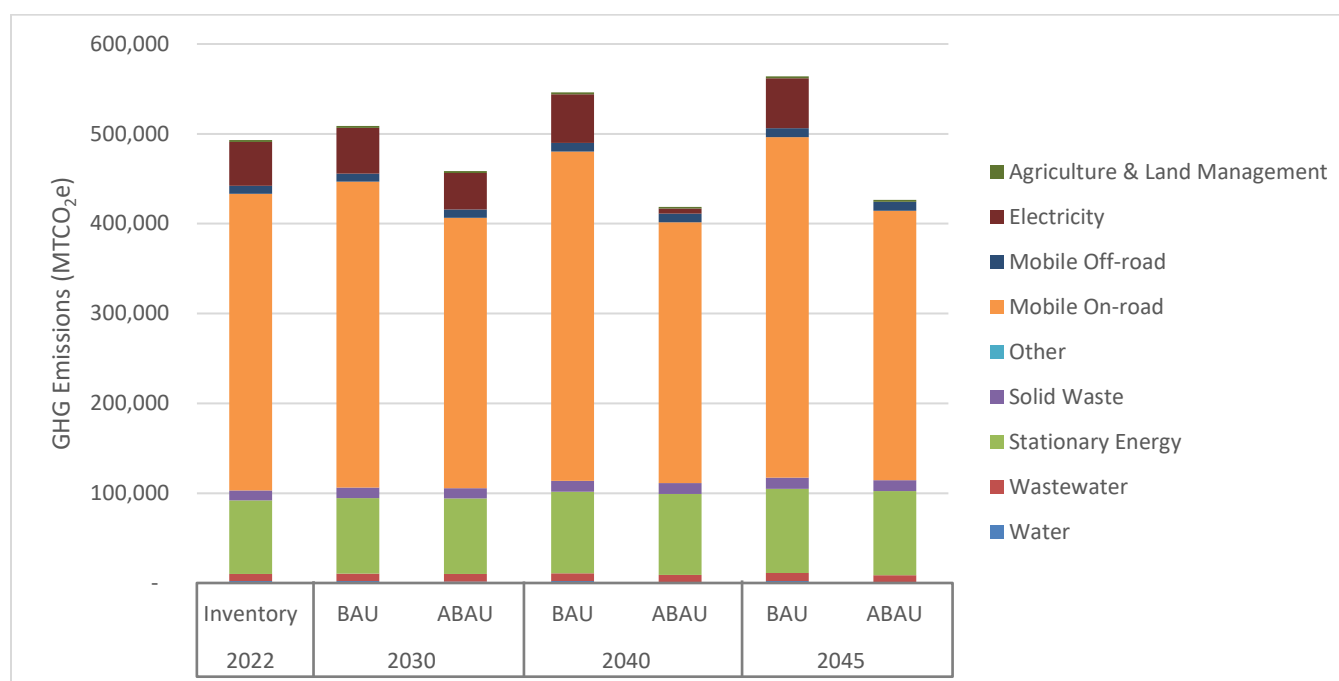
Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Imported Water	Commercial/Institutional	413	332	437	44	446	—
Imported Water	Agricultural	1,744	1,401	1,744	175	1,744	—
Mobile On-road	Residential	54,446	44,268	57,029	41,153	57,801	40,996
Mobile On-road	Commercial/Institutional	286,163	256,742	309,405	249,038	321,195	258,629
Mobile Off-road	Commercial/Institutional	7,923	7,923	8,566	8,566	8,893	8,893
Mobile Off-road	Agricultural	1,099	1,099	1,099	1,099	1,099	1,099

Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 3 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Shafter's 2022 GHG emissions inventory for comparison, all categorized by emissions sources.

Figure 3 City of Shafter 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sources (MTCO₂e)

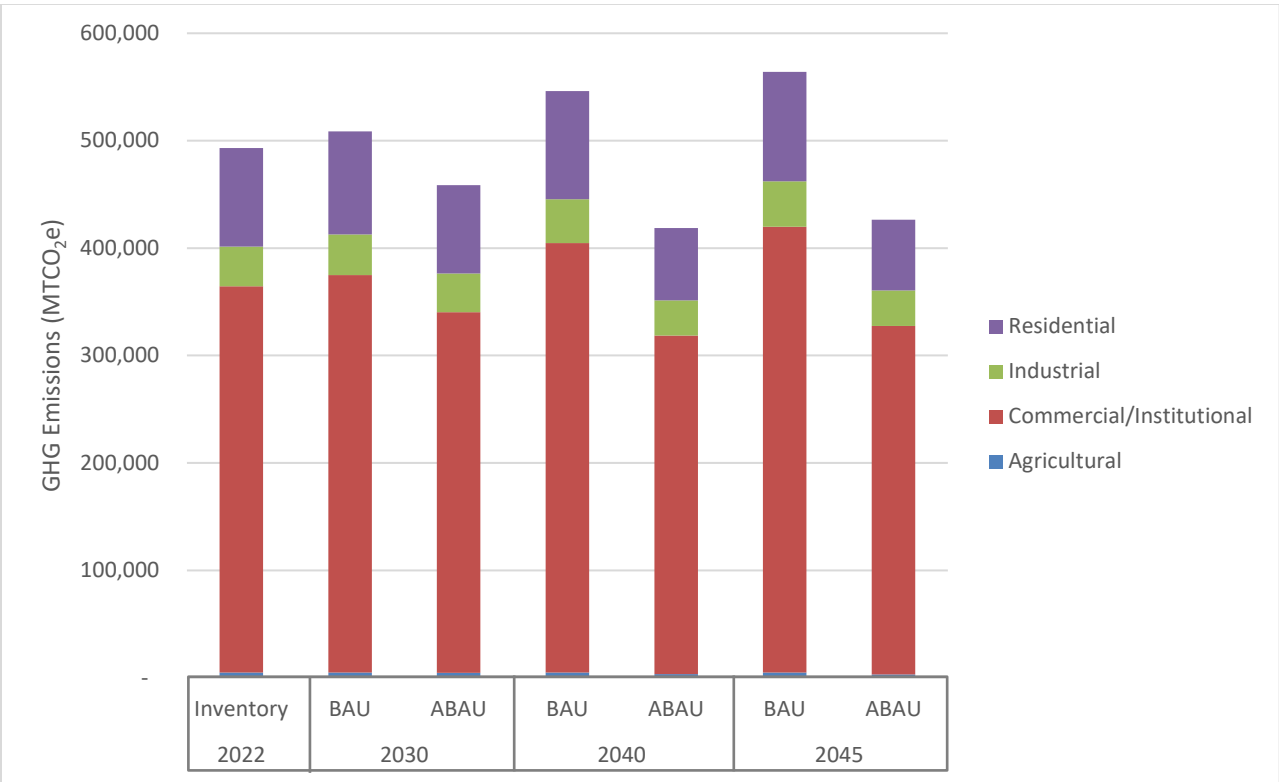


Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 4 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Shafter's 2022 GHG emissions inventory for comparison, all categorized by emissions sectors.

Figure 4 City of Shafter 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sectors (MTCO₂e)



Notes: Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

3 GREENHOUSE GAS EMISSIONS INVENTORY METHODS

This section of the report details the methods used to develop the GHG emissions inventory for the City of Shafter. It includes descriptions of the data sources and data processing, and the inputs and outputs for the GHG emissions calculations. The methods are organized by GHG emissions sources (stationary energy, electricity, etc.) for the City of Shafter, based on the EPA Local GHG Inventory Tool.

The EPA Local GHG Inventory Tool was primarily used for GHG emissions calculations. Activity data (e.g., energy consumed, tons of waste landfilled, etc.) inputs for the City of Shafter were entered into the tool and parameters were set to represent local conditions (e.g., annual electricity consumption data was imported into the tool as the input to calculate City of Shafter's GHG emissions associated with electricity, and the appropriate electricity grid was selected to represent local conditions). GHG emissions from on-road transportation were calculated externally to the EPA Local GHG Inventory Tool, due to data format inconsistencies. All other GHG emissions sources were calculated within, or entered into the tool. The tool also categorizes GHG emissions into different sectors: residential, commercial/institutional, industrial, and agricultural. Industrial and agricultural sectors were only used when explicitly differentiated in the available datasets. In all other cases, sector categorization followed the classifications provided by the EPA Local GHG Inventory Tool or as defined by the underlying data sources.

This report only documents data processing and calculations that were performed outside of the EPA Local GHG Inventory Tool and provides the GHG emissions outputs from the tool; it does not expand on the calculation methods within the tool. Documentation for the EPA Local GHG Inventory Tool can be found on the EPA website at: <https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool>.

3.1 GREENHOUSE GASES AND GLOBAL WARMING POTENTIAL

GHG emissions other than carbon dioxide (CO₂) 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). CO₂ has a GWP factor of one, while all other GHGs have GWP factors measured in multiples of one relative to the GWP of CO₂. This conversion of non-CO₂ gases to one unit enables the reporting of all emissions in terms of carbon dioxide equivalent (CO₂e), 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 (MTCO₂e). For this emissions inventory and forecast, the three primary and most abundant GHGs were accounted for: CO₂, methane (CH₄) and nitrous oxide (N₂O).

Consistent with the best available science, the inventory uses GWP factors published in the Fifth Assessment Report (AR5) from Intergovernmental Panel on Climate Change (IPCC), where CH₄ and N₂O have GWP factors of 28 and 265, respectively (IPCC 2014). These values represent the GWP of GHG on a 100-year time horizon. This means that CH₄ is approximately 28 times stronger than CO₂ and N₂O is 265 times stronger than CO₂ in their potential to warm Earth's atmosphere over the course of 100 years. The use of 100-year GWP values is consistent with the California Air Resources Board (CARB) and EPA GHG accounting methods.

3.2 DATA REVIEW

The general approach for developing the GHG emissions inventory involved the collection of total activity and/or emissions data for Kern county for the year 2022 for each relevant GHG emissions source and then apportioning that data to individual jurisdictions and sectors using appropriate attribution metrics. These metrics include the City of Shafter's contribution to total countywide population, commercial building floor space, and agricultural land acreage. In some cases, such as for landfilled solid waste and industrial facilities, jurisdiction-specific data were available from publicly available resources.

The primary data sources used to compile activity and emissions data for all of Kern county are listed in Table 3.

Table 3 Data Sources for Countywide Activity and Emissions Data

GHG Emission Source	Data Source(s)
Mobile On-road	CARB EMFAC2021 on-road emission inventory model (CARB 2022a)
Mobile Off-road	CARB OFFROAD2021 off-road emission inventory model (CARB 2022b)
Stationary Energy	CEC energy database (CEC 2023), EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases
Electricity	CEC energy database (CEC 2022), Pacific Gas & Electric Co (PG&E)
Imported Water	Water Association of Kern County
Agriculture	CDFA's fertilizing materials tonnage report (CDFA 2025)
Other Industrial Sources	EPA FLIGHT database (EPA 2023)

Notes: CARB = California Air Resources Board; ; CDFA = California's Department of Food & Agriculture CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

Attribution metrics were used to apportion countywide activity and/or emissions data to individual jurisdictions by the appropriate GHG emissions sector. These attribution metrics include:

- ▶ population share for allocating activity associated with the residential sector (US Census Bureau 2025),
- ▶ commercial building floor space share for activity associated with the commercial/institutional sector (Open Energy Data Initiative 2020), and
- ▶ farmland, grazing land, and other agricultural land cover types share for the agricultural sector (DOC 2022).

These attribution metrics and the associated values for each jurisdiction in Kern county are shown in Table 4 below.

Table 4 Attribution Metrics Used to Apportion Countywide Activities and GHG Emissions

Jurisdiction	Population	Population %	Agricultural Land Acreage	Agricultural Land Acreage %	Commercial Building Floor Space in Square Footage	Commercial Building Floor Space in Square Footage %
Shafter	19,613	2.2%	1,487	0.1%	1,400	0.9%
Bakersfield	404,321	44.6%	41,684	1.5%	79,800	50.7%
California City	15,002	1.7%	112	0.0%	1,000	0.6%
Shafter	50,498	5.6%	4,141	0.2%	5,800	3.7%
Maricopa	1,217	0.1%	558	0.0%	—	0.0%
McFarland	13,971	1.5%	2,754	0.1%	600	0.4%
Ridgecrest	28,118	3.1%	62	0.0%	4,000	2.5%
Shafter	20,162	2.2%	19,419	0.7%	10,700	6.8%
Taft	7,414	0.8%	4,507	0.2%	1,000	0.6%
Tehachapi	12,855	1.4%	2,764	0.1%	1,700	1.1%
Wasco	26,317	2.9%	3,421	0.1%	1,800	1.1%
Unincorporated County	307,395	33.9%	2,666,205	97.1%	49,700	31.6%
Kern County Total	906,883	100%	2,747,115	100%	157,500	100%

Note: Population and agricultural land acreage data reflect conditions in 2022. The most recent data available for commercial building floor space was from 2019, which was used as the attribution metric in this analysis. Because the calculations relied on percentage shares rather than absolute floor space values, using 2019 data was considered appropriate for consistency across jurisdictions.

Sources: US Census Bureau 2025; DOC 2022; Open Energy Data Initiative 2020; analysis conducted by Ascent in 2025.

For the wastewater and solid waste emissions sources, as well as the industrial emissions sector, data and information were collected at the jurisdiction level to calculate associated GHG emissions.

For wastewater, jurisdiction-specific data were obtained from a variety of sources, including any publicly available data about wastewater treatment plant operations. When such data were not publicly available, default values from the EPA Local GHG Inventory Tool and the Local Governments for Sustainability *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* were used to fill data gaps.

For solid waste, jurisdiction-specific disposal data were sourced from the California Department of Resources Recycling and Recovery (CalRecycle), specifically from the Jurisdiction Disposal and Beneficial Reuse by Destination database.

For the industrial emissions sector, jurisdiction-specific emissions data were also obtained directly from the EPA FLIGHT and CARB MRR databases, which report facility-level emissions for large industrial sources.

Data sources for jurisdiction-specific activity and emissions data are shown in Table 5 below.

Table 5 Data Sources for Jurisdiction-Specific Activity and Emissions Data

GHG Emission Source/Sector	Data Source(s)
Wastewater	ICLEI (ICLEI 2019)
Solid Waste	CalRecycle's Jurisdiction Disposal and Beneficial Reuse by Destination database (CalRecycle 2025), EPA FLIGHT database (EPA 2023)
Industrial Sector	EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases

Notes: ICLEI = Local Governments for Sustainability; CalRecycle = California Department of Resources Recycling and Recovery; CARB = California Air Resources Board; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

3.3 INVENTORY METHODS BY GHG EMISSIONS SOURCE

This section details the data and methods used to calculate GHG emissions in the 2022 inventory, organized by emissions source. It presents the corresponding data inputs into the EPA Local GHG Inventory Tool, any data processing that was performed, and the resulting emissions estimates by source and sector for the City of Shafter. All calculations of GHG emissions use the IPCC AR5 GWP values to convert GHG emissions results to CO₂e.

3.3.1 Mobile On-road

The Mobile On-road 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.” The estimation of these emissions relies on EMFAC2021, a statewide mobile source emissions inventory model developed by CARB. EMFAC2021 was used instead of the EPA Local GHG Inventory Tool to calculate mobile on-road GHG emissions because EMFAC2021 provides GHG emissions estimates that more closely represent the vehicle fleet operating on roadways in Kern County. The EPA Local GHG Inventory Tool utilizes national fuel efficiency averages for a select number of vehicle types to calculate GHG emissions, whereas EMFAC2021 considers fuel efficiency by vehicle type and model, providing more accurate estimates of fuel consumption and GHG emissions.

To calculate emissions for the 2022 inventory year, total countywide vehicle miles traveled (VMT) were first obtained from EMFAC2021. These VMT figures were then allocated to emission sectors defined by the EPA’s Local GHG Inventory Tool based on vehicle class, specifically, the residential and commercial/institutional sectors. For the purposes of sector-specific emissions calculations, light-duty vehicles were attributed to the residential sector, as they primarily reflect personal vehicle use by residents. In contrast, medium- and heavy-duty trucks were attributed to the commercial/institutional sector, as these vehicle types are more commonly associated with goods movement, service fleets, and business operations. Sector-specific VMT totals were then apportioned to each jurisdiction based on appropriate attribution metrics: population share for residential VMT and commercial building square footage share for commercial/institutional VMT.

EMFAC2021 was also used to generate countywide GHG emissions factors for the two sectors, expressed in MTCO₂e per vehicle mile traveled. These factors accounted for all vehicle classes, model years, speeds, and fuel types. The sector-specific factors were derived by dividing total countywide emissions of CO₂, CH₄, and N₂O (converted to CO₂e using the appropriate GWP) by the corresponding sector-specific countywide total VMT, with emissions and VMT categorized into the residential and commercial/institutional sectors based on vehicle class.

Finally, each jurisdiction’s total Mobile On-road emissions by sector were calculated by multiplying the jurisdiction’s sector-specific VMT by the respective countywide sector-specific MTCO₂e per VMT emissions factors. Table 6 presents the City of Shafter’s total Mobile On-road VMT, associated sector-specific GHG emissions factors, and the resulting total GHG emissions by sector.

Table 6 City of Shafter Mobile On-road Data Inputs and Results

Vehicle Sector	Total Activity (VMT)	GHG Emissions Factor (MTCO ₂ e/VMT)	GHG Emissions (MTCO ₂ e)
Residential	161,716,457	0.00035	52,022
Commercial/Institutional	277,485,232	0.0011	278,056

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: CARB 2022a; analysis conducted by Ascent in 2025.

3.3.2 Mobile Off-road

Emissions from Mobile Off-road sources result from the combustion of fuel in various types of off-road vehicles and equipment (e.g. agricultural tractors, construction equipment). Emissions data for these sources were obtained from

CARB's OFFROAD2021 model, which provides detailed estimates for Kern county for the 2022 inventory year. The data include, but are not limited to, information on equipment categories, fuel types, and the amount of fuel consumed.

Using the off-road vehicle categories in OFFROAD2021, the emissions data were organized into two relevant sectors defined by the EPA Local GHG Inventory Tool: agricultural and commercial/institutional. Sector-specific off-road fuel consumption totals were then apportioned to each jurisdiction using appropriate attribution metrics. Specifically, the share of farmland, grazing land, and other agricultural land was used to allocate agricultural emissions, while the commercial building square footage share was used to distribute commercial/institutional emissions.

Finally, each jurisdiction's sector-specific off-road fuel consumption data were entered into the "Mobile-Data" sheet of the EPA Local GHG Inventory Tool to calculate Mobile Off-road emissions. The EPA Local GHG Inventory Tool includes emissions factors by fuel type. Table 7 presents the City of Shafter's total Mobile Off-road fuel consumption by fuel type and the resulting total GHG emissions by sector.

Table 7 City of Shafter Mobile Off-road Data Inputs and Results

Vehicle Sector	Diesel Consumption (gallons)	Gasoline Consumption (gallons)	Liquefied Natural Gas (LNG) Consumption (gallons)	Total Fuel Consumption (gallons)	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	530,435	232,073	12,807	775,315	7,698
Agricultural	102,767	1,900	—	104,667	1,099

Notes: GHG = greenhouse Gas; LNG = liquefied natural gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CARB 2022b, analysis conducted by Ascent in 2025.

3.3.3 Stationary Energy

The stationary energy source of GHG emissions includes natural gas combustion in residential, commercial/institutional and industrial uses. Residential uses primarily consume natural gas for space and water heating, and cooking. Commercial/institutional uses may include space heating and cooling, cooking in restaurants, and smaller boilers or generators. Industrial uses are often process-specific uses tied to manufacturing or heavy operations such as process heating, steam generation, and boiler systems. Propane fuel usage was not included in the stationary energy-related calculations as propane usage data for these various uses was not available at the same level of detail or consistency as other stationary energy data sources at the county scale.

RESIDENTIAL AND COMMERCIAL/INSTITUTIONAL

Total countywide natural gas usage data for the 2022 inventory year was obtained from the CEC Energy Reports: Gas Consumption by County, which categorizes usage into residential and non-residential sectors. Residential natural gas consumption was allocated to each jurisdiction based on its share of the county's population.

To isolate commercial/institutional usage, countywide industrial natural gas consumption, sourced from the EPA FLIGHT database and CARB MRR database, was subtracted from the CEC total non-residential usage. The resulting commercial/institutional natural gas usage was then apportioned to each jurisdiction using commercial building floor space share as the attribution metric.

Finally, each jurisdiction's residential and commercial/institutional natural gas usage data were entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate residential and commercial/institutional stationary energy emissions. Table 8 below shows the City of Shafter's total stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions in residential and commercial/institutional sectors.

Table 8 City of Shafter Residential and Commercial/Institutional Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Residential	212,332	11,675
Commercial/Institutional	760,304	41,806

Notes: mcf = thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

INDUSTRIAL

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the City of Shafter. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the City of Shafter. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

Jurisdiction-specific emissions data were then converted into estimates of natural gas consumption using IPCC Fourth Assessment Report (AR4) GWP values and Subpart C Tier 1 GHG emissions factors, given that the emissions data obtained from the EPA FLIGHT and CARB MRR databases were calculated using AR4 GWP values. This approach was taken to ensure consistency with the emissions data obtained from the EPA FLIGHT and CARB MRR databases, which were originally calculated using AR4 GWP values. These converted fuel usage estimates were subsequently entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate industrial stationary energy emissions for each jurisdiction.

Table 9 below shows the City of Shafter's industrial stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions.

Table 9 City of Shafter Industrial Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Industrial	520,127	28,600

Notes: mcf = one thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

The list of industrial facilities from which data was used to estimate jurisdiction-specific industrial stationary energy emissions is provided in Table 10. In some cases, a facility may use a separate address for reporting purposes than where the facility is physically located. The reporting addresses and physical locations of facilities were reviewed such that GHG emissions could be allocated to jurisdictions based on the physical location within the jurisdiction's boundary. Note that the GHG emission totals provided in Table 10 are obtained directly from the CARB or EPA data sources and have not been converted to AR5 GWPs. As such, these totals may not match those reported in Table 9 above.

Table 10 City of Shafter Industrial Facilities Located in Geographical Boundary

Facility Name	GHG Emissions (MTCO ₂ e)	Physical Location Notes
Building Materials Manufacturing Corporation (DBA GAF)	12,524	Physical location is the same as the reporting location.
California Paper Products, LLC	16,130	Physical location is the same as the reporting location.

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

3.3.4 Electricity

The electricity source addresses energy-related indirect GHG emissions resulting from the consumption of grid-supplied electricity within the City of Shafter's boundary. Consumption of grid-supplied electricity is considered an "indirect" GHG emissions source, because GHG emissions occur at the source of electricity generation, which is usually outside of a jurisdiction's boundary. The location-based method was used to calculate electricity GHG emissions, which uses regional grid-average emission factors. In the United States, these factors are provided by the EPA's Emissions & Generation Resource Integrated Database (eGRID). Specifically, emission factors for the CAMX eGRID subregion were applied, as this subregion encompasses the geographic area of Kern county.

Total electricity usage data for Kern county in 2022 was obtained from CEC Energy Reports: Electricity by County, which categorized usage into residential and non-residential sectors (CEC 2023). Electricity usage data for the City of Bakersfield, which was also separated into residential and non-residential categories, was acquired directly from the Pacific Gas and Electric Company (PG&E). To estimate electricity usage for the rest of the county (i.e., all jurisdictions excluding Bakersfield), the City of Bakersfield's electricity data was subtracted from the total Kern county data.

Residential electricity usage outside of Bakersfield was apportioned to each jurisdiction based on its share of the county's total population. For non-residential electricity usage, estimates were further categorized into industrial and commercial/institutional sectors using attribution metrics derived from natural gas consumption data previously calculated under stationary energy. In 2022, 93.1 percent of the county's stationary natural gas combustion was attributed to industrial use and 6.9 percent to commercial/institutional use. These same ratios were applied to the county's total non-residential electricity usage, under the assumption that the sectoral split in electricity usage mirrors that of natural gas usage. This assumption was validated using available industrial electricity and natural gas usage data in PG&E's service territory, from the CEC Energy Reports. The electricity-to-gas ratio, expressed as gigawatt-hour per million therms, was calculated by dividing total industrial electricity usage by industrial natural gas consumption for the service territory. The resulting value closely aligns with the assumptions applied in this here, supporting its validity.

The City of Shafter's share of commercial building square footage was used to attribute commercial/institutional electricity usage. Industrial electricity usage was attributed based on the proportion of countywide industrial natural gas within the City of Shafter. Finally, the sector-specific electricity usage data for each jurisdiction was entered into the "Electricity-Data" sheet of the EPA Local GHG Inventory Tool to calculate associated GHG emissions.

Table 11 below shows the City of Shafter's electricity activity data and the associated GHG emissions by emission sectors.

Table 11 City of Shafter Electricity Energy Data Inputs and Results

Sector	Total Activity (kWh of Electricity Consumed)	GHG Emissions (MTCO ₂ e)
Residential	75,410,636	17,080
Commercial/Institutional	104,731,491	23,721
Industrial	36,108,603	8,179

Notes: kWh = kilowatt-hour; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; PG&E 2025; analysis conducted by Ascent in 2025.

3.3.5 Imported Water

The water source category captures GHG emissions from energy use associated with the conveyance, treatment, and distribution of water within a jurisdiction. In Kern county, the WAKC reports that approximately 166,000 acre-feet of water are used annually for municipal and industrial purposes, and 2,294,000 acre-feet for agricultural purposes.

In addition to local surface water, Kern county draws water from several sources. Among these, only water supplied through the State Water Project (SWP) and the federal Central Valley Project (CVP) is considered imported, and therefore potentially results in GHG emissions due to long-distance conveyance. All other sources are classified as local. It was assumed that energy used for extracting, conveying, treating, and distributing local water is captured under the emissions estimates for stationary energy and electricity, since these activities occur within the county. In addition, upon further review, it was also determined that the federal CVP does not consume energy for water delivery to Kern County, as water is primarily conveyed using gravity (Friant Water Authority 2019). As a result, only the SWP, which accounts for 26 percent of the county's water supply, contributes to GHG emissions. Table 12 provides a summary of the water sources in Kern county and their contribution to the total water supply.

Table 12 Kern County Water Sources

Source	Percentage
Kern River	20%
State Water Project (California Aqueduct)	26%
Federal Central Valley Project (Friant-Kern Canal)	12%
Local Streams and Other Sources (Poso Creek, Kern River, etc.)	6%
Groundwater	36%
Total	100%

Source: WAKC n.d.

Water use in Kern County is characterized into municipal and industrial, and agricultural sectors in data obtained from WAKC. It is assumed that water included in "municipal" uses is delivered to both commercial and residential customers. However, sufficient data was not available to disaggregate the water consumption between industrial, commercial, and residential customers. For the purpose of this GHG emissions inventory, all non-agricultural water consumption was categorized under the commercial/institutional sector.

To allocate sector-specific water usage to individual jurisdictions, the following attribution metrics were used:

- ▶ Agricultural water use was apportioned based on each jurisdiction's share of farmland, grazing land, and other agricultural land.
- ▶ Commercial/institutional water use was distributed according to the share of commercial building square footage in each jurisdiction.

These apportioned figures were then entered into the "Imported Water" sheet of the EPA Local GHG Inventory Tool, applying a universal 26 percent imported water rate, to estimate the associated GHG emissions from water conveyance and use. Table 13 presents the City of Shafter's activity data related to imported water, including the percentage of total water supply that is imported and the associated GHG emissions.

Table 13 City of Shafter Imported Water Energy Data Inputs and Results

Sector	Total Activity (Gallons of Water)	Percentage of Water Imported	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	312,667,574	26%	397
Agricultural	1,373,856,830		1,744

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: WAKC n.d.; analysis conducted by Ascent in 2025.

3.3.6 Wastewater

The wastewater source accounts for GHG emissions resulting from the treatment of sewage. To support this analysis, a review of publicly available wastewater treatment characteristics was conducted to collect the data required for completing the “Wastewater-Control” tab of the EPA’s Local GHG Inventory Tool. The data sources and corresponding assumptions for the City of Shafter’s wastewater treatment systems are summarized in Table 12. Where jurisdiction-specific data were not publicly available, the default input values provided by the EPA tool were used.

To estimate GHG emissions, population data for each jurisdiction were subsequently entered into the “Wastewater-Entry” tab of the tool. The resulting emissions estimates are also presented in Table 14, alongside the data sources and assumptions used.

Table 14 City of Shafter Wastewater Treatment Assumptions

Wastewater Process/Treatment Type	Conditions Assumed	Data Source	GHG Emissions (MTCO ₂ e)
Population served by septic systems	5 percent of the city’s population	ICLEI’s default proportion of population that utilizes septic tanks for an urban area (Box WW.11(alt).2).	7,917
One or more wastewater treatment plants (WWTPs) where wastewater is treated in aerobic or anaerobic conditions	Anerobic	No public information is available. The default value is anerobic.	
One or more WWTPs conduct or do not conduct nitrification/denitrification	Denitrification	No public information is available. The default value is no nitrification/denitrification.	

Notes: WWTP = wastewater treatment plant; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; ICLEI = Local Governments for Sustainability.

Sources: ICLEI 2019; analysis conducted by Ascent in 2025.

3.3.7 Solid Waste

Community-generated solid waste emissions are primarily associated with the decomposition of solid waste in landfills. There are two methods for accounting for GHG emissions associated with waste disposal:

- ▶ Waste generation method – Accounts for the total GHG emissions that would be generated over time as municipal solid waste (MSW) that is sent to a landfill in only the inventory year decomposes.
- ▶ Waste-in-place method – Accounts for the total GHG emissions generated in a given year at a specific landfill location by the decomposition of all MSW previously disposed at the landfill.

Generally, there is some risk of double counting GHG emissions when combining both of these methods, as a portion of the emissions accounted for using the waste generation method may occur at an in-boundary landfill that has emissions reported using the waste-in-place method. However, the scale of the overlapping GHG emissions between the two methods would be expected as very small in comparison to total emission using either accounting method.

WASTE GENERATION

Landfill tonnage data for 2022 was obtained from CalRecycle’s Jurisdiction Disposal and Beneficial Reuse by Destination database. This data was entered into the EPA’s Waste Reduction Model (WARM Tool) as “mixed MSW” to estimate waste generation emissions. The default national average values were used in the WARM Tool, except for Question 7, where the k value was set to “dry” based on the county’s annual precipitation (less than 20 inches) (NCEI 2025). The WARM output was then imported into the EPA Local GHG Inventory Tool’s “Waste Production” tab, with solid-waste associated emissions attributed to the residential sector by default.

The total activity for solid waste disposal and the resulting waste generation GHG emissions results from the WARM Tool are provided in Table 15.

Table 15 City of Shafter Waste Generation Data Inputs and Results

Sector	Total Activity (tons of MSW disposed)	GHG Emissions (MTCO ₂ e) (WARM Output)
Residential	38,284	11,050

Notes: MSW = mixed municipal solid waste; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; WARM = Waste Reduction Model.

Source: CalRecycle 2025; analysis conducted by Ascent in 2025.

WASTE-IN-PLACE

EPA's FLIGHT database was reviewed to determine emissions from landfills located within the City of Shafter's geopolitical boundary, which would provide emissions data for any landfills that generated emissions greater than 25,000 MTCO₂e in 2022. No reporting landfills were identified for the City of Shafter.

3.3.8 Agriculture

The agriculture emissions source captures GHG emissions generated from fertilizer application.

FERTILIZER APPLICATION

Fertilizer application results in GHG emissions primarily due to the release of N₂O, a potent GHG with a global warming potential nearly 300 times greater than CO₂. When nitrogen-based fertilizers are applied to soil, a portion of the nitrogen undergoes microbial processes (nitrification and denitrification), which convert it into N₂O. These emissions can occur directly from the soil or indirectly through leaching and runoff.

The total tonnage of nitrogen in synthetic fertilizers applied in Kern county during the 2022 inventory year was obtained from CDFA's fertilizing materials tonnage report. This countywide total was then apportioned to individual jurisdictions based on each jurisdiction's proportional share of farmland, grazing land, and other agricultural land. Only data for synthetic fertilizers was publicly available for calculation, although other organic or manure-based fertilizers may be used.

The resulting tonnage of nitrogen in synthetic fertilizers estimated for the City of Shafter was entered into the "Agriculture & Land Management" sheet of the EPA's Local GHG Inventory Tool to calculate the associated emissions. Table 16 provides the estimated total tons of nitrogen applied and resulting GHG emissions.

Table 16 City of Shafter Fertilizer Application Data Inputs and Results

Sector	Total Activity (tons of nitrogen applied)	GHG Emissions (MTCO ₂ e)
Agricultural	294	2,111

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CDFA 2025; analysis conducted by Ascent in 2025.

4 GREENHOUSE GAS EMISSIONS FORECAST METHODS

This section provides the methods and data used to project future GHG emissions under a BAU scenario, as well as the calculations of reductions from adopted legislation and regulations under an ABAU scenario.

The BAU GHG emissions forecasts assess how emissions generated by community activities will change over time without further State, federal, regional, or local action. The BAU scenario forecast accounts for the changes in population and employment that can influence communitywide GHG emissions. The ABAU scenario forecast includes

adopted policies and regulations at the State and federal levels that would affect emissions without any local action, such as regulatory requirements to increase vehicle fuel efficiency and increase renewable energy sources in grid electricity portfolios. These forecasts provide the City of Shafter with information needed to understand specific GHG emissions sources with the greatest opportunities for reduction with future plans, projects, or programs. It is important to note that the ABAU forecasts only account for emissions reductions associated with adopted policies and regulations; they do not account for proposed and/or unadopted GHG reduction actions established by regional, State, and federal agencies or executive orders outside of adopted legislation and regulations.

The GHG emissions forecasts project GHG emissions for the years 2030, 2040, and 2045 to align with key regulatory timelines for the State. Two key legislative actions establish statewide GHG reduction targets for the years 2030 and 2045, including:

- ▶ Senate Bill (SB) 32 of 2016, which sets a statewide GHG reduction target for the year 2030, and
- ▶ Assembly Bill 1279 of 2022, which sets a statewide GHG reduction target for the year 2045.

The forecast years selected do not necessarily align with the targets established by adopted legislation, but they do provide an analysis of emissions that aligns with the relevant horizon years. The year 2040 was also included in the analysis as an interim year between the 2030 and 2045 forecast years.

4.1 GROWTH PROJECTIONS

GHG emissions forecasts were developed based on projected changes in Kern county’s demographics, specifically population, employment, and service population (defined as residents plus employees), between 2022 and 2045. These projections were obtained from the Regional Growth Forecast and Demographic Forecast prepared by the Kern COG (Kern COG 2024). It is assumed that the incorporated cities and the unincorporated county will experience demographic growth at the same rate as the county overall, as jurisdiction-specific growth projections were not available at the time of this analysis.

Between 2022 and 2045, Kern county’s population and employment are projected to increase by approximately 11.1 and 15.5 percent, respectively. The service population is expected to grow by 12.4 percent. These growth factors were applied to forecast GHG emissions for the years 2030, 2040, and 2045 across various emissions sources included in the inventory. The values used for population, employment, and service population used to project future emissions are provided in Table 17.

Table 17 Kern County Demographics and Calculated Growth Rates for Future Emissions Forecasts

Calculation Factor	2022	2030	2040	2045
Population				
Total Kern County	906,883	949,134	994,167	1,007,627
Kern County Growth from 2022		4.7%	9.6%	11.1%
Employment				
Total Kern County	358,961	369,427	399,432	414,652
Kern County Growth from 2022		2.9%	11.3%	15.5%
Service Population				
Total Kern County	1,265,844	1,318,561	1,393,598	1,422,279
Kern County Growth from 2022		4.2%	10.1%	12.4%

Source: US Census Bureau 2025; Kern COG 2024; analysis conducted by Ascent in 2025.

Additional details on how growth factors were applied to individual sources are provided in the following sections. It is important to note that agricultural emissions, including those from fertilizer application, as well as livestock enteric fermentation and manure management, are assumed to remain constant throughout the forecast period, with no

projected increase in activity levels. Agricultural activities are difficult to project in any detail, with production intensities, number of livestock, and crop types being highly susceptible to global markets and local climate patterns. As such, projections of agriculture GHG emissions-generating activities are not attempted.

4.2 BUSINESS-AS-USUAL SCENARIO FORECAST

The BAU forecast represents a projection of future GHG emissions based solely on expected demographic and economic growth (e.g., population, employment, and service population) between 2022 and 2045. It does not account for the potential impacts of future policies, programs, or actions that may reduce emissions, such as energy efficiency improvements, renewable energy adoption, or transportation electrification.

In the BAU scenario, GHG emissions factors are held constant at the levels used in the 2022 GHG inventory, meaning the carbon intensity of electricity, fuels, and other activities is assumed not to change over time. As a result, any changes in future emissions are driven entirely by growth in activity levels, not by improvements in emissions performance.

4.2.1 Business-As-Usual Scenario Forecast Results

Table 18 presents the projected activity data for the City of Shafter across all forecast years, organized by emissions source and sector. Table 18 also indicates which sources and sectors used population, employment, or service population as a growth metric.

Table 18 City of Shafter BAU Scenario Projected Activity Data for All Forecast Years

Source	Sector	Growth Metric	Units	2030	2040	2045
Stationary Energy	Residential	Population	scf	222,224	232,768	235,919
Stationary Energy	Commercial/Institutional	Employment	scf	782,472	846,024	878,262
Stationary Energy	Industrial	Employment	scf	535,292	578,768	600,822
Electricity	Residential	Population	kWh	78,923,945	82,668,587	83,787,852
Electricity	Commercial/Institutional	Employment	kWh	107,785,198	116,539,368	120,980,174
Electricity	Industrial	Employment	kWh	37,161,439	40,179,642	41,710,712
Other Industrial	Industrial	Employment	MTCO ₂ e	—	—	—
Agriculture – Fertilizer Application	Agricultural ¹	N/A	ton	294	294	294
Solid Waste	Residential	Population	ton	40,067	41,969	42,537
Wastewater	Commercial/Institutional	Service Population	MTCO ₂ e	8,247	8,716	8,895
Imported Water	Commercial/Institutional	Service Population	Gallon	325,688,893	344,223,325	351,307,576
Imported Water	Agricultural ¹	N/A	Gallon	1,373,856,830	1,373,856,830	1,373,856,830
Mobile On-road	Residential	Population	VMT	169,250,670	177,280,973	179,681,212
Mobile On-road	Commercial/Institutional	Employment	VMT	285,576,003	308,770,105	320,535,984
Mobile Off-road	Commercial/Institutional	Employment	MTCO ₂ e	7,923	8,566	8,893
Mobile Off-road	Agricultural ¹	N/A	MTCO ₂ e	1,099	1,099	1,099

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; scf = standard cubic foot.

¹ Activity levels for the agricultural sector are assumed to remain constant over the forecast period; therefore, growth metrics are listed as “N/A.”

Source: Analysis conducted by Ascent in 2025.

Table 19 below presents the projected GHG emissions for the City of Shafter across all forecast years, also organized by emissions source and sector.

Table 19 City of Shafter BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	12,158	12,735	12,907
Stationary Energy	Commercial/Institutional	MTCO ₂ e	42,809	46,286	48,050
Stationary Energy	Industrial	MTCO ₂ e	29,286	31,665	32,871
Electricity	Residential	MTCO ₂ e	17,875	18,723	18,976
Electricity	Commercial/Institutional	MTCO ₂ e	24,411	26,394	27,399
Electricity	Industrial	MTCO ₂ e	8,416	9,100	9,447
Other Industrial	Industrial	MTCO ₂ e	—	—	—
Agriculture – Fertilizer Application	Agricultural	MTCO ₂ e	2,111	2,111	2,111
Solid Waste	Residential	MTCO ₂ e	11,564	12,113	12,277
Wastewater	Commercial/Institutional	MTCO ₂ e	8,247	8,716	8,895
Imported Water	Commercial/Institutional	MTCO ₂ e	413	437	446
Imported Water	Agricultural	MTCO ₂ e	1,744	1,744	1,744
Mobile On-road	Residential	MTCO ₂ e	54,446	57,029	57,801
Mobile On-road	Commercial/Institutional	MTCO ₂ e	286,163	309,405	321,195
Mobile Off-road	Commercial/Institutional	MTCO ₂ e	7,923	8,566	8,893
Mobile Off-road	Agricultural	MTCO ₂ e	1,099	1,099	1,099

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

4.3 LEGISLATIVE-ADJUSTED BUSINESS-AS-USUAL SCENARIO FORECAST

ABAU emissions forecasts were prepared using the same demographic data that were used for the BAU forecasts, while also accounting for State and federal policies and regulations that would affect local emissions. These forecasts provide the City of Shafter with a more robust understanding of future community emissions based on the GHG reduction efforts at the state and federal level. A summary of applicable legislative reductions is provided in Table 20.

Table 20 Legislative Reductions Summary

Source	Legislative Reduction	Description	Sources Applied
State	Renewable Energy and Zero-Carbon Electricity Requirements [SB 1020 and SB 100]	Requires California energy utilities to procure 60 percent of electricity from eligible renewable and zero-carbon sources by 2030, 95 percent by 2040, and 100 percent by 2045.	Electricity, Imported Water
State	California's Building Energy Efficiency Standards (2019 and 2022 Title 24, Part 6)	Requires all new buildings in California to comply with energy efficiency standards established by CEC. Accounts for the energy efficiency gains in new residential and nonresidential buildings.	Stationary Energy, Electricity
State	Advanced Clean Car I Regulation	Establishes GHG emission reduction standards for model years 2017 through 2025 that are more stringent than federal CAFE standards.	Mobile On-road
State	Truck and Bus Regulation	Requires diesel trucks and buses that operate in California to be upgraded to reduce GHG emissions.	Mobile On-road
Federal	Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles	Establishes fuel efficiency standards for medium- and heavy-duty engines and vehicles.	Mobile On-road

Notes: CAFE = Corporate Average Fuel Economy; CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; SUV = sports utility vehicle; SB = Senate Bill.

4.3.1 Title 24 Adjustments

Future energy use was adjusted to reflect increased emissions-intensity stringency under California’s Building Energy Efficiency Standards (California Code of Regulations Title 24 Part 6, hereafter referred to as “Title 24”). Although Title 24 applies to both new residential and nonresidential construction, for the purposes of this forecast, adjustments were applied only to residential construction for reasons described below.

This approach accounts for uncertainties in energy consumption patterns and end uses in nonresidential buildings, and uncertainty in the non-residential building types that would be constructed in the future. Title 24 primarily regulates energy efficiency in building envelopes and lighting systems. This is expected to substantially reduce energy consumption for building types where the primary end uses of energy are lighting and heating, ventilation, and air conditioning, such as new office, institutional, and hotel buildings. However, Title 24 may not significantly affect other high-energy-consuming uses in nonresidential facilities, such as process loads or specialized equipment. As such, limiting adjustments to residential construction provides a more conservative and reliable estimate of future energy-related GHG emissions.

The 2019 Title 24 standards apply to projects constructed after January 1, 2020, while the 2022 standards apply after January 1, 2023. The 2025 Title 24 will go into effect statewide in January of 2026; however, detailed data on the changes in building-level energy consumption between the 2025 code and previous code cycles was not available at the time of this analysis. To estimate changes in future energy consumption under the 2022 standards, electricity and natural gas adjustment factors were calculated based on differences in average residential energy use between buildings built to the 2019 and 2022 standards. These factors were derived from CEC’s data specific to the 2019 and 2022 standards and climate zone-based energy usage rates. For the City of Shafter, Climate Zone 13 was used in the analysis.

These adjustment factors were then applied to the ABAU forecasts of energy consumption activity for both stationary energy and electricity use to reflect the impact of legislative energy efficiency improvements on future development. The adjustment factors, presented in Table 21, show the percentage change in energy use for buildings built to 2022 standards relative to those built to 2019 standards. Positive values indicate an anticipated increase in energy use, while negative values indicate an anticipated decrease in energy use.

As shown in Table 21:

- ▶ ABAU electricity activity is projected to be higher than BAU in each forecast year due to positive adjustment factors.
- ▶ ABAU stationary energy activity is projected to be lower than BAU due to negative adjustment factors.

Importantly, these adjustments were applied only to energy use growth occurring after the 2022 baseline, reflecting new development that would be subject to the 2022 Title 24, or a later cycle of standards. In addition, it is important to note that although average electricity use in new residential buildings is anticipated to rise under 2022 Title 24 (due to an increase in electrical demand associated with electric appliances installed instead of natural gas appliances), emissions from new residential buildings are expected to be lower than they would be under 2019 Title 24 as a result of overall lower building emissions intensities (due to lower emissions factors associated with electricity compared to natural gas).

Table 21 Stationary Energy and Electricity Adjustment Factors and Activity Forecast Results for Residential Buildings

Energy Type	Forecast Scenario	Adjustment Factor	Activity Units	2022	2030	2040	2045
Electricity	BAU	—	kWh	75,410,636	78,923,945	82,668,587	83,787,852
Electricity	ABAU	+12%	kWh	75,410,636	79,344,096	83,536,555	84,789,671
Stationary Energy (Natural Gas)	BAU	—	mcf	212,332	222,224	232,768	235,919
Stationary Energy (Natural Gas)	ABAU	-29%	mcf	212,332	219,345	226,820	229,054

Notes: BAU = Business-as-Usual; ABAU = legislative-adjusted BAU; mcf = one thousand cubic feet; kWh = kilowatt-hour.

Source: Analysis conducted by Ascent in 2025.

4.3.2 Senate Bill 100 and Senate Bill 1020 Adjustments

SB 100 requires that 100 percent of retail electricity sales in California come from renewable and zero-carbon resources by 2045. This legislation builds upon the state’s existing Renewables Portfolio Standard (RPS) by increasing the required percentage of RPS-eligible renewable electricity over time. SB 1020 builds on SB 100 by introducing interim targets for GHG-free electricity for the years 2035 and 2040. As shown in Table 22, SB 100 and SB 1020 require utility providers to supply electricity that is 60 percent GHG-free by 2030, 95 percent by 2040, and 100 percent by 2045. The emissions sources affected by these adjustments include electricity and imported water, both of which are estimated based on the carbon intensity of the electricity grid.

To estimate future GHG emissions factors, the 2022 GHG-free electricity percentage and GHG emissions factors for the CAMX eGRID subregion were first obtained from the EPA’s eGRID database. Using these 2022 values as a baseline, emissions factors for the forecast years (2030, 2040, and 2045) were calculated based on the GHG-free electricity targets established by SB 100 and SB 1020.

Table 22 below demonstrates these GHG-free electricity percentage baseline values and targets, as well as the baseline and calculated emissions factors for the forecast years. Given 2045’s 100 percent GHG-free electricity percentage target, the emissions factor for 2045 is 0. In contrast to the ABAU forecast, the CAMX eGRID emissions factors under the BAU scenario are assumed to remain constant at their 2022 baseline values throughout the forecast years.

Table 22 CAMX eGRID Electricity GHG Emissions Factors Adjusted for SB100 and SB1020

Calculation Factor	Units	2022	2030	2040	2045
SB 100 and SB 1020 GHG-free electricity percentage targets	Percent GHG-free	N/A	60%	95%	100%
CAMX eGRID GHG-free electricity percentage baseline and targets	Percent GHG-free	50%	60%	95%	100%
CAMX eGRID baseline and interpolated emissions factors	MTCO ₂ e/MWh	0.2265	0.1819	0.0227	0

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MWh = megawatt-hour; N/A = Not Applicable.

Source: Analysis conducted by Ascent in 2025.

4.3.3 On-road Vehicle Emissions Standards

State and federal regulations are expected to significantly reduce on-road GHG emissions by requiring improvements in vehicle fuel efficiency and accelerating the transition to zero-emission vehicles (ZEVs). The ABAU forecast for the Mobile On-road source takes into consideration the following State and federal regulations:

- ▶ Innovative Clean Transit Regulation, which requires all California public transit agencies to begin phasing in zero-emission buses (ZEB) starting in 2023 and transition to 100 percent ZEB fleets by 2040 and
- ▶ Advanced Clean Trucks Regulation, which requires truck and van manufacturers to sell a growing share of ZEVs beginning in model year 2024.

All these regulations are reflected in EMFAC2021’s emissions data for the forecast years (2030, 2040 and 2045), which serve as the basis for the Mobile On-road source’s ABAU forecast. In addition to these regulations, EMFAC2021’s data also takes into consideration future increases in light-duty ZEV sales, which would be influenced by California’s Advanced Clean Cars I regulation.

Accordingly, EMFAC2021’s VMT and emissions estimates for forecast years were used to calculate Mobile On-road emissions under the legislative adjustment scenario. As with the inventory methodology, sector-specific emissions factors for each forecast year were calculated by dividing sector-specific VMT by sector-specific emissions for each forecast year. These emissions factors were then multiplied by projected future VMT, which were scaled by relevant activity growth factors (population for the residential sector and employment for the commercial/institutional sector)

to estimate future emissions. The baseline and projected future emissions factors calculated using EMFAC2021 are shown in Table 23.

In contrast, under the BAU scenario, Mobile On-road emissions factors are held constant at their 2022 baseline values for all forecast years, reflecting no change in vehicle efficiency or fleet composition.

Table 23 Mobile On-road Baseline and Projected GHG Emissions Factors

Sector	Units	2022	2030	2040	2045
Commercial Institutional	MTCO ₂ e/VMT	0.0010	0.00090	0.00081	0.00081
Residential	MTCO ₂ e/VMT	0.00032	0.00026	0.00023	0.00023

Notes: MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: Analysis conducted by Ascent in 2025.

4.3.4 Legislative-Adjusted Business-as-Usual Scenario Forecast Results

Table 24 presents the projected GHG emissions for the City of Shafter across all forecast years under the ABAU scenario, organized by emissions source and sector. Emissions sources and sectors not impacted by legislative adjustments are excluded from this table, as their projected GHG emissions are assumed to remain unchanged from the BAU scenario. The full results for projected GHG emissions for the City of Shafter across all forecast years under both the BAU and ABAU scenarios, organized by emissions source and sector, can be found in Table 2.

Table 24 City of Shafter Legislative-Adjusted BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	12,000	12,409	12,532
Electricity	Residential	MTCO ₂ e	14,434	1,900	—
Imported Water	Commercial/Institutional	MTCO ₂ e	332	44	—
Imported Water	Agricultural	MTCO ₂ e	1,401	175	—
Mobile On-road	Residential	MTCO ₂ e	44,268	41,153	40,996
Mobile On-road	Commercial/Institutional	MTCO ₂ e	256,742	249,038	258,629

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

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Greenhouse Gas Emissions Inventory and Forecast for the City of Taft

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June 2025

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LIST OF ABBREVIATIONS

ABAU	legislative-adjusted BAU
AR5	Fifth Assessment Report
BAU	business-as-usual
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CH ₄	methane
CO ₂	carbon dioxide
CVP	Central Valley Project
eGRID	Emissions & Generation Resource Integrated Database
EPA Local GHG Inventory Tool	EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1
EPA	US Environmental Protection Agency
GHG	greenhouse gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
Kern COG	Kern Council of Governments
MRR	Mandatory Greenhouse Gas Reporting Regulation
MSW	municipal solid waste
MTCO _{2e}	metric tons of carbon dioxide equivalent
N ₂ O	nitrous oxide
PG&E	Pacific Gas and Electric Company
RPS	Renewables Portfolio Standard
SB	Senate Bill
SWP	State Water Project
VMT	vehicle miles traveled
WARM Tool	Waste Reduction Model
ZEB	zero-emission buses
ZEV	zero-emission vehicle

1 INTRODUCTION

This report contains the methods and results for a greenhouse gas (GHG) emissions inventory and GHG emissions forecast for the City of Taft. A GHG emissions inventory provides estimates of emissions generated within a defined geographic boundary during a single year. It identifies the sectors, sources, and activities that produce these emissions and their relative contribution, while also providing a baseline to forecast future emissions trends. A GHG emissions forecast evaluates how GHG emissions may change in the future due to growth and the effects of adopted state and federal legislation and regulations. This information can be used for various purposes, including monitoring GHG emissions trends over time, or as the technical basis for planning efforts to reduce GHG emissions, such as a general plan or greenhouse gas reduction plan.

This report was developed as part of a grant provided to the City of Bakersfield by the US Environmental Protection Agency (EPA) as part of the Climate Pollution Reduction Grants program. The grant was provided to support climate pollution reduction planning in the Bakersfield Metropolitan Statistical Area, which includes the entirety of Kern county. Under this grant, funding was allocated to produce GHG emissions inventories and forecasts for each of the 12 jurisdictions in Kern county, including the City of Bakersfield, unincorporated Kern County, and all incorporated cities. These GHG emissions inventories and forecasts will be provided to the subject jurisdiction, the San Joaquin Valley Air Pollution Control District, and Kern Council of Governments (Kern COG).

The GHG emissions inventory and forecast are intended to provide an accounting of GHG emissions generating activities within the City of Taft geographical boundary for the year 2022, and projections of future emissions based on countywide growth patterns and the effects of adopted state and federal legislation and regulations. This report is accompanied by an Excel-based tool used to develop the GHG emissions inventory, the EPA *Local Greenhouse Gas Inventory Tool: Community Module version 2025.1* (the EPA Local GHG Inventory Tool). The GHG emissions inventory uses only publicly available data sets, many of which provide countywide estimates of GHG emissions generating activity, such as mobile on-road travel, energy consumption, and fertilizer use. This countywide data was scaled down to the jurisdiction level based on various attribution metrics, including population, commercial building floor space, and acres of agricultural use. GHG emissions were then forecasted using countywide growth projections for vehicle travel, population, and employment.

Because countywide data was used and scaled using attribution metrics, rather than jurisdiction-specific data, the GHG emissions inventory and forecast are intended to provide a general scale of GHG emissions for City of Taft's contribution to countywide GHG emissions and serve as a starting point for more detailed GHG emissions analyses. The Excel-based tool can be updated with more locally specific and operational data that can be obtained from relevant departments and direct requests to utility providers. GHG emissions forecasts can be replicated using more locally specific growth projections for population and employment. The results can also be used to set local GHG reduction targets and develop and quantify locally specific measures for reducing GHG emissions. Sufficient detail is provided in this report to ensure that the analyses are replicable, and data inputs can be replaced with more detailed data, if desired.

2 SUMMARY RESULTS

This section presents the results of the GHG emissions inventory and forecast for the City of Taft, providing a comprehensive overview of historical (2022 as the inventory year) and projected (2030, 2040, and 2045 as the forecast years) emissions. The results are organized by emissions sources, including stationary energy, electricity, Mobile On-road, wastewater, solid waste, and others, as well as by sectors, including residential, commercial/institutional, industrial, and agricultural.

This breakdown enables an understanding of the emissions sources and sectors that contribute most significantly to the City of Taft's overall emissions. Section 3 of this report provides additional context and methodology related to each emissions source and sector, including key assumptions, data sources, and allocation methods used in the inventory and forecast development.

2.1 2022 GREENHOUSE GAS EMISSIONS INVENTORY RESULTS

Table 1 below shows the 2022 GHG emissions inventory results for the City of Taft, categorized by emissions sources and sectors. Figure 1 shows the inventory categorized by emission sources, while Figure 2 shows the inventory categorized by emission sectors.

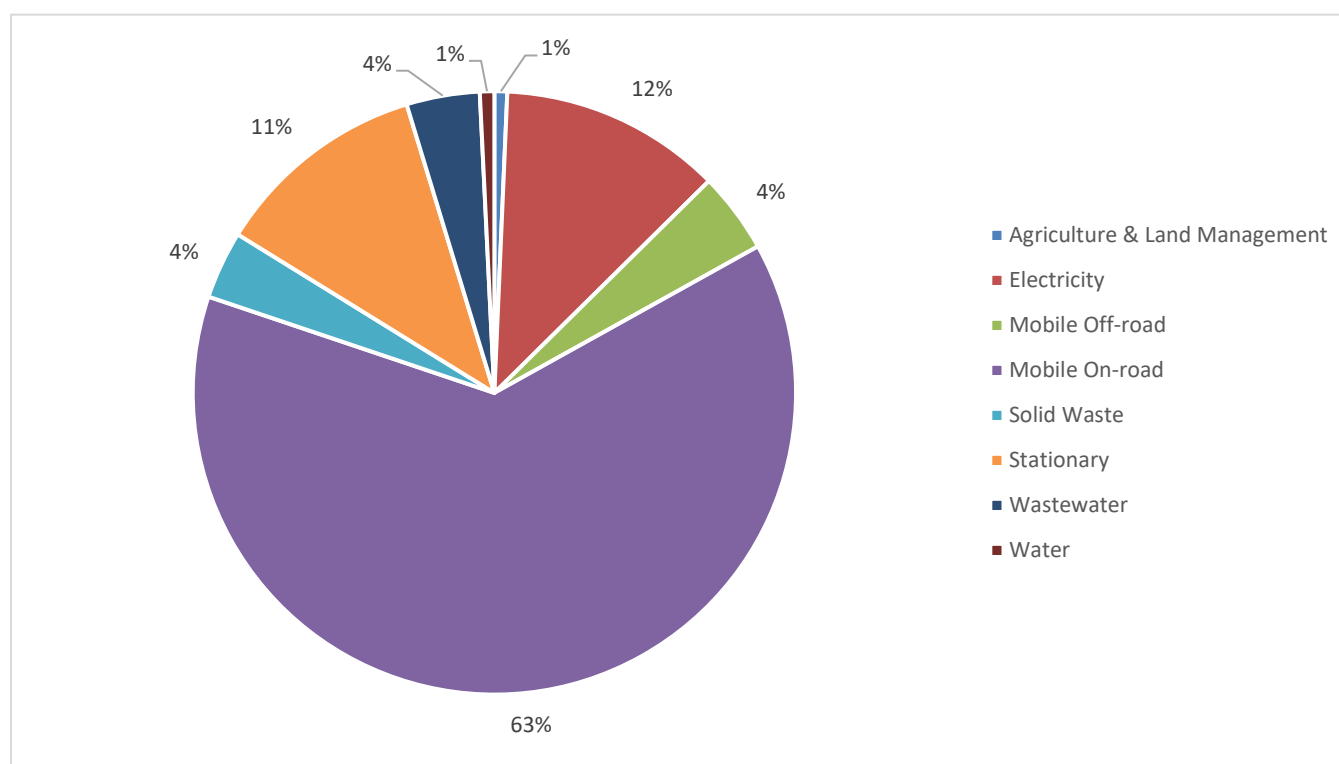
Table 1 City of Taft 2022 GHG Emissions Inventory Results (MTCO₂e)

Emissions Sources	Emissions Sectors				
	Agricultural	Commercial/Institutional	Industrial	Residential	Total
Agriculture & Land Management	490	—	—	—	490
Electricity	—	2,217	—	6,281	8,498
Mobile Off-road	255	2,831	—	—	3,086
Mobile On-road	—	25,987	—	19,130	45,116
Solid Waste	—	—	—	2,596	2,596
Stationary Energy	—	3,907	—	4,293	8,200
Wastewater	—	2,800	—	—	2,800
Water	405	146	—	—	551
Total	1,150	37,888	—	32,300	71,337

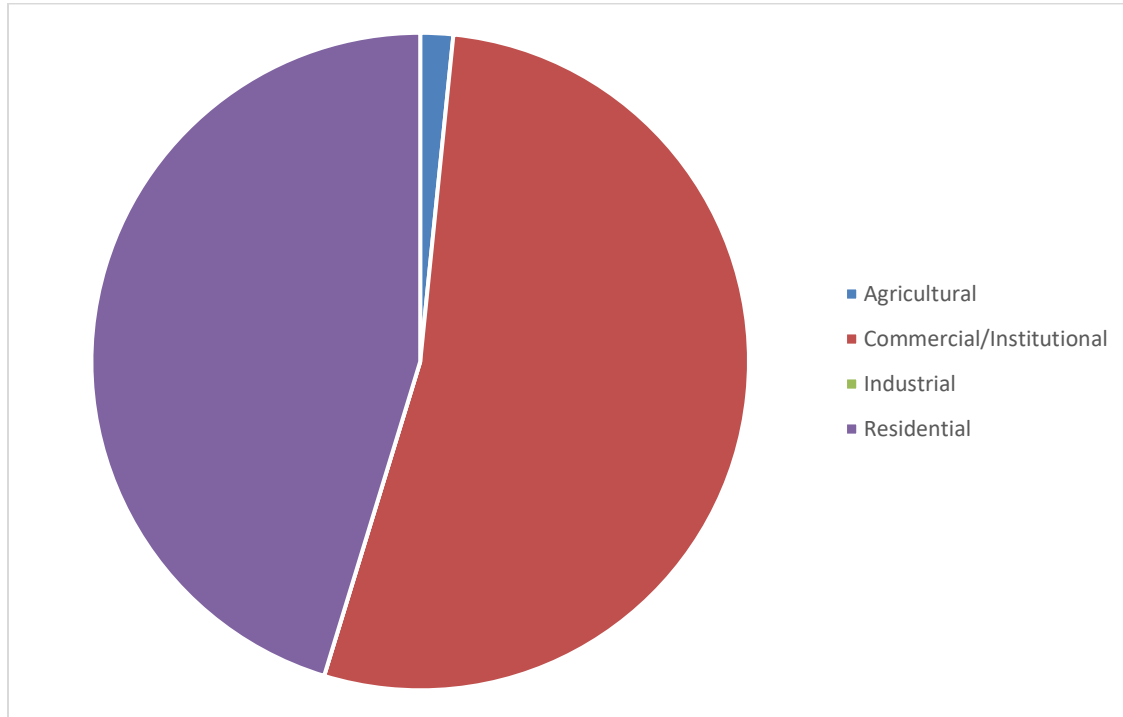
Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 1 City of Taft 2022 GHG Emissions Inventory by Emissions Sources



Source: Analysis conducted by Ascent in 2025.

Figure 2 City of Taft 2022 GHG Emissions Inventory by Emissions Sectors

Note: The City of Taft had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure.

Source: Analysis conducted by Ascent in 2025.

2.2 GREENHOUSE GAS EMISSIONS FORECAST RESULTS

Table 2 below shows the projected future GHG emissions for the City of Taft for the forecast years 2030, 2040 and 2045 under both a business-as-usual (BAU) scenario, as well as a legislative-adjusted BAU (ABAU) scenario, broken down by both emissions sources and sector. The BAU GHG emissions forecasts estimate how community-generated emissions would change over time without additional actions at the State, federal, regional, or local levels, based solely on projected population and employment growth. The ABAU forecasts incorporate the effects of adopted State and federal policies, such as vehicle fuel efficiency standards and increased renewable energy in the electricity grid, but assume no additional local measures.

Table 2 City of Taft Greenhouse Gas Emissions Forecast for 2030, 2040 and 2045 by Emissions Source and Sector (MTCO₂e)

Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Stationary Energy	Residential	4,471	4,413	4,683	4,563	4,746	4,608
Stationary Energy	Commercial/Institutional	4,001	4,001	4,326	4,326	4,491	4,491
Stationary Energy	Industrial	—	—	—	—	—	—
Electricity	Residential	6,573	5,308	6,885	698	6,978	—
Electricity	Commercial/Institutional	2,281	1,832	2,467	248	2,561	—
Electricity	Industrial	—	—	—	—	—	—
Other Industrial	Industrial	—	—	—	—	—	—
Agriculture – Fertilizer Application	Agricultural	490	490	490	490	490	490

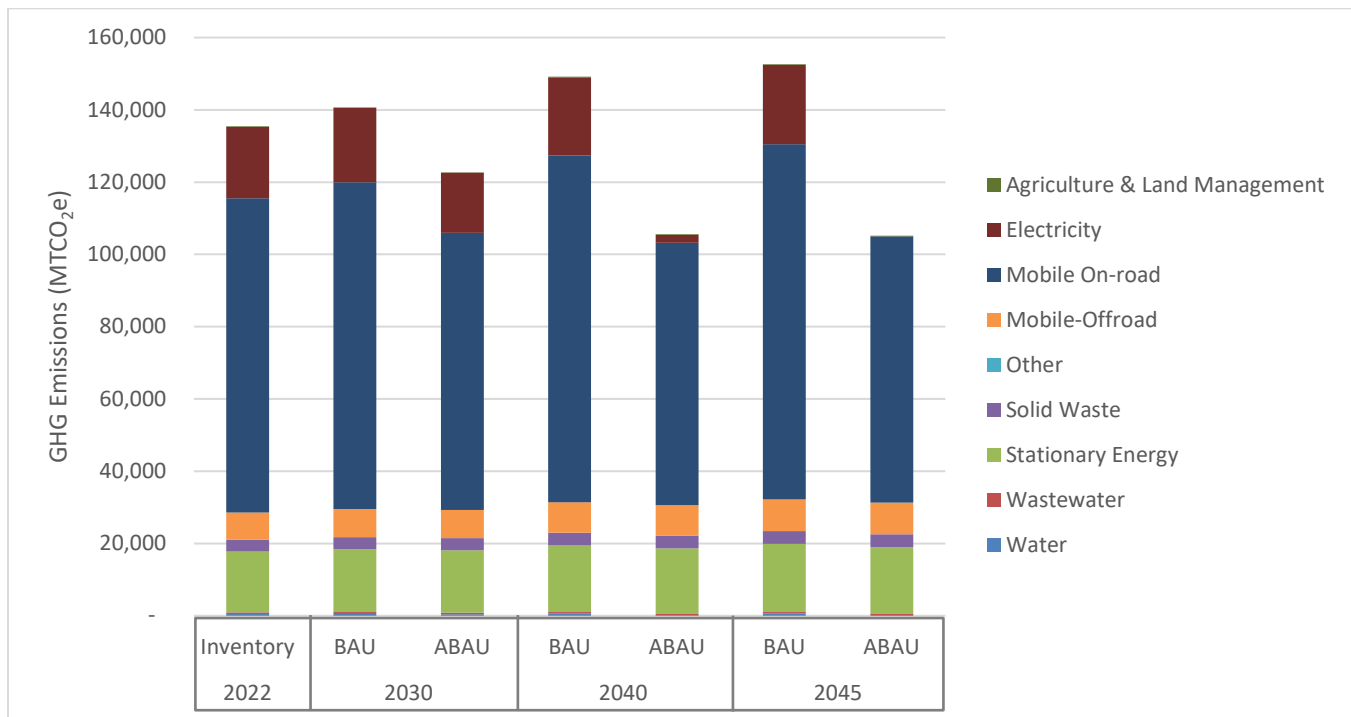
Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Solid Waste	Residential	2,717	2,717	2,846	2,846	2,884	2,884
Wastewater	Commercial/Institutional	3,032	3,032	3,205	3,205	3,271	3,271
Imported Water	Commercial/Institutional	152	122	161	16	164	—
Imported Water	Agricultural	405	325	405	41	405	—
Mobile On-road	Residential	20,021	16,278	20,971	15,133	21,255	15,075
Mobile On-road	Commercial/Institutional	26,744	23,995	28,916	23,275	30,018	24,171
Mobile Off-road	Commercial/Institutional	2,913	2,913	3,150	3,150	3,270	3,270
Mobile Off-road	Agricultural	255	255	255	255	255	255

Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 3 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Taft's 2022 GHG emissions inventory for comparison, all categorized by emissions sources.

Figure 3 City of Taft 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sources (MTCO₂e)

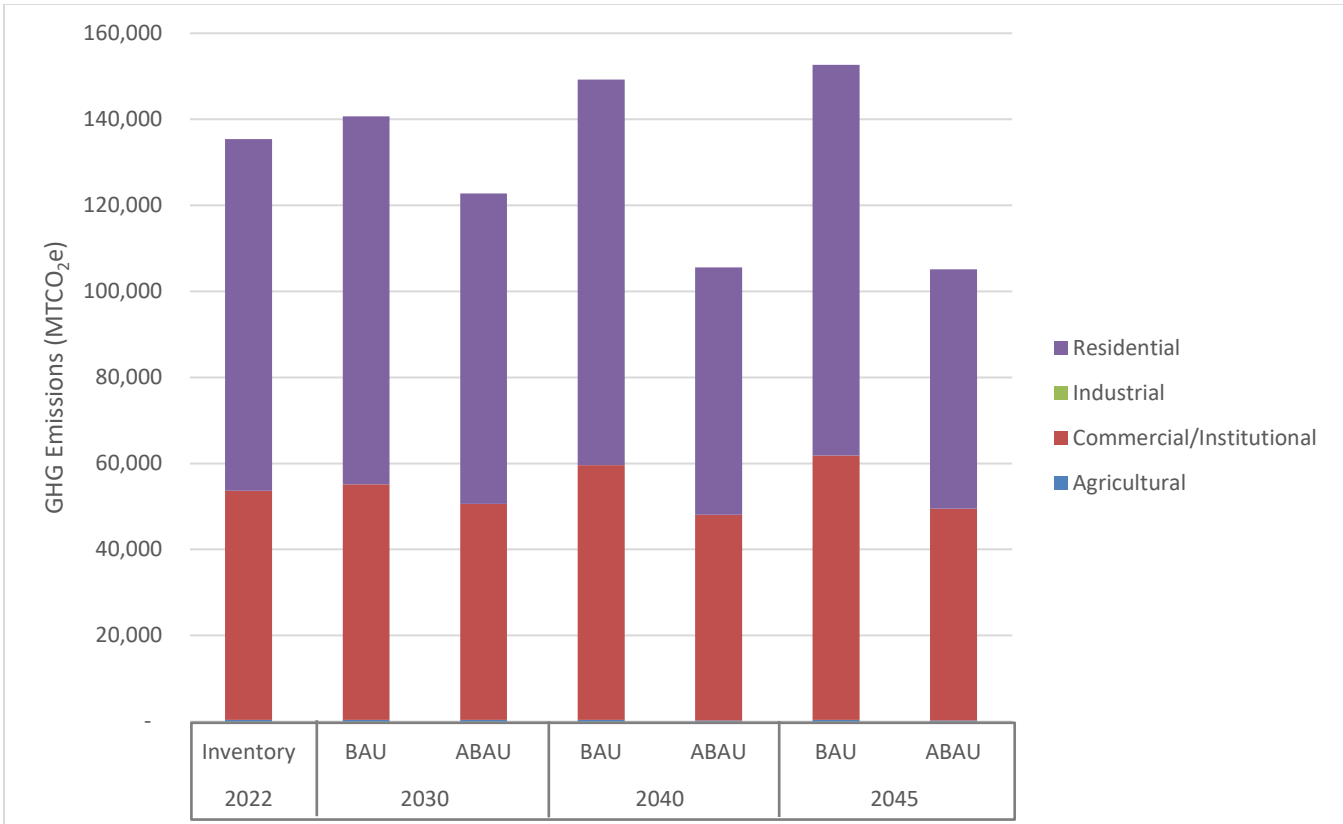


Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 4 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Taft's 2022 GHG emissions inventory for comparison, all categorized by emissions sectors.

Figure 4 City of Taft 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sectors (MTCO₂e)



Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent. The City of Taft had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure. Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

3 GREENHOUSE GAS EMISSIONS INVENTORY METHODS

This section of the report details the methods used to develop the GHG emissions inventory for the City of Taft. It includes descriptions of the data sources and data processing, and the inputs and outputs for the GHG emissions calculations. The methods are organized by GHG emissions sources (stationary energy, electricity, etc.) for the City of Taft, based on the EPA Local GHG Inventory Tool.

The EPA Local GHG Inventory Tool was primarily used for GHG emissions calculations. Activity data (e.g., energy consumed, tons of waste landfilled, etc.) inputs for the City of Taft were entered into the tool and parameters were set to represent local conditions (e.g., annual electricity consumption data was imported into the tool as the input to calculate City of Taft’s GHG emissions associated with electricity, and the appropriate electricity grid was selected to represent local conditions). GHG emissions from on-road transportation were calculated externally to the EPA Local GHG Inventory Tool, due to data format inconsistencies. All other GHG emissions sources were calculated within, or entered into the tool. The tool also categorizes GHG emissions into different sectors: residential, commercial/institutional, industrial, and agricultural. Industrial and agricultural sectors were only used when explicitly differentiated in the available datasets. In all other cases, sector categorization followed the classifications provided by the EPA Local GHG Inventory Tool or as defined by the underlying data sources.

This report only documents data processing and calculations that were performed outside of the EPA Local GHG Inventory Tool and provides the GHG emissions outputs from the tool; it does not expand on the calculation methods

within the tool. Documentation for the EPA Local GHG Inventory Tool can be found on the EPA website at: <https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool>.

3.1 GREENHOUSE GASES AND GLOBAL WARMING POTENTIAL

GHG emissions other than carbon dioxide (CO₂) 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). CO₂ has a GWP factor of one, while all other GHGs have GWP factors measured in multiples of one relative to the GWP of CO₂. This conversion of non-CO₂ gases to one unit enables the reporting of all emissions in terms of carbon dioxide equivalent (CO₂e), 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 (MTCO₂e). For this emissions inventory and forecast, the three primary and most abundant GHGs were accounted for: CO₂, methane (CH₄) and nitrous oxide (N₂O).

Consistent with the best available science, the inventory uses GWP factors published in the Fifth Assessment Report (AR5) from Intergovernmental Panel on Climate Change (IPCC), where CH₄ and N₂O have GWP factors of 28 and 265, respectively (IPCC 2014). These values represent the GWP of GHG on a 100-year time horizon. This means that CH₄ is approximately 28 times stronger than CO₂ and N₂O is 265 times stronger than CO₂ in their potential to warm Earth's atmosphere over the course of 100 years. The use of 100-year GWP values is consistent with the California Air Resources Board (CARB) and EPA GHG accounting methods.

3.2 DATA REVIEW

The general approach for developing the GHG emissions inventory involved the collection of total activity and/or emissions data for Kern county for the year 2022 for each relevant GHG emissions source and then apportioning that data to individual jurisdictions and sectors using appropriate attribution metrics. These metrics include the City of Taft's contribution to total countywide population, commercial building floor space, and agricultural land acreage. In some cases, such as for landfilled solid waste and industrial facilities, jurisdiction-specific data were available from publicly available resources.

The primary data sources used to compile activity and emissions data for all of Kern county are listed in Table 3.

Table 3 Data Sources for Countywide Activity and Emissions Data

GHG Emission Source	Data Source(s)
Mobile On-road	CARB EMFAC2021 on-road emission inventory model (CARB 2022a)
Mobile Off-road	CARB OFFROAD2021 off-road emission inventory model (CARB 2022b)
Stationary Energy	CEC energy database (CEC 2023), EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases
Electricity	CEC energy database (CEC 2022), Pacific Gas & Electric Co (PG&E)
Imported Water	Water Association of Kern County
Agriculture	CDFA's fertilizing materials tonnage report (CDFA 2025)
Other Industrial Sources	EPA FLIGHT database (EPA 2023)

Notes: CARB = California Air Resources Board; ; CDFA = California's Department of Food & Agriculture CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

Attribution metrics were used to apportion countywide activity and/or emissions data to individual jurisdictions by the appropriate GHG emissions sector. These attribution metrics include:

- population share for allocating activity associated with the residential sector (US Census Bureau 2025),

- ▶ commercial building floor space share for activity associated with the commercial/institutional sector (Open Energy Data Initiative 2020), and
- ▶ farmland, grazing land, and other agricultural land cover types share for the agricultural sector (DOC 2022).

These attribution metrics and the associated values for each jurisdiction in Kern county are shown in Table 4 below.

Table 4 Attribution Metrics Used to Apportion Countywide Activities and GHG Emissions

Jurisdiction	Population	Population %	Agricultural Land Acreage	Agricultural Land Acreage %	Commercial Building Floor Space in Square Footage	Commercial Building Floor Space in Square Footage %
Taft	19,613	2.2%	1,487	0.1%	1,400	0.9%
Bakersfield	404,321	44.6%	41,684	1.5%	79,800	50.7%
California City	15,002	1.7%	112	0.0%	1,000	0.6%
Delano	50,498	5.6%	4,141	0.2%	5,800	3.7%
Maricopa	1,217	0.1%	558	0.0%	—	0.0%
McFarland	13,971	1.5%	2,754	0.1%	600	0.4%
Ridgecrest	28,118	3.1%	62	0.0%	4,000	2.5%
Shafter	20,162	2.2%	19,419	0.7%	10,700	6.8%
Taft	7,414	0.8%	4,507	0.2%	1,000	0.6%
Tehachapi	12,855	1.4%	2,764	0.1%	1,700	1.1%
Wasco	26,317	2.9%	3,421	0.1%	1,800	1.1%
Unincorporated County	307,395	33.9%	2,666,205	97.1%	49,700	31.6%
Kern County Total	906,883	100%	2,747,115	100%	157,500	100%

Note: Population and agricultural land acreage data reflect conditions in 2022. The most recent data available for commercial building floor space was from 2019, which was used as the attribution metric in this analysis. Because the calculations relied on percentage shares rather than absolute floor space values, using 2019 data was considered appropriate for consistency across jurisdictions.

Sources: US Census Bureau 2025; DOC 2022; Open Energy Data Initiative 2020; analysis conducted by Ascent in 2025.

For the wastewater and solid waste emissions sources, as well as the industrial emissions sector, data and information were collected at the jurisdiction level to calculate associated GHG emissions.

For wastewater, jurisdiction-specific data were obtained from a variety of sources, including any publicly available data about wastewater treatment plant operations. When such data were not publicly available, default values from the EPA Local GHG Inventory Tool and the Local Governments for Sustainability *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* were used to fill data gaps.

For solid waste, jurisdiction-specific disposal data were sourced from the California Department of Resources Recycling and Recovery (CalRecycle), specifically from the Jurisdiction Disposal and Beneficial Reuse by Destination database.

For the industrial emissions sector, jurisdiction-specific emissions data were also obtained directly from the EPA FLIGHT and CARB MRR databases, which report facility-level emissions for large industrial sources.

Data sources for jurisdiction-specific activity and emissions data are shown in Table 5 below.

Table 5 Data Sources for Jurisdiction-Specific Activity and Emissions Data

GHG Emission Source/Sector	Data Source(s)
Wastewater	ICLEI (ICLEI 2019)
Solid Waste	CalRecycle's Jurisdiction Disposal and Beneficial Reuse by Destination database (CalRecycle 2025), EPA FLIGHT database (EPA 2023)

GHG Emission Source/Sector	Data Source(s)
Industrial Sector	EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases

Notes: ICLEI = Local Governments for Sustainability; CalRecycle = California Department of Resources Recycling and Recovery; CARB = California Air Resources Board; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

3.3 INVENTORY METHODS BY GHG EMISSIONS SOURCE

This section details the data and methods used to calculate GHG emissions in the 2022 inventory, organized by emissions source. It presents the corresponding data inputs into the EPA Local GHG Inventory Tool, any data processing that was performed, and the resulting emissions estimates by source and sector for the City of Taft. All calculations of GHG emissions use the IPCC AR5 GWP values to convert GHG emissions results to CO₂e.

3.3.1 Mobile On-road

The Mobile On-road 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." The estimation of these emissions relies on EMFAC2021, a statewide mobile source emissions inventory model developed by CARB. EMFAC2021 was used instead of the EPA Local GHG Inventory Tool to calculate mobile on-road GHG emissions because EMFAC2021 provides GHG emissions estimates that more closely represent the vehicle fleet operating on roadways in Kern County. The EPA Local GHG Inventory Tool utilizes national fuel efficiency averages for a select number of vehicle types to calculate GHG emissions, whereas EMFAC2021 considers fuel efficiency by vehicle type and model, providing more accurate estimates of fuel consumption and GHG emissions.

To calculate emissions for the 2022 inventory year, total countywide vehicle miles traveled (VMT) were first obtained from EMFAC2021. These VMT figures were then allocated to emission sectors defined by the EPA's Local GHG Inventory Tool based on vehicle class, specifically, the residential and commercial/institutional sectors. For the purposes of sector-specific emissions calculations, light-duty vehicles were attributed to the residential sector, as they primarily reflect personal vehicle use by residents. In contrast, medium- and heavy-duty trucks were attributed to the commercial/institutional sector, as these vehicle types are more commonly associated with goods movement, service fleets, and business operations. Sector-specific VMT totals were then apportioned to each jurisdiction based on appropriate attribution metrics: population share for residential VMT and commercial building square footage share for commercial/institutional VMT.

EMFAC2021 was also used to generate countywide GHG emissions factors for the two sectors, expressed in MTCO₂e per vehicle mile traveled. These factors accounted for all vehicle classes, model years, speeds, and fuel types. The sector-specific factors were derived by dividing total countywide emissions of CO₂, CH₄, and N₂O (converted to CO₂e using the appropriate GWP) by the corresponding sector-specific countywide total VMT, with emissions and VMT categorized into the residential and commercial/institutional sectors based on vehicle class.

Finally, each jurisdiction's total Mobile On-road emissions by sector were calculated by multiplying the jurisdiction's sector-specific VMT by the respective countywide sector-specific MTCO₂e per VMT emissions factors. Table 6 presents the City of Taft's total Mobile On-road VMT, associated sector-specific GHG emissions factors, and the resulting total GHG emissions by sector.

Table 6 City of Taft Mobile On-road Data Inputs and Results

Vehicle Sector	Total Activity (VMT)	GHG Emissions Factor (MTCO ₂ e/VMT)	GHG Emissions (MTCO ₂ e)
Residential	59,466,611	0.00035	19,130
Commercial/Institutional	25,933,199	0.0011	25,987

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: CARB 2022a; analysis conducted by Ascent in 2025.

3.3.2 Mobile Off-road

Emissions from Mobile Off-road sources result from the combustion of fuel in various types of off-road vehicles and equipment (e.g. agricultural tractors, construction equipment). Emissions data for these sources were obtained from CARB's OFFROAD2021 model, which provides detailed estimates for Kern county for the 2022 inventory year. The data include, but are not limited to, information on equipment categories, fuel types, and the amount of fuel consumed.

Using the off-road vehicle categories in OFFROAD2021, the emissions data were organized into two relevant sectors defined by the EPA Local GHG Inventory Tool: agricultural and commercial/institutional. Sector-specific off-road fuel consumption totals were then apportioned to each jurisdiction using appropriate attribution metrics. Specifically, the share of farmland, grazing land, and other agricultural land was used to allocate agricultural emissions, while the commercial building square footage share was used to distribute commercial/institutional emissions.

Finally, each jurisdiction's sector-specific off-road fuel consumption data were entered into the "Mobile-Data" sheet of the EPA Local GHG Inventory Tool to calculate Mobile Off-road emissions. The EPA Local GHG Inventory Tool includes emissions factors by fuel type. Table 7 presents the City of Taft's total Mobile Off-road fuel consumption by fuel type and the resulting total GHG emissions by sector.

Table 7 City of Taft Mobile Off-road Data Inputs and Results

Vehicle Sector	Diesel Consumption (gallons)	Gasoline Consumption (gallons)	Liquefied Natural Gas (LNG) Consumption (gallons)	Total Fuel Consumption (gallons)	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	195,052	85,338	4,709	285,100	2,831
Agricultural	23,850	441	—	24,291	255

Notes: GHG = greenhouse Gas; LNG = liquefied natural gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CARB 2022b, analysis conducted by Ascent in 2025.

3.3.3 Stationary Energy

The stationary energy source of GHG emissions includes natural gas combustion in residential, commercial/institutional and industrial uses. Residential uses primarily consume natural gas for space and water heating, and cooking. Commercial/institutional uses may include space heating and cooling, cooking in restaurants, and smaller boilers or generators. Industrial uses are often process-specific uses tied to manufacturing or heavy operations such as process heating, steam generation, and boiler systems. Propane fuel usage was not included in the stationary energy-related calculations as propane usage data for these various uses was not available at the same level of detail or consistency as other stationary energy data sources at the county scale.

RESIDENTIAL AND COMMERCIAL/INSTITUTIONAL

Total countywide natural gas usage data for the 2022 inventory year was obtained from the CEC Energy Reports: Gas Consumption by County, which categorizes usage into residential and non-residential sectors. Residential natural gas consumption was allocated to each jurisdiction based on its share of the county's population.

To isolate commercial/institutional usage, countywide industrial natural gas consumption, sourced from the EPA FLIGHT database and CARB MRR database, was subtracted from the CEC total non-residential usage. The resulting commercial/institutional natural gas usage was then apportioned to each jurisdiction using commercial building floor space share as the attribution metric.

Finally, each jurisdiction's residential and commercial/institutional natural gas usage data were entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate residential and commercial/institutional stationary energy emissions. Table 8 below shows the City of Taft's total stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions in residential and commercial/institutional sectors.

Table 8 City of Taft Residential and Commercial/Institutional Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Residential	78,079	4,293
Commercial/Institutional	71,056	3,907

Notes: mcf = thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

INDUSTRIAL

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the City of Taft. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

For the City of Taft, the databases showed that no large industrial facilities are located within its geographic boundary, therefore, there is no reported industrial stationary energy associated activity or GHG emissions for the City of Taft.

3.3.4 Electricity

The electricity source addresses energy-related indirect GHG emissions resulting from the consumption of grid-supplied electricity within the City of Taft's boundary. Consumption of grid-supplied electricity is considered an "indirect" GHG emissions source, because GHG emissions occur at the source of electricity generation, which is usually outside of a jurisdiction's boundary. The location-based method was used to calculate electricity GHG emissions, which uses regional grid-average emission factors. In the United States, these factors are provided by the EPA's Emissions & Generation Resource Integrated Database (eGRID). Specifically, emission factors for the CAMX eGRID subregion were applied, as this subregion encompasses the geographic area of Kern county.

Total electricity usage data for Kern county in 2022 was obtained from CEC Energy Reports: Electricity by County, which categorized usage into residential and non-residential sectors (CEC 2023). Electricity usage data for the City of Bakersfield, which was also separated into residential and non-residential categories, was acquired directly from the Pacific Gas and Electric Company (PG&E). To estimate electricity usage for the rest of the county (i.e., all jurisdictions excluding Bakersfield), the City of Bakersfield's electricity data was subtracted from the total Kern county data.

Residential electricity usage outside of Bakersfield was apportioned to each jurisdiction based on its share of the county's total population. For non-residential electricity usage, estimates were further categorized into industrial and commercial/institutional sectors using attribution metrics derived from natural gas consumption data previously calculated under stationary energy. In 2022, 93.1 percent of the county's stationary natural gas combustion was attributed to industrial use and 6.9 percent to commercial/institutional use. These same ratios were applied to the county's total non-residential electricity usage, under the assumption that the sectoral split in electricity usage mirrors that of natural gas usage. This assumption was validated using available industrial electricity and natural gas usage data in PG&E's service territory, from the CEC Energy Reports. The electricity-to-gas ratio, expressed as gigawatt-hour per million therms, was calculated by dividing total industrial electricity usage by industrial natural gas consumption for the service territory. The resulting value closely aligns with the assumptions applied in this here, supporting its validity.

The City of Taft's share of commercial building square footage was used to attribute commercial/institutional electricity usage. Industrial electricity usage was attributed based on the proportion of countywide industrial natural gas within the City of Taft. No industrial facilities exist in the City of Taft; therefore, no industrial electricity usage is attributed to the City of Taft. Finally, the sector-specific electricity usage data for each jurisdiction was entered into the "Electricity-Data" sheet of the EPA Local GHG Inventory Tool to calculate associated GHG emissions.

Table 9 below shows the City of Taft's electricity activity data and the associated GHG emissions by emission sectors.

Table 9 City of Taft Electricity Energy Data Inputs and Results

Sector	Total Activity (kWh of Electricity Consumed)	GHG Emissions (MTCO ₂ e)
Residential	27,730,109	6,281
Commercial/Institutional	9,787,990	2,217
Industrial	—	—

Notes: kWh = kilowatt-hour; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; PG&E 2025; analysis conducted by Ascent in 2025.

3.3.5 Imported Water

The water source category captures GHG emissions from energy use associated with the conveyance, treatment, and distribution of water within a jurisdiction. In Kern county, the WAKC reports that approximately 166,000 acre-feet of water are used annually for municipal and industrial purposes, and 2,294,000 acre-feet for agricultural purposes.

In addition to local surface water, Kern county draws water from several sources. Among these, only water supplied through the State Water Project (SWP) and the federal Central Valley Project (CVP) is considered imported, and therefore potentially results in GHG emissions due to long-distance conveyance. All other sources are classified as local. It was assumed that energy used for extracting, conveying, treating, and distributing local water is captured under the emissions estimates for stationary energy and electricity, since these activities occur within the county. In addition, upon further review, it was also determined that the federal CVP does not consume energy for water delivery to Kern County, as water is primarily conveyed using gravity (Friant Water Authority 2019). As a result, only the SWP, which accounts for 26 percent of the county's water supply, contributes to GHG emissions. Table 10 provides a summary of the water sources in Kern county and their contribution to the total water supply.

Table 10 Kern County Water Sources

Source	Percentage
Kern River	20%
State Water Project (California Aqueduct)	26%
Federal Central Valley Project (Friant-Kern Canal)	12%
Local Streams and Other Sources (Poso Creek, Kern River, etc.)	6%
Groundwater	36%
Total	100%

Source: WAKC n.d.

Water use in Kern County is characterized into municipal and industrial, and agricultural sectors in data obtained from WAKC. It is assumed that water included in "municipal" uses is delivered to both commercial and residential customers. However, sufficient data was not available to disaggregate the water consumption between industrial, commercial, and residential customers. For the purpose of this GHG emissions inventory, all non-agricultural water consumption was categorized under the commercial/institutional sector.

To allocate sector-specific water usage to individual jurisdictions, the following attribution metrics were used:

- ▶ Agricultural water use was apportioned based on each jurisdiction's share of farmland, grazing land, and other agricultural land.
- ▶ Commercial/institutional water use was distributed according to the share of commercial building square footage in each jurisdiction.

These apportioned figures were then entered into the “Imported Water” sheet of the EPA Local GHG Inventory Tool, applying a universal 26 percent imported water rate, to estimate the associated GHG emissions from water conveyance and use. Table 11 presents the City of Taft’s activity data related to imported water, including the percentage of total water supply that is imported and the associated GHG emissions.

Table 11 City of Taft Imported Water Energy Data Inputs and Results

Sector	Total Activity (Gallons of Water)	Percentage of Water Imported	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	114,974,576	26%	146
Agricultural	318,845,203		405

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: WAKC n.d.; analysis conducted by Ascent in 2025.

3.3.6 Wastewater

The wastewater source accounts for GHG emissions resulting from the treatment of sewage. To support this analysis, a review of publicly available wastewater treatment characteristics was conducted to collect the data required for completing the “Wastewater-Control” tab of the EPA’s Local GHG Inventory Tool. The data sources and corresponding assumptions for the City of Taft’s wastewater treatment systems are summarized in Table 12. Where jurisdiction-specific data were not publicly available, the default input values provided by the EPA tool were used.

To estimate GHG emissions, population data for each jurisdiction were subsequently entered into the “Wastewater-Entry” tab of the tool. The resulting emissions estimates are also presented in Table 12, alongside the data sources and assumptions used.

Table 12 City of Taft Wastewater Treatment Assumptions

Wastewater Process/Treatment Type	Conditions Assumed	Data Source	GHG Emissions (MTCO ₂ e)
Population served by septic systems	5 percent of the city’s population	ICLEI’s default proportion of population that utilizes septic tanks for an urban area (Box WW.11(alt).2).	2,911
One or more wastewater treatment plants (WWTPs) where wastewater is treated in aerobic or anaerobic conditions	Anerobic	No public information is available. The default value is anerobic.	
One or more WWTPs conduct or do not conduct nitrification/denitrification	No nitrification/denitrification	No public information is available. The default value is no nitrification/denitrification.	

Notes: WWTP = wastewater treatment plant; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; ICLEI = Local Governments for Sustainability.

Sources: ICLEI 2019; analysis conducted by Ascent in 2025.

3.3.7 Solid Waste

Community-generated solid waste emissions are primarily associated with the decomposition of solid waste in landfills. There are two methods for accounting for GHG emissions associated with waste disposal:

- ▶ Waste generation method – Accounts for the total GHG emissions that would be generated over time as municipal solid waste (MSW) that is sent to a landfill in only the inventory year decomposes.
- ▶ Waste-in-place method – Accounts for the total GHG emissions generated in a given year at a specific landfill location by the decomposition of all MSW previously disposed at the landfill.

Generally, there is some risk of double counting GHG emissions when combining both of these methods, as a portion of the emissions accounted for using the waste generation method may occur at an in-boundary landfill that has emissions reported using the waste-in-place method. However, the scale of the overlapping GHG emissions between the two methods would be expected as very small in comparison to total emission using either accounting method.

WASTE GENERATION

Landfill tonnage data for 2022 was obtained from CalRecycle’s Jurisdiction Disposal and Beneficial Reuse by Destination database. This data was entered into the EPA’s Waste Reduction Model (WARM Tool) as “mixed MSW” to estimate waste generation emissions. The default national average values were used in the WARM Tool, except for Question 7, where the k value was set to “dry” based on the county’s annual precipitation (less than 20 inches) (NCEI 2025). The WARM output was then imported into the EPA Local GHG Inventory Tool’s “Waste Production” tab, with solid-waste associated emissions attributed to the residential sector by default.

The total activity for solid waste disposal and the resulting waste generation GHG emissions results from the WARM Tool are provided in Table 13.

Table 13 City of Taft Waste Generation Data Inputs and Results

Sector	Total Activity (tons of MSW disposed)	GHG Emissions (MTCO ₂ e) (WARM Output)
Residential	8,994	2,596

Notes: MSW = mixed municipal solid waste; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; WARM = Waste Reduction Model.

Source: CalRecycle 2025; analysis conducted by Ascent in 2025.

WASTE-IN-PLACE

EPA’s FLIGHT database was reviewed to determine emissions from landfills located within the City of Taft’s geopolitical boundary, which would provide emissions data for any landfills that generated emissions greater than 25,000 MTCO₂e in 2022. No reporting landfills were identified for the City of Taft.

3.3.8 Agriculture

The agriculture emissions source captures GHG emissions generated from fertilizer application.

FERTILIZER APPLICATION

Fertilizer application results in GHG emissions primarily due to the release of N₂O, a potent GHG with a global warming potential nearly 300 times greater than CO₂. When nitrogen-based fertilizers are applied to soil, a portion of the nitrogen undergoes microbial processes (nitrification and denitrification), which convert it into N₂O. These emissions can occur directly from the soil or indirectly through leaching and runoff

The total tonnage of nitrogen in synthetic fertilizers applied in Kern county during the 2022 inventory year was obtained from CDFA’s fertilizing materials tonnage report. This countywide total was then apportioned to individual jurisdictions based on each jurisdiction’s proportional share of farmland, grazing land, and other agricultural land. Only data for synthetic fertilizers was publicly available for calculation, although other organic or manure-based fertilizers may be used.

The resulting tonnage of nitrogen in synthetic fertilizers estimated for the City of Taft was entered into the “Agriculture & Land Management” sheet of the EPA’s Local GHG Inventory Tool to calculate the associated emissions. Table 14 provides the estimated total tons of nitrogen applied and resulting GHG emissions.

Table 14 City of Taft Fertilizer Application Data Inputs and Results

Sector	Total Activity (tons of nitrogen applied)	GHG Emissions (MTCO ₂ e)
Agricultural	68	490

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CDFA 2025; analysis conducted by Ascent in 2025.

4 GREENHOUSE GAS EMISSIONS FORECAST METHODS

This section provides the methods and data used to project future GHG emissions under a BAU scenario, as well as the calculations of reductions from adopted legislation and regulations under an ABAU scenario.

The BAU GHG emissions forecasts assess how emissions generated by community activities will change over time without further State, federal, regional, or local action. The BAU scenario forecast accounts for the changes in population and employment that can influence communitywide GHG emissions. The ABAU scenario forecast includes adopted policies and regulations at the State and federal levels that would affect emissions without any local action, such as regulatory requirements to increase vehicle fuel efficiency and increase renewable energy sources in grid electricity portfolios. These forecasts provide the City of Taft with information needed to understand specific GHG emissions sources with the greatest opportunities for reduction with future plans, projects, or programs. It is important to note that the ABAU forecasts only account for emissions reductions associated with adopted policies and regulations; they do not account for proposed and/or unadopted GHG reduction actions established by regional, State, and federal agencies or executive orders outside of adopted legislation and regulations.

The GHG emissions forecasts project GHG emissions for the years 2030, 2040, and 2045 to align with key regulatory timelines for the State. Two key legislative actions establish statewide GHG reduction targets for the years 2030 and 2045, including:

- ▶ Senate Bill (SB) 32 of 2016, which sets a statewide GHG reduction target for the year 2030, and
- ▶ Assembly Bill 1279 of 2022, which sets a statewide GHG reduction target for the year 2045.

The forecast years selected do not necessarily align with the targets established by adopted legislation, but they do provide an analysis of emissions that aligns with the relevant horizon years. The year 2040 was also included in the analysis as an interim year between the 2030 and 2045 forecast years.

4.1 GROWTH PROJECTIONS

GHG emissions forecasts were developed based on projected changes in Kern county's demographics, specifically population, employment, and service population (defined as residents plus employees), between 2022 and 2045. These projections were obtained from the Regional Growth Forecast and Demographic Forecast prepared by the Kern COG (Kern COG 2024). It is assumed that the incorporated cities and the unincorporated county will experience demographic growth at the same rate as the county overall, as jurisdiction-specific growth projections were not available at the time of this analysis.

Between 2022 and 2045, Kern county's population and employment are projected to increase by approximately 11.1 and 15.5 percent, respectively. The service population is expected to grow by 12.4 percent. These growth factors were applied to forecast GHG emissions for the years 2030, 2040, and 2045 across various emissions sources included in the inventory. The values used for population, employment, and service population used to project future emissions are provided in Table 15.

Table 15 Kern County Demographics and Calculated Growth Rates for Future Emissions Forecasts

Calculation Factor	2022	2030	2040	2045
Population				
Total Kern County	906,883	949,134	994,167	1,007,627
Kern County Growth from 2022		4.7%	9.6%	11.1%
Employment				
Total Kern County	358,961	369,427	399,432	414,652
Kern County Growth from 2022		2.9%	11.3%	15.5%
Service Population				
Total Kern County	1,265,844	1,318,561	1,393,598	1,422,279
Kern County Growth from 2022		4.2%	10.1%	12.4%

Source: US Census Bureau 2025; Kern COG 2024; analysis conducted by Ascent in 2025.

Additional details on how growth factors were applied to individual sources are provided in the following sections. It is important to note that agricultural emissions, including those from fertilizer application, as well as livestock enteric fermentation and manure management, are assumed to remain constant throughout the forecast period, with no projected increase in activity levels. Agricultural activities are difficult to project in any detail, with production intensities, number of livestock, and crop types being highly susceptible to global markets and local climate patterns. As such, projections of agriculture GHG emissions-generating activities are not attempted.

4.2 BUSINESS-AS-USUAL SCENARIO FORECAST

The BAU forecast represents a projection of future GHG emissions based solely on expected demographic and economic growth (e.g., population, employment, and service population) between 2022 and 2045. It does not account for the potential impacts of future policies, programs, or actions that may reduce emissions, such as energy efficiency improvements, renewable energy adoption, or transportation electrification.

In the BAU scenario, GHG emissions factors are held constant at the levels used in the 2022 GHG inventory, meaning the carbon intensity of electricity, fuels, and other activities is assumed not to change over time. As a result, any changes in future emissions are driven entirely by growth in activity levels, not by improvements in emissions performance.

4.2.1 Business-As-Usual Scenario Forecast Results

Table 16 presents the projected activity data for the City of Taft across all forecast years, organized by emissions source and sector. Table 16 also indicates which sources and sectors used population, employment, or service population as a growth metric.

Table 16 City of Taft BAU Scenario Projected Activity Data for All Forecast Years

Source	Sector	Growth Metric	Units	2030	2040	2045
Stationary Energy	Residential	Population	scf	81,716	85,594	86,752
Stationary Energy	Commercial/Institutional	Employment	scf	73,128	79,068	82,081
Stationary Energy	Industrial	Employment	scf	—	—	—
Electricity	Residential	Population	kWh	29,022,028	30,399,013	30,810,591
Electricity	Commercial/Institutional	Employment	kWh	10,073,383	10,891,530	11,306,558
Electricity	Industrial	Employment	kWh	—	—	—
Other Industrial	Industrial	Employment	MTCO ₂ e	—	—	—

Source	Sector	Growth Metric	Units	2030	2040	2045
Agriculture – Fertilizer Application	Agricultural ¹	N/A	ton	68	68	68
Solid Waste	Residential	Population	ton	9,413	9,860	9,993
Wastewater	Commercial/Institutional	Service Population	MTCO ₂ e	3,032	3,205	3,271
Imported Water	Commercial/Institutional	Service Population	Gallon	119,762,794	126,578,302	129,183,333
Imported Water	Agricultural ¹	N/A	Gallon	318,845,203	318,845,203	318,845,203
Mobile On-road	Residential	Population	VMT	62,237,103	65,190,018	66,072,637
Mobile On-road	Commercial/Institutional	Employment	VMT	26,689,346	28,857,019	29,956,634
Mobile Off-road	Commercial/Institutional	Employment	MTCO ₂ e	2,913	3,150	3,270
Mobile Off-road	Agricultural ¹	N/A	MTCO ₂ e	255	255	255

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; scf = standard cubic foot.

¹ Activity levels for the agricultural sector are assumed to remain constant over the forecast period; therefore, growth metrics are listed as “N/A.”

Source: Analysis conducted by Ascent in 2025.

Table 17 below presents the projected GHG emissions for the City of Taft across all forecast years, also organized by emissions source and sector.

Table 17 City of Taft BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	4,471	4,683	4,746
Stationary Energy	Commercial/Institutional	MTCO ₂ e	4,001	4,326	4,491
Stationary Energy	Industrial	MTCO ₂ e	—	—	—
Electricity	Residential	MTCO ₂ e	6,573	6,885	6,978
Electricity	Commercial/Institutional	MTCO ₂ e	2,281	2,467	2,561
Electricity	Industrial	MTCO ₂ e	—	—	—
Other Industrial	Industrial	MTCO ₂ e	—	—	—
Agriculture – Fertilizer Application	Agricultural	MTCO ₂ e	490	490	490
Solid Waste	Residential	MTCO ₂ e	2,717	2,846	2,884
Wastewater	Commercial/Institutional	MTCO ₂ e	3,032	3,205	3,271
Imported Water	Commercial/Institutional	MTCO ₂ e	152	161	164
Imported Water	Agricultural	MTCO ₂ e	405	405	405
Mobile On-road	Residential	MTCO ₂ e	20,021	20,971	21,255
Mobile On-road	Commercial/Institutional	MTCO ₂ e	26,744	28,916	30,018
Mobile Off-road	Commercial/Institutional	MTCO ₂ e	2,913	3,150	3,270
Mobile Off-road	Agricultural	MTCO ₂ e	255	255	255

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

4.3 LEGISLATIVE-ADJUSTED BUSINESS-AS-USUAL SCENARIO FORECAST

ABAU emissions forecasts were prepared using the same demographic data that were used for the BAU forecasts, while also accounting for State and federal policies and regulations that would affect local emissions. These forecasts provide the City of Taft with a more robust understanding of future community emissions based on the GHG reduction efforts at the state and federal level. A summary of applicable legislative reductions is provided in Table 18.

Table 18 Legislative Reductions Summary

Source	Legislative Reduction	Description	Sources Applied
State	Renewable Energy and Zero-Carbon Electricity Requirements [SB 1020 and SB 100]	Requires California energy utilities to procure 60 percent of electricity from eligible renewable and zero-carbon sources by 2030, 95 percent by 2040, and 100 percent by 2045.	Electricity, Imported Water
State	California's Building Energy Efficiency Standards (2019 and 2022 Title 24, Part 6)	Requires all new buildings in California to comply with energy efficiency standards established by CEC. Accounts for the energy efficiency gains in new residential and nonresidential buildings.	Stationary Energy, Electricity
State	Advanced Clean Car I Regulation	Establishes GHG emission reduction standards for model years 2017 through 2025 that are more stringent than federal CAFE standards.	Mobile On-road
State	Truck and Bus Regulation	Requires diesel trucks and buses that operate in California to be upgraded to reduce GHG emissions.	Mobile On-road
Federal	Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles	Establishes fuel efficiency standards for medium- and heavy-duty engines and vehicles.	Mobile On-road

Notes: CAFE = Corporate Average Fuel Economy; CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; SUV = sports utility vehicle; SB = Senate Bill.

4.3.1 Title 24 Adjustments

Future energy use was adjusted to reflect increased emissions-intensity stringency under California's Building Energy Efficiency Standards (California Code of Regulations Title 24 Part 6, hereafter referred to as "Title 24"). Although Title 24 applies to both new residential and nonresidential construction, for the purposes of this forecast, adjustments were applied only to residential construction for reasons described below.

This approach accounts for uncertainties in energy consumption patterns and end uses in nonresidential buildings, and uncertainty in the non-residential building types that would be constructed in the future. Title 24 primarily regulates energy efficiency in building envelopes and lighting systems. This is expected to substantially reduce energy consumption for building types where the primary end uses of energy are lighting and heating, ventilation, and air conditioning, such as new office, institutional, and hotel buildings. However, Title 24 may not significantly affect other high-energy-consuming uses in nonresidential facilities, such as process loads or specialized equipment. As such, limiting adjustments to residential construction provides a more conservative and reliable estimate of future energy-related GHG emissions.

The 2019 Title 24 standards apply to projects constructed after January 1, 2020, while the 2022 standards apply after January 1, 2023. The 2025 Title 24 will go into effect statewide in January of 2026; however, detailed data on the changes in building-level energy consumption between the 2025 code and previous code cycles was not available at the time of this analysis. To estimate changes in future energy consumption under the 2022 standards, electricity and natural gas adjustment factors were calculated based on differences in average residential energy use between buildings built to the 2019 and 2022 standards. These factors were derived from CEC's data specific to the 2019 and 2022 standards and climate zone-based energy usage rates. For the City of Taft, Climate Zone 13 was used in the analysis.

These adjustment factors were then applied to the ABAU forecasts of energy consumption activity for both stationary energy and electricity use to reflect the impact of legislative energy efficiency improvements on future development. The adjustment factors, presented in Table 19, show the percentage change in energy use for buildings built to 2022

standards relative to those built to 2019 standards. Positive values indicate an anticipated increase in energy use, while negative values indicate an anticipated decrease in energy use.

As shown in Table 19:

- ▶ ABAU electricity activity is projected to be higher than BAU in each forecast year due to positive adjustment factors.
- ▶ ABAU stationary energy activity is projected to be lower than BAU due to negative adjustment factors.

Importantly, these adjustments were applied only to energy use growth occurring after the 2022 baseline, reflecting new development that would be subject to the 2022 Title 24, or a later cycle of standards. In addition, it is important to note that although average electricity use in new residential buildings is anticipated to rise under 2022 Title 24 (due to an increase in electrical demand associated with electric appliances installed instead of natural gas appliances), emissions from new residential buildings are expected to be lower than they would be under 2019 Title 24 as a result of overall lower building emissions intensities (due to lower emissions factors associated with electricity compared to natural gas).

Table 19 Stationary Energy and Electricity Adjustment Factors and Activity Forecast Results for Residential Buildings

Energy Type	Forecast Scenario	Adjustment Factor	Activity Units	2022	2030	2040	2045
Electricity	BAU	—	kWh	27,730,109	29,022,028	30,399,013	30,810,591
Electricity	ABAU	+12%	kWh	27,730,109	29,176,527	30,718,184	31,178,981
Stationary Energy (Natural Gas)	BAU	—	mcf	78,079	81,716	85,594	86,752
Stationary Energy (Natural Gas)	ABAU	-29%	mcf	78,079	80,658	83,407	84,228

Notes: BAU = Business-as-Usual; ABAU = legislative-adjusted BAU; mcf = one thousand cubic feet; kWh = kilowatt-hour.

Source: Analysis conducted by Ascent in 2025.

4.3.2 Senate Bill 100 and Senate Bill 1020 Adjustments

SB 100 requires that 100 percent of retail electricity sales in California come from renewable and zero-carbon resources by 2045. This legislation builds upon the state's existing Renewables Portfolio Standard (RPS) by increasing the required percentage of RPS-eligible renewable electricity over time. SB 1020 builds on SB 100 by introducing interim targets for GHG-free electricity for the years 2035 and 2040. As shown in Table 20, SB 100 and SB 1020 require utility providers to supply electricity that is 60 percent GHG-free by 2030, 95 percent by 2040, and 100 percent by 2045. The emissions sources affected by these adjustments include electricity and imported water, both of which are estimated based on the carbon intensity of the electricity grid.

To estimate future GHG emissions factors, the 2022 GHG-free electricity percentage and GHG emissions factors for the CAMX eGRID subregion were first obtained from the EPA's eGRID database. Using these 2022 values as a baseline, emissions factors for the forecast years (2030, 2040, and 2045) were calculated based on the GHG-free electricity targets established by SB 100 and SB 1020.

Table 20 below demonstrates these GHG-free electricity percentage baseline values and targets, as well as the baseline and calculated emissions factors for the forecast years. Given 2045's 100 percent GHG-free electricity percentage target, the emissions factor for 2045 is 0. In contrast to the ABAU forecast, the CAMX eGRID emissions factors under the BAU scenario are assumed to remain constant at their 2022 baseline values throughout the forecast years.

Table 20 CAMX eGRID Electricity GHG Emissions Factors Adjusted for SB100 and SB1020

Calculation Factor	Units	2022	2030	2040	2045
SB 100 and SB 1020 GHG-free electricity percentage targets	Percent GHG-free	N/A	60%	95%	100%
CAMX eGRID GHG-free electricity percentage baseline and targets	Percent GHG-free	50%	60%	95%	100%
CAMX eGRID baseline and interpolated emissions factors	MTCO ₂ e/MWh	0.2265	0.1819	0.0227	0

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MWh = megawatt-hour; N/A = Not Applicable.

Source: Analysis conducted by Ascent in 2025.

4.3.3 On-road Vehicle Emissions Standards

State and federal regulations are expected to significantly reduce on-road GHG emissions by requiring improvements in vehicle fuel efficiency and accelerating the transition to zero-emission vehicles (ZEVs). The ABAU forecast for the Mobile On-road source takes into consideration the following State and federal regulations:

- ▶ Innovative Clean Transit Regulation, which requires all California public transit agencies to begin phasing in zero-emission buses (ZEB) starting in 2023 and transition to 100 percent ZEB fleets by 2040 and
- ▶ Advanced Clean Trucks Regulation, which requires truck and van manufacturers to sell a growing share of ZEVs beginning in model year 2024.

All these regulations are reflected in EMFAC2021's emissions data for the forecast years (2030, 2040 and 2045), which serve as the basis for the Mobile On-road source's ABAU forecast. In addition to these regulations, EMFAC2021's data also takes into consideration future increases in light-duty ZEV sales, which would be influenced by California's Advanced Clean Cars I regulation.

Accordingly, EMFAC2021's VMT and emissions estimates for forecast years were used to calculate Mobile On-road emissions under the legislative adjustment scenario. As with the inventory methodology, sector-specific emissions factors for each forecast year were calculated by dividing sector-specific VMT by sector-specific emissions for each forecast year. These emissions factors were then multiplied by projected future VMT, which were scaled by relevant activity growth factors (population for the residential sector and employment for the commercial/institutional sector) to estimate future emissions. The baseline and projected future emissions factors calculated using EMFAC2021 are shown in Table 21.

In contrast, under the BAU scenario, Mobile On-road emissions factors are held constant at their 2022 baseline values for all forecast years, reflecting no change in vehicle efficiency or fleet composition.

Table 21 Mobile On-road Baseline and Projected GHG Emissions Factors

Sector	Units	2022	2030	2040	2045
Commercial Institutional	MTCO ₂ e/VMT	0.0010	0.00090	0.00081	0.00081
Residential	MTCO ₂ e/VMT	0.00032	0.00026	0.00023	0.00023

Notes: MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: Analysis conducted by Ascent in 2025.

4.3.4 Legislative-Adjusted Business-as-Usual Scenario Forecast Results

Table 22 presents the projected GHG emissions for the City of Taft across all forecast years under the ABAU scenario, organized by emissions source and sector. Emissions sources and sectors not impacted by legislative adjustments are

excluded from this table, as their projected GHG emissions are assumed to remain unchanged from the BAU scenario. The full results for projected GHG emissions for the City of Taft across all forecast years under both the BAU and ABAU scenarios, organized by emissions source and sector, can be found in Table 2.

Table 22 City of Taft Legislative-Adjusted BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	4,413	4,563	4,608
Electricity	Residential	MTCO ₂ e	5,308	698	—
Imported Water	Commercial/Institutional	MTCO ₂ e	122	16	—
Imported Water	Agricultural	MTCO ₂ e	325	41	—
Mobile On-road	Residential	MTCO ₂ e	16,278	15,133	15,075
Mobile On-road	Commercial/Institutional	MTCO ₂ e	23,995	23,275	24,171

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

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WAKC. See Water Association of Kern County.

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Greenhouse Gas Emissions Inventory and Forecast for the City of Tehachapi

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LIST OF ABBREVIATIONS

ABAU	legislative-adjusted BAU
AR5	Fifth Assessment Report
BAU	business-as-usual
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CH ₄	methane
CO ₂	carbon dioxide
CVP	Central Valley Project
eGRID	Emissions & Generation Resource Integrated Database
EPA Local GHG Inventory Tool	EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1
EPA	US Environmental Protection Agency
GHG	greenhouse gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
Kern COG	Kern Council of Governments
MRR	Mandatory Greenhouse Gas Reporting Regulation
MSW	municipal solid waste
MTCO _{2e}	metric tons of carbon dioxide equivalent
N ₂ O	nitrous oxide
PG&E	Pacific Gas and Electric Company
RPS	Renewables Portfolio Standard
SB	Senate Bill
SWP	State Water Project
VMT	vehicle miles traveled
WARM Tool	Waste Reduction Model
ZEB	zero-emission buses
ZEV	zero-emission vehicle

1 INTRODUCTION

This report contains the methods and results for a greenhouse gas (GHG) emissions inventory and GHG emissions forecast for the City of Tehachapi. A GHG emissions inventory provides estimates of emissions generated within a defined geographic boundary during a single year. It identifies the sectors, sources, and activities that produce these emissions and their relative contribution, while also providing a baseline to forecast future emissions trends. A GHG emissions forecast evaluates how GHG emissions may change in the future due to growth and the effects of adopted state and federal legislation and regulations. This information can be used for various purposes, including monitoring GHG emissions trends over time, or as the technical basis for planning efforts to reduce GHG emissions, such as a general plan or greenhouse gas reduction plan.

This report was developed as part of a grant provided to the City of Bakersfield by the US Environmental Protection Agency (EPA) as part of the Climate Pollution Reduction Grants program. The grant was provided to support climate pollution reduction planning in the Bakersfield Metropolitan Statistical Area, which includes the entirety of Kern county. Under this grant, funding was allocated to produce GHG emissions inventories and forecasts for each of the 12 jurisdictions in Kern county, including the City of Bakersfield, unincorporated Kern County, and all incorporated cities. These GHG emissions inventories and forecasts will be provided to the subject jurisdiction, the San Joaquin Valley Air Pollution Control District, and Kern Council of Governments (Kern COG).

The GHG emissions inventory and forecast are intended to provide an accounting of GHG emissions generating activities within the City of Tehachapi geographical boundary for the year 2022, and projections of future emissions based on countywide growth patterns and the effects of adopted state and federal legislation and regulations. This report is accompanied by an Excel-based tool used to develop the GHG emissions inventory, the EPA *Local Greenhouse Gas Inventory Tool: Community Module version 2025.1* (the EPA Local GHG Inventory Tool). The GHG emissions inventory uses only publicly available data sets, many of which provide countywide estimates of GHG emissions generating activity, such as mobile on-road travel, energy consumption, and fertilizer use. This countywide data was scaled down to the jurisdiction level based on various attribution metrics, including population, commercial building floor space, and acres of agricultural use. GHG emissions were then forecasted using countywide growth projections for vehicle travel, population, and employment.

Because countywide data was used and scaled using attribution metrics, rather than jurisdiction-specific data, the GHG emissions inventory and forecast are intended to provide a general scale of GHG emissions for City of Tehachapi's contribution to countywide GHG emissions and serve as a starting point for more detailed GHG emissions analyses. The Excel-based tool can be updated with more locally specific and operational data that can be obtained from relevant departments and direct requests to utility providers. GHG emissions forecasts can be replicated using more locally specific growth projections for population and employment. The results can also be used to set local GHG reduction targets and develop and quantify locally specific measures for reducing GHG emissions. Sufficient detail is provided in this report to ensure that the analyses are replicable, and data inputs can be replaced with more detailed data, if desired.

2 SUMMARY RESULTS

This section presents the results of the GHG emissions inventory and forecast for the City of Tehachapi, providing a comprehensive overview of historical (2022 as the inventory year) and projected (2030, 2040, and 2045 as the forecast years) emissions. The results are organized by emissions sources, including stationary energy, electricity, Mobile On-road, wastewater, solid waste, and others, as well as by sectors, including residential, commercial/institutional, industrial, and agricultural.

This breakdown enables an understanding of the emissions sources and sectors that contribute most significantly to the City of Tehachapi's overall emissions. Section 3 of this report provides additional context and methodology related to each emissions source and sector, including key assumptions, data sources, and allocation methods used in the inventory and forecast development.

2.1 2022 GREENHOUSE GAS EMISSIONS INVENTORY RESULTS

Table 1 below shows the 2022 GHG emissions inventory results for the City of Tehachapi, categorized by emissions sources and sectors. Figure 1 shows the inventory categorized by emission sources, while Figure 2 shows the inventory categorized by emission sectors.

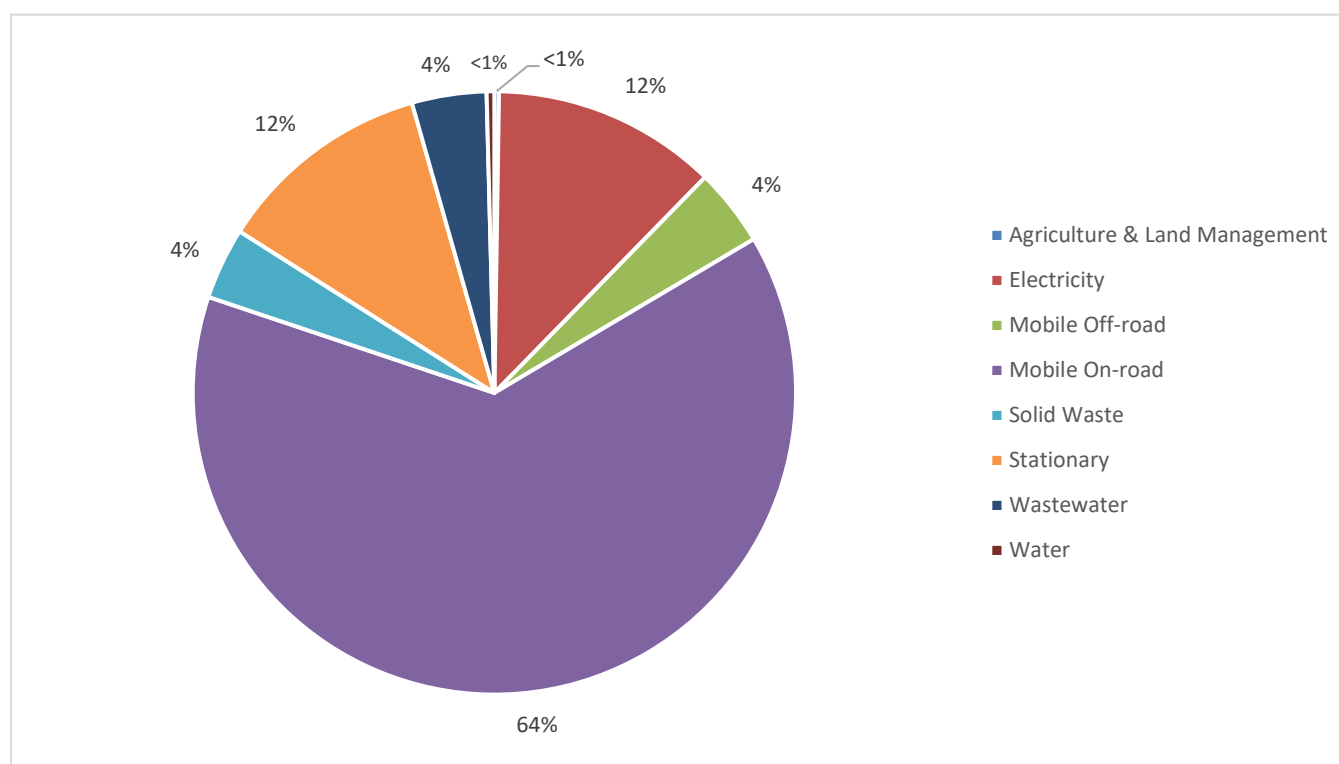
Table 1 City of Tehachapi 2022 GHG Emissions Inventory Results (MTCO₂e)

Emissions Sources	Emissions Sectors				
	Agricultural	Commercial/Institutional	Industrial	Residential	Total
Agriculture & Land Management	490	—	—	—	490
Electricity	—	2,217	—	6,281	8,498
Mobile Off-road	255	2,831	—	—	3,086
Mobile On-road	—	25,987	—	19,130	45,116
Solid Waste	—	—	—	2,596	2,596
Stationary Energy	—	3,907	—	4,293	8,200
Wastewater	—	2,800	—	—	2,800
Water	405	146	—	—	551
Total	1,150	37,888	—	32,300	71,337

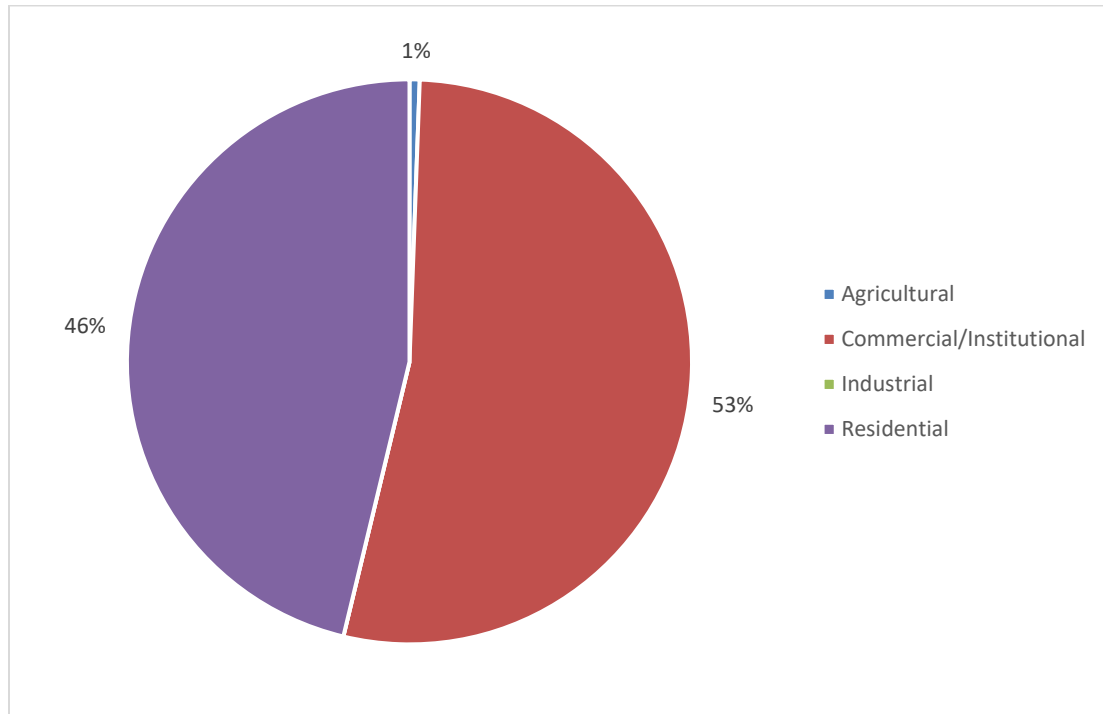
Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 1 City of Tehachapi 2022 GHG Emissions Inventory by Emissions Sources



Source: Analysis conducted by Ascent in 2025.

Figure 2 City of Tehachapi 2022 GHG Emissions Inventory by Emissions Sectors

Note: The City of Tehachapi had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure. Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

2.2 GREENHOUSE GAS EMISSIONS FORECAST RESULTS

Table 2 below shows the projected future GHG emissions for the City of Tehachapi for the forecast years 2030, 2040 and 2045 under both a business-as-usual (BAU) scenario, as well as a legislative-adjusted BAU (ABAU) scenario, broken down by both emissions sources and sector. The BAU GHG emissions forecasts estimate how community-generated emissions would change over time without additional actions at the State, federal, regional, or local levels, based solely on projected population and employment growth. The ABAU forecasts incorporate the effects of adopted State and federal policies, such as vehicle fuel efficiency standards and increased renewable energy in the electricity grid, but assume no additional local measures.

Table 2 City of Tehachapi Greenhouse Gas Emissions Forecast for 2030, 2040 and 2045 by Emissions Source and Sector (MTCO_{2e})

Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Stationary Energy	Residential	7,752	7,651	8,120	7,912	8,229	7,990
Stationary Energy	Commercial/Institutional	6,802	6,802	7,354	7,354	7,634	7,634
Stationary Energy	Industrial	—	—	—	—	—	—
Electricity	Residential	11,397	9,203	11,937	1,211	12,099	—
Electricity	Commercial/Institutional	3,878	3,115	4,193	421	4,353	—
Electricity	Industrial	—	—	—	—	—	—
Other Industrial	Industrial	—	—	—	—	—	—
Agriculture – Fertilizer Application	Agricultural	301	301	301	301	301	301

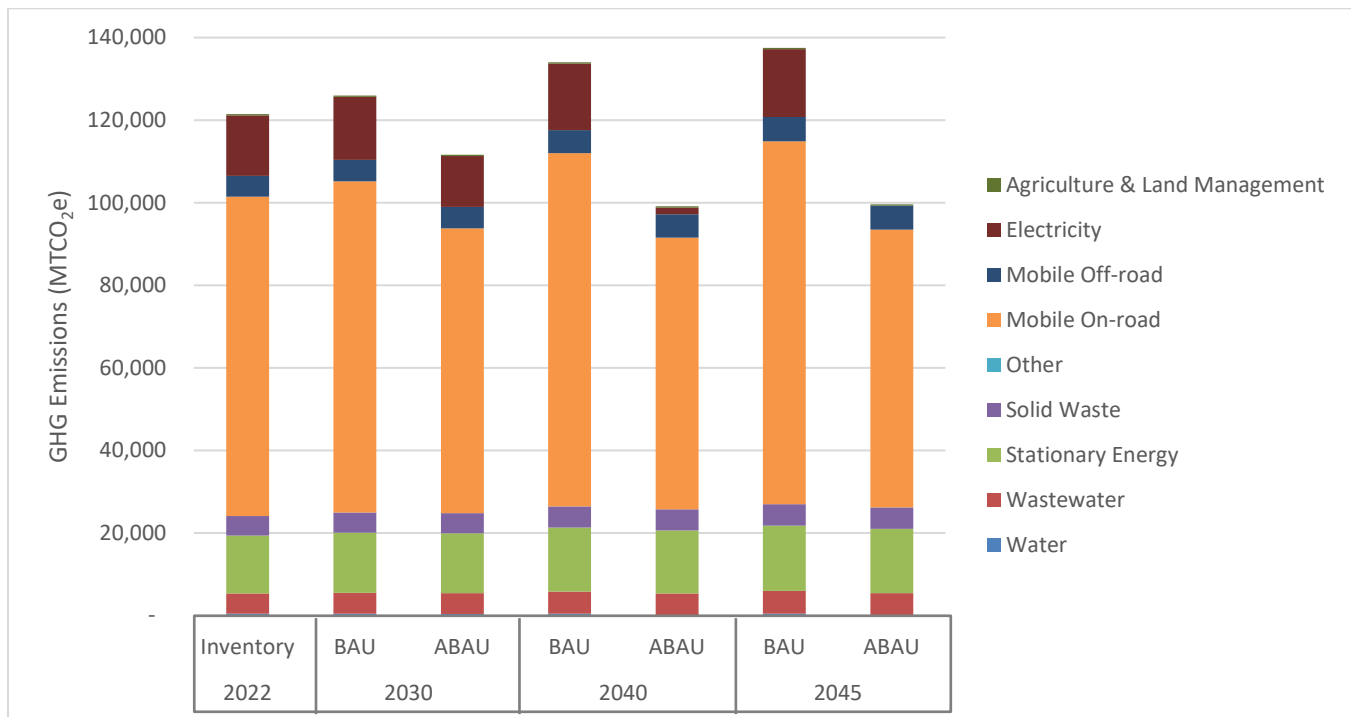
Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Solid Waste	Residential	4,884	4,884	5,115	5,115	5,185	5,185
Wastewater	Commercial/Institutional	5,058	5,058	5,345	5,345	5,455	5,455
Imported Water	Commercial/Institutional	264	212	279	28	284	—
Imported Water	Agricultural	248	199	248	25	248	—
Mobile On-road	Residential	34,714	28,225	36,361	26,238	36,853	26,138
Mobile On-road	Commercial/Institutional	45,465	40,791	49,158	39,567	51,031	41,091
Mobile Off-road	Commercial/Institutional	5,051	5,051	5,462	5,462	5,670	5,670
Mobile Off-road	Agricultural	157	157	157	157	157	157

Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 3 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Tehachapi's 2022 GHG emissions inventory for comparison, all categorized by emissions sources.

Figure 3 City of Tehachapi 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sources (MTCO₂e)

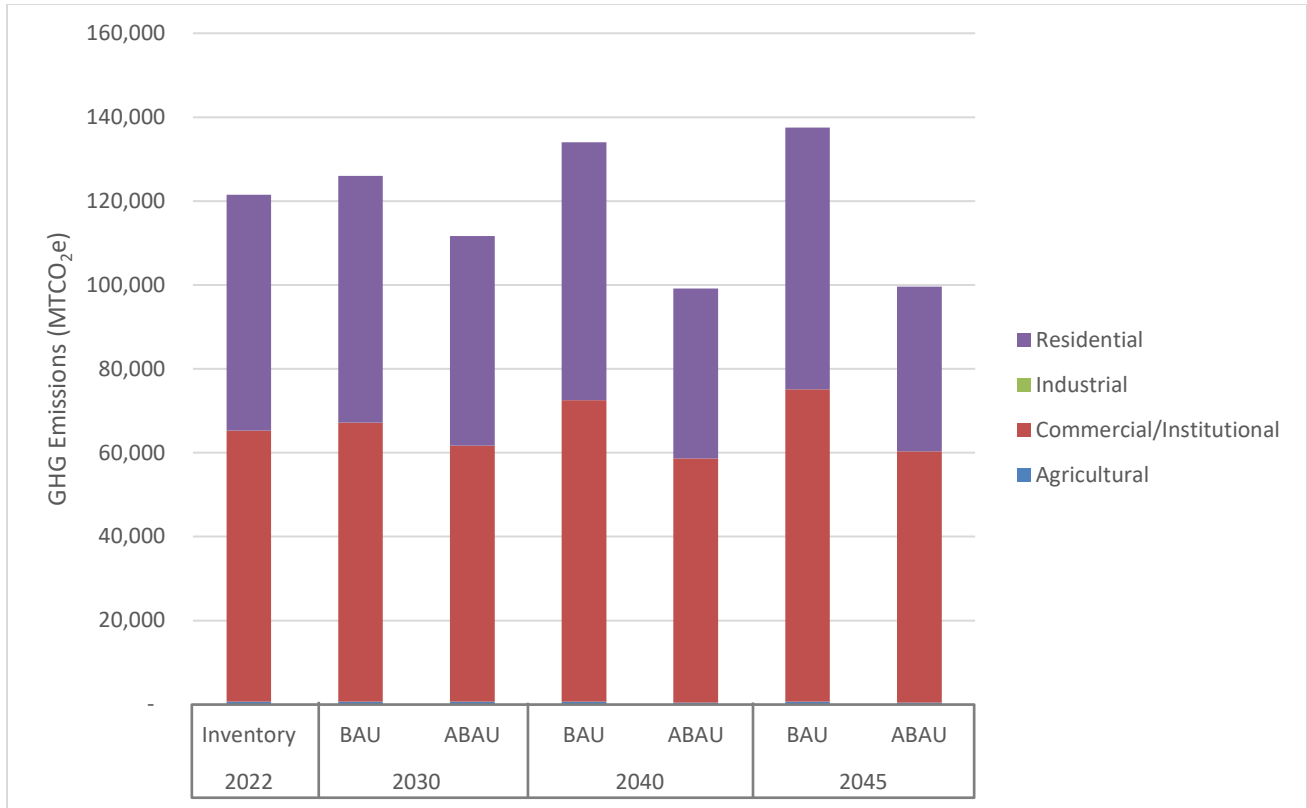


Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 4 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Tehachapi's 2022 GHG emissions inventory for comparison, all categorized by emissions sectors.

Figure 4 City of Tehachapi 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sectors (MTCO₂e)



Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent. The City of Tehachapi had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure. Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

3 GREENHOUSE GAS EMISSIONS INVENTORY METHODS

This section of the report details the methods used to develop the GHG emissions inventory for the City of Tehachapi. It includes descriptions of the data sources and data processing, and the inputs and outputs for the GHG emissions calculations. The methods are organized by GHG emissions sources (stationary energy, electricity, etc.) for the City of Tehachapi, based on the EPA Local GHG Inventory Tool.

The EPA Local GHG Inventory Tool was primarily used for GHG emissions calculations. Activity data (e.g., energy consumed, tons of waste landfilled, etc.) inputs for the City of Tehachapi were entered into the tool and parameters were set to represent local conditions (e.g., annual electricity consumption data was imported into the tool as the input to calculate City of Tehachapi’s GHG emissions associated with electricity, and the appropriate electricity grid was selected to represent local conditions). GHG emissions from on-road transportation were calculated externally to the EPA Local GHG Inventory Tool, due to data format inconsistencies. All other GHG emissions sources were calculated within, or entered into the tool. The tool also categorizes GHG emissions into different sectors: residential, commercial/institutional, industrial, and agricultural. Industrial and agricultural sectors were only used when explicitly differentiated in the available datasets. In all other cases, sector categorization followed the classifications provided by the EPA Local GHG Inventory Tool or as defined by the underlying data sources.

This report only documents data processing and calculations that were performed outside of the EPA Local GHG Inventory Tool and provides the GHG emissions outputs from the tool; it does not expand on the calculation methods

within the tool. Documentation for the EPA Local GHG Inventory Tool can be found on the EPA website at: <https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool>.

3.1 GREENHOUSE GASES AND GLOBAL WARMING POTENTIAL

GHG emissions other than carbon dioxide (CO₂) 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). CO₂ has a GWP factor of one, while all other GHGs have GWP factors measured in multiples of one relative to the GWP of CO₂. This conversion of non-CO₂ gases to one unit enables the reporting of all emissions in terms of carbon dioxide equivalent (CO₂e), 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 (MTCO₂e). For this emissions inventory and forecast, the three primary and most abundant GHGs were accounted for: CO₂, methane (CH₄) and nitrous oxide (N₂O).

Consistent with the best available science, the inventory uses GWP factors published in the Fifth Assessment Report (AR5) from Intergovernmental Panel on Climate Change (IPCC), where CH₄ and N₂O have GWP factors of 28 and 265, respectively (IPCC 2014). These values represent the GWP of GHG on a 100-year time horizon. This means that CH₄ is approximately 28 times stronger than CO₂ and N₂O is 265 times stronger than CO₂ in their potential to warm Earth's atmosphere over the course of 100 years. The use of 100-year GWP values is consistent with the California Air Resources Board (CARB) and EPA GHG accounting methods.

3.2 DATA REVIEW

The general approach for developing the GHG emissions inventory involved the collection of total activity and/or emissions data for Kern county for the year 2022 for each relevant GHG emissions source and then apportioning that data to individual jurisdictions and sectors using appropriate attribution metrics. These metrics include the City of Tehachapi's contribution to total countywide population, commercial building floor space, and agricultural land acreage. In some cases, such as for landfilled solid waste and industrial facilities, jurisdiction-specific data were available from publicly available resources.

The primary data sources used to compile activity and emissions data for all of Kern county are listed in Table 3.

Table 3 Data Sources for Countywide Activity and Emissions Data

GHG Emission Source	Data Source(s)
Mobile On-road	CARB EMFAC2021 on-road emission inventory model (CARB 2022a)
Mobile Off-road	CARB OFFROAD2021 off-road emission inventory model (CARB 2022b)
Stationary Energy	CEC energy database (CEC 2023), EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases
Electricity	CEC energy database (CEC 2022), Pacific Gas & Electric Co (PG&E)
Imported Water	Water Association of Kern County
Agriculture	CDFA's fertilizing materials tonnage report (CDFA 2025)
Other Industrial Sources	EPA FLIGHT database (EPA 2023)

Notes: CARB = California Air Resources Board; ; CDFA = California's Department of Food & Agriculture CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

Attribution metrics were used to apportion countywide activity and/or emissions data to individual jurisdictions by the appropriate GHG emissions sector. These attribution metrics include:

- population share for allocating activity associated with the residential sector (US Census Bureau 2025),

- ▶ commercial building floor space share for activity associated with the commercial/institutional sector (Open Energy Data Initiative 2020), and
- ▶ farmland, grazing land, and other agricultural land cover types share for the agricultural sector (DOC 2022).

These attribution metrics and the associated values for each jurisdiction in Kern county are shown in Table 4 below.

Table 4 Attribution Metrics Used to Apportion Countywide Activities and GHG Emissions

Jurisdiction	Population	Population %	Agricultural Land Acreage	Agricultural Land Acreage %	Commercial Building Floor Space in Square Footage	Commercial Building Floor Space in Square Footage %
Tehachapi	19,613	2.2%	1,487	0.1%	1,400	0.9%
Bakersfield	404,321	44.6%	41,684	1.5%	79,800	50.7%
California City	15,002	1.7%	112	0.0%	1,000	0.6%
Delano	50,498	5.6%	4,141	0.2%	5,800	3.7%
Maricopa	1,217	0.1%	558	0.0%	—	0.0%
McFarland	13,971	1.5%	2,754	0.1%	600	0.4%
Ridgecrest	28,118	3.1%	62	0.0%	4,000	2.5%
Shafter	20,162	2.2%	19,419	0.7%	10,700	6.8%
Taft	7,414	0.8%	4,507	0.2%	1,000	0.6%
Tehachapi	12,855	1.4%	2,764	0.1%	1,700	1.1%
Wasco	26,317	2.9%	3,421	0.1%	1,800	1.1%
Unincorporated County	307,395	33.9%	2,666,205	97.1%	49,700	31.6%
Kern County Total	906,883	100%	2,747,115	100%	157,500	100%

Note: Population and agricultural land acreage data reflect conditions in 2022. The most recent data available for commercial building floor space was from 2019, which was used as the attribution metric in this analysis. Because the calculations relied on percentage shares rather than absolute floor space values, using 2019 data was considered appropriate for consistency across jurisdictions.

Sources: US Census Bureau 2025; DOC 2022; Open Energy Data Initiative 2020; analysis conducted by Ascent in 2025.

For the wastewater and solid waste emissions sources, as well as the industrial emissions sector, data and information were collected at the jurisdiction level to calculate associated GHG emissions.

For wastewater, jurisdiction-specific data were obtained from a variety of sources, including any publicly available data about wastewater treatment plant operations. When such data were not publicly available, default values from the EPA Local GHG Inventory Tool and the Local Governments for Sustainability *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* were used to fill data gaps.

For solid waste, jurisdiction-specific disposal data were sourced from the California Department of Resources Recycling and Recovery (CalRecycle), specifically from the Jurisdiction Disposal and Beneficial Reuse by Destination database.

For the industrial emissions sector, jurisdiction-specific emissions data were also obtained directly from the EPA FLIGHT and CARB MRR databases, which report facility-level emissions for large industrial sources.

Data sources for jurisdiction-specific activity and emissions data are shown in Table 5 below.

Table 5 Data Sources for Jurisdiction-Specific Activity and Emissions Data

GHG Emission Source/Sector	Data Source(s)
Wastewater	ICLEI (ICLEI 2019)
Solid Waste	CalRecycle's Jurisdiction Disposal and Beneficial Reuse by Destination database (CalRecycle 2025), EPA FLIGHT database (EPA 2023)

GHG Emission Source/Sector	Data Source(s)
Industrial Sector	EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases

Notes: ICLEI = Local Governments for Sustainability; CalRecycle = California Department of Resources Recycling and Recovery; CARB = California Air Resources Board; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

3.3 INVENTORY METHODS BY GHG EMISSIONS SOURCE

This section details the data and methods used to calculate GHG emissions in the 2022 inventory, organized by emissions source. It presents the corresponding data inputs into the EPA Local GHG Inventory Tool, any data processing that was performed, and the resulting emissions estimates by source and sector for the City of Tehachapi. All calculations of GHG emissions use the IPCC AR5 GWP values to convert GHG emissions results to CO₂e.

3.3.1 Mobile On-road

The Mobile On-road 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." The estimation of these emissions relies on EMFAC2021, a statewide mobile source emissions inventory model developed by CARB. EMFAC2021 was used instead of the EPA Local GHG Inventory Tool to calculate mobile on-road GHG emissions because EMFAC2021 provides GHG emissions estimates that more closely represent the vehicle fleet operating on roadways in Kern County. The EPA Local GHG Inventory Tool utilizes national fuel efficiency averages for a select number of vehicle types to calculate GHG emissions, whereas EMFAC2021 considers fuel efficiency by vehicle type and model, providing more accurate estimates of fuel consumption and GHG emissions.

To calculate emissions for the 2022 inventory year, total countywide vehicle miles traveled (VMT) were first obtained from EMFAC2021. These VMT figures were then allocated to emission sectors defined by the EPA's Local GHG Inventory Tool based on vehicle class, specifically, the residential and commercial/institutional sectors. For the purposes of sector-specific emissions calculations, light-duty vehicles were attributed to the residential sector, as they primarily reflect personal vehicle use by residents. In contrast, medium- and heavy-duty trucks were attributed to the commercial/institutional sector, as these vehicle types are more commonly associated with goods movement, service fleets, and business operations. Sector-specific VMT totals were then apportioned to each jurisdiction based on appropriate attribution metrics: population share for residential VMT and commercial building square footage share for commercial/institutional VMT.

EMFAC2021 was also used to generate countywide GHG emissions factors for the two sectors, expressed in MTCO₂e per vehicle mile traveled. These factors accounted for all vehicle classes, model years, speeds, and fuel types. The sector-specific factors were derived by dividing total countywide emissions of CO₂, CH₄, and N₂O (converted to CO₂e using the appropriate GWP) by the corresponding sector-specific countywide total VMT, with emissions and VMT categorized into the residential and commercial/institutional sectors based on vehicle class.

Finally, each jurisdiction's total Mobile On-road emissions by sector were calculated by multiplying the jurisdiction's sector-specific VMT by the respective countywide sector-specific MTCO₂e per VMT emissions factors. Table 6 presents the City of Tehachapi's total Mobile On-road VMT, associated sector-specific GHG emissions factors, and the resulting total GHG emissions by sector.

Table 6 City of Tehachapi Mobile On-road Data Inputs and Results

Vehicle Sector	Total Activity (VMT)	GHG Emissions Factor (MTCO ₂ e/VMT)	GHG Emissions (MTCO ₂ e)
Residential	103,108,078	0.00035	33,169
Commercial/Institutional	44,086,439	0.0011	44,177

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: CARB 2022a; analysis conducted by Ascent in 2025.

3.3.2 Mobile Off-road

Emissions from Mobile Off-road sources result from the combustion of fuel in various types of off-road vehicles and equipment (e.g. agricultural tractors, construction equipment). Emissions data for these sources were obtained from CARB's OFFROAD2021 model, which provides detailed estimates for Kern county for the 2022 inventory year. The data include, but are not limited to, information on equipment categories, fuel types, and the amount of fuel consumed.

Using the off-road vehicle categories in OFFROAD2021, the emissions data were organized into two relevant sectors defined by the EPA Local GHG Inventory Tool: agricultural and commercial/institutional. Sector-specific off-road fuel consumption totals were then apportioned to each jurisdiction using appropriate attribution metrics. Specifically, the share of farmland, grazing land, and other agricultural land was used to allocate agricultural emissions, while the commercial building square footage share was used to distribute commercial/institutional emissions.

Finally, each jurisdiction's sector-specific off-road fuel consumption data were entered into the "Mobile-Data" sheet of the EPA Local GHG Inventory Tool to calculate Mobile Off-road emissions. The EPA Local GHG Inventory Tool includes emissions factors by fuel type. Table 7 presents the City of Tehachapi's total Mobile Off-road fuel consumption by fuel type and the resulting total GHG emissions by sector.

Table 7 City of Tehachapi Mobile Off-road Data Inputs and Results

Vehicle Sector	Diesel Consumption (gallons)	Gasoline Consumption (gallons)	Liquefied Natural Gas (LNG) Consumption (gallons)	Total Fuel Consumption (gallons)	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	338,198	147,966	8,165	494,329	4,908
Agricultural	14,628	270	—	14,898	157

Notes: GHG = greenhouse Gas; LNG = liquefied natural gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CARB 2022b, analysis conducted by Ascent in 2025.

3.3.3 Stationary Energy

The stationary energy source of GHG emissions includes natural gas combustion in residential, commercial/institutional and industrial uses. Residential uses primarily consume natural gas for space and water heating, and cooking. Commercial/institutional uses may include space heating and cooling, cooking in restaurants, and smaller boilers or generators. Industrial uses are often process-specific uses tied to manufacturing or heavy operations such as process heating, steam generation, and boiler systems. Propane fuel usage was not included in the stationary energy-related calculations as propane usage data for these various uses was not available at the same level of detail or consistency as other stationary energy data sources at the county scale.

RESIDENTIAL AND COMMERCIAL/INSTITUTIONAL

Total countywide natural gas usage data for the 2022 inventory year was obtained from the CEC Energy Reports: Gas Consumption by County, which categorizes usage into residential and non-residential sectors. Residential natural gas consumption was allocated to each jurisdiction based on its share of the county's population.

To isolate commercial/institutional usage, countywide industrial natural gas consumption, sourced from the EPA FLIGHT database and CARB MRR database, was subtracted from the CEC total non-residential usage. The resulting commercial/institutional natural gas usage was then apportioned to each jurisdiction using commercial building floor space share as the attribution metric.

Finally, each jurisdiction's residential and commercial/institutional natural gas usage data were entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate residential and commercial/institutional stationary energy emissions. Table 8 below shows the City of Tehachapi's total stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions in residential and commercial/institutional sectors.

Table 8 City of Tehachapi Residential and Commercial/Institutional Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Residential	135,380	7,444
Commercial/Institutional	120,796	6,642

Notes: mcf = thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

INDUSTRIAL

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the City of Tehachapi. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

For the City of Tehachapi, the databases showed that no large industrial facilities are located within its geographic boundary, therefore, there is no reported industrial stationary energy associated activity or GHG emissions for the City of Tehachapi.

3.3.4 Electricity

The electricity source addresses energy-related indirect GHG emissions resulting from the consumption of grid-supplied electricity within the City of Tehachapi's boundary. Consumption of grid-supplied electricity is considered an "indirect" GHG emissions source, because GHG emissions occur at the source of electricity generation, which is usually outside of a jurisdiction's boundary. The location-based method was used to calculate electricity GHG emissions, which uses regional grid-average emission factors. In the United States, these factors are provided by the EPA's Emissions & Generation Resource Integrated Database (eGRID). Specifically, emission factors for the CAMX eGRID subregion were applied, as this subregion encompasses the geographic area of Kern county.

Total electricity usage data for Kern county in 2022 was obtained from CEC Energy Reports: Electricity by County, which categorized usage into residential and non-residential sectors (CEC 2023). Electricity usage data for the City of Bakersfield, which was also separated into residential and non-residential categories, was acquired directly from the Pacific Gas and Electric Company (PG&E). To estimate electricity usage for the rest of the county (i.e., all jurisdictions excluding Bakersfield), the City of Bakersfield's electricity data was subtracted from the total Kern county data.

Residential electricity usage outside of Bakersfield was apportioned to each jurisdiction based on its share of the county's total population. For non-residential electricity usage, estimates were further categorized into industrial and commercial/institutional sectors using attribution metrics derived from natural gas consumption data previously calculated under stationary energy. In 2022, 93.1 percent of the county's stationary natural gas combustion was attributed to industrial use and 6.9 percent to commercial/institutional use. These same ratios were applied to the county's total non-residential electricity usage, under the assumption that the sectoral split in electricity usage mirrors that of natural gas usage. This assumption was validated using available industrial electricity and natural gas usage data in PG&E's service territory, from the CEC Energy Reports. The electricity-to-gas ratio, expressed as gigawatt-hour per million therms, was calculated by dividing total industrial electricity usage by industrial natural gas consumption for the service territory. The resulting value closely aligns with the assumptions applied in this here, supporting its validity.

The City of Tehachapi's share of commercial building square footage was used to attribute commercial/institutional electricity usage. Industrial electricity usage was attributed based on the proportion of countywide industrial natural gas within the City of Tehachapi. No industrial facilities exist in the City of Tehachapi; therefore, no industrial electricity usage is attributed to the City of Tehachapi. Finally, the sector-specific electricity usage data for each jurisdiction was entered into the "Electricity-Data" sheet of the EPA Local GHG Inventory Tool to calculate associated GHG emissions.

Table 9 below shows the City of Tehachapi's electricity activity data and the associated GHG emissions by emission sectors.

Table 9 City of Tehachapi Electricity Energy Data Inputs and Results

Sector	Total Activity (kWh of Electricity Consumed)	GHG Emissions (MTCO ₂ e)
Residential	48,080,733	10,890
Commercial/Institutional	16,639,583	3,769
Industrial	—	—

Notes: kWh = kilowatt-hour; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; PG&E 2025; analysis conducted by Ascent in 2025.

3.3.5 Imported Water

The water source category captures GHG emissions from energy use associated with the conveyance, treatment, and distribution of water within a jurisdiction. In Kern county, the WAKC reports that approximately 166,000 acre-feet of water are used annually for municipal and industrial purposes, and 2,294,000 acre-feet for agricultural purposes.

In addition to local surface water, Kern county draws water from several sources. Among these, only water supplied through the State Water Project (SWP) and the federal Central Valley Project (CVP) is considered imported, and therefore potentially results in GHG emissions due to long-distance conveyance. All other sources are classified as local. It was assumed that energy used for extracting, conveying, treating, and distributing local water is captured under the emissions estimates for stationary energy and electricity, since these activities occur within the county. In addition, upon further review, it was also determined that the federal CVP does not consume energy for water delivery to Kern County, as water is primarily conveyed using gravity (Friant Water Authority 2019). As a result, only the SWP, which accounts for 26 percent of the county's water supply, contributes to GHG emissions. Table 10 provides a summary of the water sources in Kern county and their contribution to the total water supply.

Table 10 Kern County Water Sources

Source	Percentage
Kern River	20%
State Water Project (California Aqueduct)	26%
Federal Central Valley Project (Friant-Kern Canal)	12%
Local Streams and Other Sources (Poso Creek, Kern River, etc.)	6%
Groundwater	36%
Total	100%

Source: WAKC n.d.

Water use in Kern County is characterized into municipal and industrial, and agricultural sectors in data obtained from WAKC. It is assumed that water included in "municipal" uses is delivered to both commercial and residential customers. However, sufficient data was not available to disaggregate the water consumption between industrial, commercial, and residential customers. For the purpose of this GHG emissions inventory, all non-agricultural water consumption was categorized under the commercial/institutional sector.

To allocate sector-specific water usage to individual jurisdictions, the following attribution metrics were used:

- ▶ Agricultural water use was apportioned based on each jurisdiction's share of farmland, grazing land, and other agricultural land.
- ▶ Commercial/institutional water use was distributed according to the share of commercial building square footage in each jurisdiction.

These apportioned figures were then entered into the “Imported Water” sheet of the EPA Local GHG Inventory Tool, applying a universal 26 percent imported water rate, to estimate the associated GHG emissions from water conveyance and use. Table 11 presents the City of Tehachapi’s activity data related to imported water, including the percentage of total water supply that is imported and the associated GHG emissions.

Table 11 City of Tehachapi Imported Water Energy Data Inputs and Results

Sector	Total Activity (Gallons of Water)	Percentage of Water Imported	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	199,352,329	26%	253
Agricultural	195,557,411		248

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: WAKC n.d.; analysis conducted by Ascent in 2025.

3.3.6 Wastewater

The wastewater source accounts for GHG emissions resulting from the treatment of sewage. To support this analysis, a review of publicly available wastewater treatment characteristics was conducted to collect the data required for completing the “Wastewater-Control” tab of the EPA’s Local GHG Inventory Tool. The data sources and corresponding assumptions for the City of Tehachapi’s wastewater treatment systems are summarized in Table 12. Where jurisdiction-specific data were not publicly available, the default input values provided by the EPA tool were used.

To estimate GHG emissions, population data for each jurisdiction were subsequently entered into the “Wastewater-Entry” tab of the tool. The resulting emissions estimates are also presented in Table 12, alongside the data sources and assumptions used.

Table 12 City of Tehachapi Wastewater Treatment Assumptions

Wastewater Process/Treatment Type	Conditions Assumed	Data Source	GHG Emissions (MTCO ₂ e)
Population served by septic systems	5 percent of the city’s population	ICLEI’s default proportion of population that utilizes septic tanks for an urban area (Box WW.11(alt).2).	4,855
One or more wastewater treatment plants (WWTPs) where wastewater is treated in aerobic or anaerobic conditions	Anerobic	No public information is available. The default value is anerobic.	
One or more WWTPs conduct or do not conduct nitrification/denitrification	Nitrification	Obtained from the Central Valley Regional Water Quality Control Board.	

Notes: WWTP = wastewater treatment plant; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; ICLEI = Local Governments for Sustainability.

Sources: ICLEI 2019; analysis conducted by Ascent in 2025.

3.3.7 Solid Waste

Community-generated solid waste emissions are primarily associated with the decomposition of solid waste in landfills. There are two methods for accounting for GHG emissions associated with waste disposal:

- ▶ Waste generation method – Accounts for the total GHG emissions that would be generated over time as municipal solid waste (MSW) that is sent to a landfill in only the inventory year decomposes.
- ▶ Waste-in-place method – Accounts for the total GHG emissions generated in a given year at a specific landfill location by the decomposition of all MSW previously disposed at the landfill.

Generally, there is some risk of double counting GHG emissions when combining both of these methods, as a portion of the emissions accounted for using the waste generation method may occur at an in-boundary landfill that has emissions reported using the waste-in-place method. However, the scale of the overlapping GHG emissions between the two methods would be expected as very small in comparison to total emission using either accounting method.

WASTE GENERATION

Landfill tonnage data for 2022 was obtained from CalRecycle’s Jurisdiction Disposal and Beneficial Reuse by Destination database. This data was entered into the EPA’s Waste Reduction Model (WARM Tool) as “mixed MSW” to estimate waste generation emissions. The default national average values were used in the WARM Tool, except for Question 7, where the k value was set to “dry” based on the county’s annual precipitation (less than 20 inches) (NCEI 2025). The WARM output was then imported into the EPA Local GHG Inventory Tool’s “Waste Production” tab, with solid-waste associated emissions attributed to the residential sector by default.

The total activity for solid waste disposal and the resulting waste generation GHG emissions results from the WARM Tool are provided in Table 13.

Table 13 City of Tehachapi Waste Generation Data Inputs and Results

Sector	Total Activity (tons of MSW disposed)	GHG Emissions (MTCO ₂ e) (WARM Output)
Residential	16,168	4,667

Notes: MSW = mixed municipal solid waste; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; WARM = Waste Reduction Model.

Source: CalRecycle 2025; analysis conducted by Ascent in 2025.

WASTE-IN-PLACE

EPA’s FLIGHT database was reviewed to determine emissions from landfills located within the City of Tehachapi’s geopolitical boundary, which would provide emissions data for any landfills that generated emissions greater than 25,000 MTCO₂e in 2022. No reporting landfills were identified for the City of Tehachapi.

3.3.8 Agriculture

The agriculture emissions source captures GHG emissions generated from fertilizer application.

FERTILIZER APPLICATION

Fertilizer application results in GHG emissions primarily due to the release of N₂O, a potent GHG with a global warming potential nearly 300 times greater than CO₂. When nitrogen-based fertilizers are applied to soil, a portion of the nitrogen undergoes microbial processes (nitrification and denitrification), which convert it into N₂O. These emissions can occur directly from the soil or indirectly through leaching and runoff

The total tonnage of nitrogen in synthetic fertilizers applied in Kern county during the 2022 inventory year was obtained from CDFA’s fertilizing materials tonnage report. This countywide total was then apportioned to individual jurisdictions based on each jurisdiction’s proportional share of farmland, grazing land, and other agricultural land. Only data for synthetic fertilizers was publicly available for calculation, although other organic or manure-based fertilizers may be used.

The resulting tonnage of nitrogen in synthetic fertilizers estimated for the City of Tehachapi was entered into the “Agriculture & Land Management” sheet of the EPA’s Local GHG Inventory Tool to calculate the associated emissions. Table 14 provides the estimated total tons of nitrogen applied and resulting GHG emissions.

Table 14 City of Tehachapi Fertilizer Application Data Inputs and Results

Sector	Total Activity (tons of nitrogen applied)	GHG Emissions (MTCO ₂ e)
Agricultural	42	301

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CDFA 2025; analysis conducted by Ascent in 2025.

4 GREENHOUSE GAS EMISSIONS FORECAST METHODS

This section provides the methods and data used to project future GHG emissions under a BAU scenario, as well as the calculations of reductions from adopted legislation and regulations under an ABAU scenario.

The BAU GHG emissions forecasts assess how emissions generated by community activities will change over time without further State, federal, regional, or local action. The BAU scenario forecast accounts for the changes in population and employment that can influence communitywide GHG emissions. The ABAU scenario forecast includes adopted policies and regulations at the State and federal levels that would affect emissions without any local action, such as regulatory requirements to increase vehicle fuel efficiency and increase renewable energy sources in grid electricity portfolios. These forecasts provide the City of Tehachapi with information needed to understand specific GHG emissions sources with the greatest opportunities for reduction with future plans, projects, or programs. It is important to note that the ABAU forecasts only account for emissions reductions associated with adopted policies and regulations; they do not account for proposed and/or unadopted GHG reduction actions established by regional, State, and federal agencies or executive orders outside of adopted legislation and regulations.

The GHG emissions forecasts project GHG emissions for the years 2030, 2040, and 2045 to align with key regulatory timelines for the State. Two key legislative actions establish statewide GHG reduction targets for the years 2030 and 2045, including:

- ▶ Senate Bill (SB) 32 of 2016, which sets a statewide GHG reduction target for the year 2030, and
- ▶ Assembly Bill 1279 of 2022, which sets a statewide GHG reduction target for the year 2045.

The forecast years selected do not necessarily align with the targets established by adopted legislation, but they do provide an analysis of emissions that aligns with the relevant horizon years. The year 2040 was also included in the analysis as an interim year between the 2030 and 2045 forecast years.

4.1 GROWTH PROJECTIONS

GHG emissions forecasts were developed based on projected changes in Kern county's demographics, specifically population, employment, and service population (defined as residents plus employees), between 2022 and 2045. These projections were obtained from the Regional Growth Forecast and Demographic Forecast prepared by the Kern COG (Kern COG 2024). It is assumed that the incorporated cities and the unincorporated county will experience demographic growth at the same rate as the county overall, as jurisdiction-specific growth projections were not available at the time of this analysis.

Between 2022 and 2045, Kern county's population and employment are projected to increase by approximately 11.1 and 15.5 percent, respectively. The service population is expected to grow by 12.4 percent. These growth factors were applied to forecast GHG emissions for the years 2030, 2040, and 2045 across various emissions sources included in the inventory. The values used for population, employment, and service population used to project future emissions are provided in Table 15.

Table 15 Kern County Demographics and Calculated Growth Rates for Future Emissions Forecasts

Calculation Factor	2022	2030	2040	2045
Population				
Total Kern County	906,883	949,134	994,167	1,007,627
Kern County Growth from 2022		4.7%	9.6%	11.1%
Employment				
Total Kern County	358,961	369,427	399,432	414,652
Kern County Growth from 2022		2.9%	11.3%	15.5%
Service Population				
Total Kern County	1,265,844	1,318,561	1,393,598	1,422,279
Kern County Growth from 2022		4.2%	10.1%	12.4%

Source: US Census Bureau 2025; Kern COG 2024; analysis conducted by Ascent in 2025.

Additional details on how growth factors were applied to individual sources are provided in the following sections. It is important to note that agricultural emissions, including those from fertilizer application, as well as livestock enteric fermentation and manure management, are assumed to remain constant throughout the forecast period, with no projected increase in activity levels. Agricultural activities are difficult to project in any detail, with production intensities, number of livestock, and crop types being highly susceptible to global markets and local climate patterns. As such, projections of agriculture GHG emissions-generating activities are not attempted.

4.2 BUSINESS-AS-USUAL SCENARIO FORECAST

The BAU forecast represents a projection of future GHG emissions based solely on expected demographic and economic growth (e.g., population, employment, and service population) between 2022 and 2045. It does not account for the potential impacts of future policies, programs, or actions that may reduce emissions, such as energy efficiency improvements, renewable energy adoption, or transportation electrification.

In the BAU scenario, GHG emissions factors are held constant at the levels used in the 2022 GHG inventory, meaning the carbon intensity of electricity, fuels, and other activities is assumed not to change over time. As a result, any changes in future emissions are driven entirely by growth in activity levels, not by improvements in emissions performance.

4.2.1 Business-As-Usual Scenario Forecast Results

Table 16 presents the projected activity data for the City of Tehachapi across all forecast years, organized by emissions source and sector. Table 16 also indicates which sources and sectors used population, employment, or service population as a growth metric.

Table 16 City of Tehachapi BAU Scenario Projected Activity Data for All Forecast Years

Source	Sector	Growth Metric	Units	2030	2040	2045
Stationary Energy	Residential	Population	scf	141,687	148,409	150,419
Stationary Energy	Commercial/Institutional	Employment	scf	124,318	134,415	139,537
Stationary Energy	Industrial	Employment	scf	—	—	—
Electricity	Residential	Population	kWh	50,320,767	52,708,297	53,421,924
Electricity	Commercial/Institutional	Employment	kWh	17,124,751	18,515,601	19,221,149
Electricity	Industrial	Employment	kWh	—	—	—
Other Industrial	Industrial	Employment	MTCO ₂ e	—	—	—

Source	Sector	Growth Metric	Units	2030	2040	2045
Agriculture – Fertilizer Application	Agricultural ¹	N/A	ton	42	42	42
Solid Waste	Residential	Population	ton	16,922	17,724	17,964
Wastewater	Commercial/Institutional	Service Population	MTCO ₂ e	5,058	5,345	5,455
Imported Water	Commercial/Institutional	Service Population	Gallon	207,654,534	219,471,820	223,988,636
Imported Water	Agricultural ¹	N/A	Gallon	195,557,411	195,557,411	195,557,411
Mobile On-road	Residential	Population	VMT	107,911,783	113,031,788	114,562,146
Mobile On-road	Commercial/Institutional	Employment	VMT	45,371,888	49,056,933	50,926,278
Mobile Off-road	Commercial/Institutional	Employment	MTCO ₂ e	5,051	5,462	5,670
Mobile Off-road	Agricultural ¹	N/A	MTCO ₂ e	157	157	157

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; scf = standard cubic foot.

¹ Activity levels for the agricultural sector are assumed to remain constant over the forecast period; therefore, growth metrics are listed as “N/A.”

Source: Analysis conducted by Ascent in 2025.

Table 17 below presents the projected GHG emissions for the City of Tehachapi across all forecast years, also organized by emissions source and sector.

Table 17 City of Tehachapi BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	7,752	8,120	8,229
Stationary Energy	Commercial/Institutional	MTCO ₂ e	6,802	7,354	7,634
Stationary Energy	Industrial	MTCO ₂ e	—	—	—
Electricity	Residential	MTCO ₂ e	11,397	11,937	12,099
Electricity	Commercial/Institutional	MTCO ₂ e	3,878	4,193	4,353
Electricity	Industrial	MTCO ₂ e	—	—	—
Other Industrial	Industrial	MTCO ₂ e	—	—	—
Agriculture – Fertilizer Application	Agricultural	MTCO ₂ e	301	301	301
Solid Waste	Residential	MTCO ₂ e	4,884	5,115	5,185
Wastewater	Commercial/Institutional	MTCO ₂ e	5,058	5,345	5,455
Imported Water	Commercial/Institutional	MTCO ₂ e	264	279	284
Imported Water	Agricultural	MTCO ₂ e	248	248	248
Mobile On-road	Residential	MTCO ₂ e	34,714	36,361	36,853
Mobile On-road	Commercial/Institutional	MTCO ₂ e	45,465	49,158	51,031
Mobile Off-road	Commercial/Institutional	MTCO ₂ e	5,051	5,462	5,670
Mobile Off-road	Agricultural	MTCO ₂ e	157	157	157

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

4.3 LEGISLATIVE-ADJUSTED BUSINESS-AS-USUAL SCENARIO FORECAST

ABAU emissions forecasts were prepared using the same demographic data that were used for the BAU forecasts, while also accounting for State and federal policies and regulations that would affect local emissions. These forecasts provide the City of Tehachapi with a more robust understanding of future community emissions based on the GHG reduction efforts at the state and federal level. A summary of applicable legislative reductions is provided in Table 18.

Table 18 Legislative Reductions Summary

Source	Legislative Reduction	Description	Sources Applied
State	Renewable Energy and Zero-Carbon Electricity Requirements [SB 1020 and SB 100]	Requires California energy utilities to procure 60 percent of electricity from eligible renewable and zero-carbon sources by 2030, 95 percent by 2040, and 100 percent by 2045.	Electricity, Imported Water
State	California's Building Energy Efficiency Standards (2019 and 2022 Title 24, Part 6)	Requires all new buildings in California to comply with energy efficiency standards established by CEC. Accounts for the energy efficiency gains in new residential and nonresidential buildings.	Stationary Energy, Electricity
State	Advanced Clean Car I Regulation	Establishes GHG emission reduction standards for model years 2017 through 2025 that are more stringent than federal CAFE standards.	Mobile On-road
State	Truck and Bus Regulation	Requires diesel trucks and buses that operate in California to be upgraded to reduce GHG emissions.	Mobile On-road
Federal	Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles	Establishes fuel efficiency standards for medium- and heavy-duty engines and vehicles.	Mobile On-road

Notes: CAFE = Corporate Average Fuel Economy; CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; SUV = sports utility vehicle; SB = Senate Bill.

4.3.1 Title 24 Adjustments

Future energy use was adjusted to reflect increased emissions-intensity stringency under California's Building Energy Efficiency Standards (California Code of Regulations Title 24 Part 6, hereafter referred to as "Title 24"). Although Title 24 applies to both new residential and nonresidential construction, for the purposes of this forecast, adjustments were applied only to residential construction for reasons described below.

This approach accounts for uncertainties in energy consumption patterns and end uses in nonresidential buildings, and uncertainty in the non-residential building types that would be constructed in the future. Title 24 primarily regulates energy efficiency in building envelopes and lighting systems. This is expected to substantially reduce energy consumption for building types where the primary end uses of energy are lighting and heating, ventilation, and air conditioning, such as new office, institutional, and hotel buildings. However, Title 24 may not significantly affect other high-energy-consuming uses in nonresidential facilities, such as process loads or specialized equipment. As such, limiting adjustments to residential construction provides a more conservative and reliable estimate of future energy-related GHG emissions.

The 2019 Title 24 standards apply to projects constructed after January 1, 2020, while the 2022 standards apply after January 1, 2023. The 2025 Title 24 will go into effect statewide in January of 2026; however, detailed data on the changes in building-level energy consumption between the 2025 code and previous code cycles was not available at the time of this analysis. To estimate changes in future energy consumption under the 2022 standards, electricity and natural gas adjustment factors were calculated based on differences in average residential energy use between buildings built to the 2019 and 2022 standards. These factors were derived from CEC's data specific to the 2019 and 2022 standards and climate zone-based energy usage rates. For the City of Tehachapi, Climate Zone 13 was used in the analysis.

These adjustment factors were then applied to the ABAU forecasts of energy consumption activity for both stationary energy and electricity use to reflect the impact of legislative energy efficiency improvements on future development.

The adjustment factors, presented in Table 19, show the percentage change in energy use for buildings built to 2022 standards relative to those built to 2019 standards. Positive values indicate an anticipated increase in energy use, while negative values indicate an anticipated decrease in energy use.

As shown in Table 19:

- ▶ ABAU electricity activity is projected to be higher than BAU in each forecast year due to positive adjustment factors.
- ▶ ABAU stationary energy activity is projected to be lower than BAU due to negative adjustment factors.

Importantly, these adjustments were applied only to energy use growth occurring after the 2022 baseline, reflecting new development that would be subject to the 2022 Title 24, or a later cycle of standards. In addition, it is important to note that although average electricity use in new residential buildings is anticipated to rise under 2022 Title 24 (due to an increase in electrical demand associated with electric appliances installed instead of natural gas appliances), emissions from new residential buildings are expected to be lower than they would be under 2019 Title 24 as a result of overall lower building emissions intensities (due to lower emissions factors associated with electricity compared to natural gas).

Table 19 Stationary Energy and Electricity Adjustment Factors and Activity Forecast Results for Residential Buildings

Energy Type	Forecast Scenario	Adjustment Factor	Activity Units	2022	2030	2040	2045
Electricity	BAU	—	kWh	48,080,733	50,320,767	52,708,297	53,421,924
Electricity	ABAU	+12%	kWh	48,080,733	50,588,650	53,261,701	54,060,670
Stationary Energy (Natural Gas)	BAU	—	mcf	135,380	141,687	148,409	150,419
Stationary Energy (Natural Gas)	ABAU	-29%	mcf	135,380	139,851	144,617	146,042

Notes: BAU = Business-as-Usual; ABAU = legislative-adjusted BAU; mcf = one thousand cubic feet; kWh = kilowatt-hour.

Source: Analysis conducted by Ascent in 2025.

4.3.2 Senate Bill 100 and Senate Bill 1020 Adjustments

SB 100 requires that 100 percent of retail electricity sales in California come from renewable and zero-carbon resources by 2045. This legislation builds upon the state's existing Renewables Portfolio Standard (RPS) by increasing the required percentage of RPS-eligible renewable electricity over time. SB 1020 builds on SB 100 by introducing interim targets for GHG-free electricity for the years 2035 and 2040. As shown in Table 20, SB 100 and SB 1020 require utility providers to supply electricity that is 60 percent GHG-free by 2030, 95 percent by 2040, and 100 percent by 2045. The emissions sources affected by these adjustments include electricity and imported water, both of which are estimated based on the carbon intensity of the electricity grid.

To estimate future GHG emissions factors, the 2022 GHG-free electricity percentage and GHG emissions factors for the CAMX eGRID subregion were first obtained from the EPA's eGRID database. Using these 2022 values as a baseline, emissions factors for the forecast years (2030, 2040, and 2045) were calculated based on the GHG-free electricity targets established by SB 100 and SB 1020.

Table 20 below demonstrates these GHG-free electricity percentage baseline values and targets, as well as the baseline and calculated emissions factors for the forecast years. Given 2045's 100 percent GHG-free electricity percentage target, the emissions factor for 2045 is 0. In contrast to the ABAU forecast, the CAMX eGRID emissions factors under the BAU scenario are assumed to remain constant at their 2022 baseline values throughout the forecast years.

Table 20 CAMX eGRID Electricity GHG Emissions Factors Adjusted for SB100 and SB1020

Calculation Factor	Units	2022	2030	2040	2045
SB 100 and SB 1020 GHG-free electricity percentage targets	Percent GHG-free	N/A	60%	95%	100%
CAMX eGRID GHG-free electricity percentage baseline and targets	Percent GHG-free	50%	60%	95%	100%
CAMX eGRID baseline and interpolated emissions factors	MTCO ₂ e/MWh	0.2265	0.1819	0.0227	0

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MWh = megawatt-hour; N/A = Not Applicable.

Source: Analysis conducted by Ascent in 2025.

4.3.3 On-road Vehicle Emissions Standards

State and federal regulations are expected to significantly reduce on-road GHG emissions by requiring improvements in vehicle fuel efficiency and accelerating the transition to zero-emission vehicles (ZEVs). The ABAU forecast for the Mobile On-road source takes into consideration the following State and federal regulations:

- ▶ Innovative Clean Transit Regulation, which requires all California public transit agencies to begin phasing in zero-emission buses (ZEB) starting in 2023 and transition to 100 percent ZEB fleets by 2040 and
- ▶ Advanced Clean Trucks Regulation, which requires truck and van manufacturers to sell a growing share of ZEVs beginning in model year 2024.

All these regulations are reflected in EMFAC2021's emissions data for the forecast years (2030, 2040 and 2045), which serve as the basis for the Mobile On-road source's ABAU forecast. In addition to these regulations, EMFAC2021's data also takes into consideration future increases in light-duty ZEV sales, which would be influenced by California's Advanced Clean Cars I regulation.

Accordingly, EMFAC2021's VMT and emissions estimates for forecast years were used to calculate Mobile On-road emissions under the legislative adjustment scenario. As with the inventory methodology, sector-specific emissions factors for each forecast year were calculated by dividing sector-specific VMT by sector-specific emissions for each forecast year. These emissions factors were then multiplied by projected future VMT, which were scaled by relevant activity growth factors (population for the residential sector and employment for the commercial/institutional sector) to estimate future emissions. The baseline and projected future emissions factors calculated using EMFAC2021 are shown in Table 21.

In contrast, under the BAU scenario, Mobile On-road emissions factors are held constant at their 2022 baseline values for all forecast years, reflecting no change in vehicle efficiency or fleet composition.

Table 21 Mobile On-road Baseline and Projected GHG Emissions Factors

Sector	Units	2022	2030	2040	2045
Commercial Institutional	MTCO ₂ e/VMT	0.0010	0.00090	0.00081	0.00081
Residential	MTCO ₂ e/VMT	0.00032	0.00026	0.00023	0.00023

Notes: MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: Analysis conducted by Ascent in 2025.

4.3.4 Legislative-Adjusted Business-as-Usual Scenario Forecast Results

Table 22 presents the projected GHG emissions for the City of Tehachapi across all forecast years under the ABAU scenario, organized by emissions source and sector. Emissions sources and sectors not impacted by legislative

adjustments are excluded from this table, as their projected GHG emissions are assumed to remain unchanged from the BAU scenario. The full results for projected GHG emissions for the City of Tehachapi across all forecast years under both the BAU and ABAU scenarios, organized by emissions source and sector, can be found in Table 2.

Table 22 City of Tehachapi Legislative-Adjusted BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	7,651	7,912	7,990
Electricity	Residential	MTCO ₂ e	9,203	1,211	—
Imported Water	Commercial/Institutional	MTCO ₂ e	212	28	—
Imported Water	Agricultural	MTCO ₂ e	199	25	—
Mobile On-road	Residential	MTCO ₂ e	28,225	26,238	26,138
Mobile On-road	Commercial/Institutional	MTCO ₂ e	40,791	39,567	41,091

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

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Greenhouse Gas Emissions Inventory and Forecast for the Unincorporated County

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June 2025

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LIST OF ABBREVIATIONS

ABAU	legislative-adjusted BAU
AR5	Fifth Assessment Report
BAU	business-as-usual
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CH ₄	methane
CO ₂	carbon dioxide
CVP	Central Valley Project
eGRID	Emissions & Generation Resource Integrated Database
EPA Local GHG Inventory Tool	EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1
EPA	US Environmental Protection Agency
GHG	greenhouse gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
Kern COG	Kern Council of Governments
MRR	Mandatory Greenhouse Gas Reporting Regulation
MSW	municipal solid waste
MTCO _{2e}	metric tons of carbon dioxide equivalent
N ₂ O	nitrous oxide
PG&E	Pacific Gas and Electric Company
RPS	Renewables Portfolio Standard
SB	Senate Bill
SWP	State Water Project
VMT	vehicle miles traveled
WARM Tool	Waste Reduction Model
ZEB	zero-emission buses
ZEV	zero-emission vehicle

1 INTRODUCTION

This report contains the methods and results for a greenhouse gas (GHG) emissions inventory and GHG emissions forecast for the unincorporated Kern county (unincorporated county). A GHG emissions inventory provides estimates of emissions generated within a defined geographic boundary during a single year. It identifies the sectors, sources, and activities that produce these emissions and their relative contribution, while also providing a baseline to forecast future emissions trends. A GHG emissions forecast evaluates how GHG emissions may change in the future due to growth and the effects of adopted state and federal legislation and regulations. This information can be used for various purposes, including monitoring GHG emissions trends over time, or as the technical basis for planning efforts to reduce GHG emissions, such as a general plan or greenhouse gas reduction plan.

This report was developed as part of a grant provided to the City of Bakersfield by the US Environmental Protection Agency (EPA) as part of the Climate Pollution Reduction Grants program. The grant was provided to support climate pollution reduction planning in the Bakersfield Metropolitan Statistical Area, which includes the entirety of Kern county. Under this grant, funding was allocated to produce GHG emissions inventories and forecasts for each of the 12 jurisdictions in Kern county, including the City of Bakersfield, unincorporated Kern County, and all incorporated cities. These GHG emissions inventories and forecasts will be provided to the subject jurisdiction, the San Joaquin Valley Air Pollution Control District, and Kern Council of Governments (Kern COG).

The GHG emissions inventory and forecast are intended to provide an accounting of GHG emissions generating activities within the unincorporated county geographical boundary for the year 2022, and projections of future emissions based on countywide growth patterns and the effects of adopted state and federal legislation and regulations. This report is accompanied by an Excel-based tool used to develop the GHG emissions inventory, the *EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1* (the EPA Local GHG Inventory Tool). The GHG emissions inventory uses only publicly available data sets, many of which provide countywide estimates of GHG emissions generating activity, such as mobile on-road travel, energy consumption, and fertilizer use. This countywide data was scaled down to the jurisdiction level based on various attribution metrics, including population, commercial building floor space, and acres of agricultural use. GHG emissions were then forecasted using countywide growth projections for vehicle travel, population, and employment.

Because countywide data was used and scaled using attribution metrics, rather than jurisdiction-specific data, the GHG emissions inventory and forecast are intended to provide a general scale of GHG emissions for unincorporated county's contribution to countywide GHG emissions and serve as a starting point for more detailed GHG emissions analyses. The Excel-based tool can be updated with more locally specific and operational data that can be obtained from relevant departments and direct requests to utility providers. GHG emissions forecasts can be replicated using more locally specific growth projections for population and employment. The results can also be used to set local GHG reduction targets and develop and quantify locally-specific measures for reducing GHG emissions. Sufficient detail is provided in this report to ensure that the analyses are replicable, and data inputs can be replaced with more detailed data, if desired.

2 SUMMARY RESULTS

This section presents the results of the GHG emissions inventory and forecast for the unincorporated county, providing a comprehensive overview of historical (2022 as the inventory year) and projected (2030, 2040, and 2045 as the forecast years) emissions. The results are organized by emissions sources, including stationary energy, electricity, Mobile On-road, wastewater, solid waste, and others, as well as by sectors, including residential, commercial/institutional, industrial, and agricultural.

This breakdown enables an understanding of the emissions sources and sectors that contribute most significantly to the unincorporated county's overall emissions. Section 3 of this report provides additional context and methodology related to each emissions source and sector, including key assumptions, data sources, and allocation methods used in the inventory and forecast development.

2.1 2022 GREENHOUSE GAS EMISSIONS INVENTORY RESULTS

Table 1 below shows the 2022 GHG emissions inventory results for the unincorporated county, categorized by emissions sources and sectors. Figure 1 shows the inventory categorized by emission sources, while Figure 2 shows the inventory categorized by emission sectors.

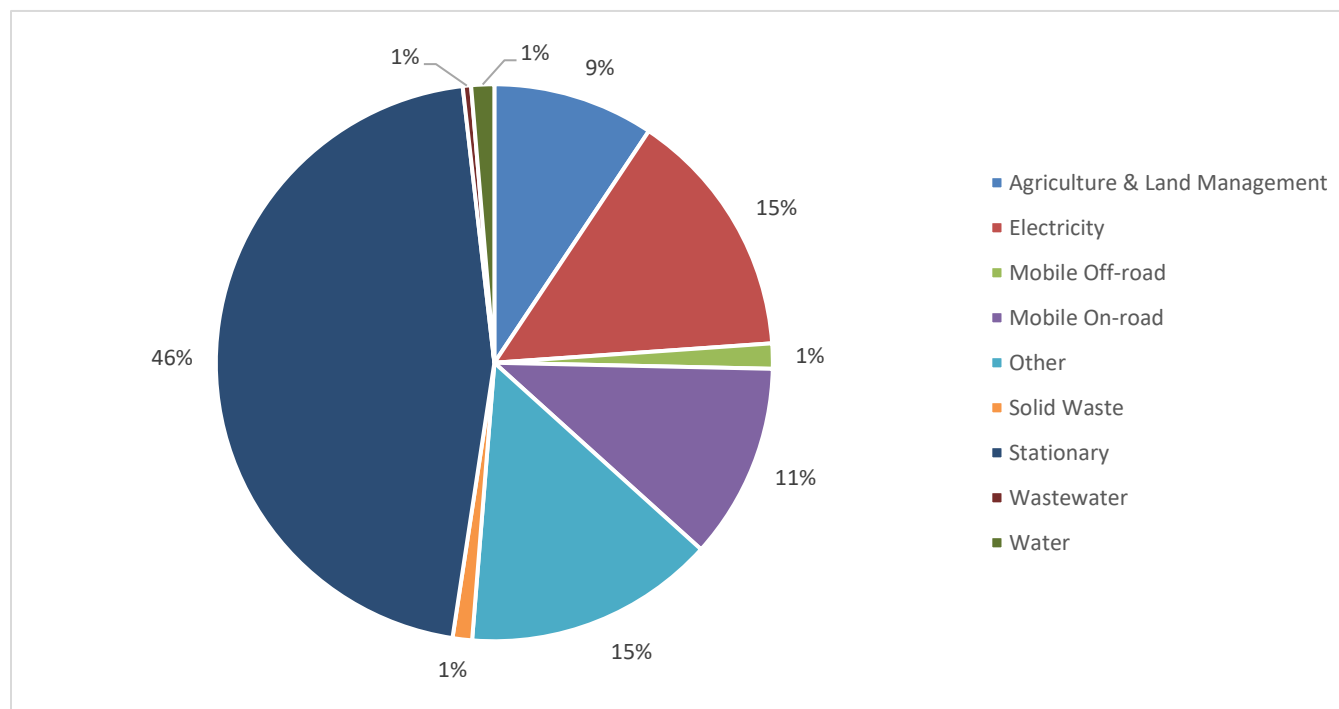
Table 1 Unincorporated County 2022 GHG Emissions Inventory Results (MTCO₂e)

Emissions Sources	Emissions Sectors				
	Agricultural	Commercial/Institutional	Industrial	Residential	Total
Agriculture & Land Management	1,720,520	—	—	—	1,720,520
Electricity	—	110,183	2,300,051	260,412	2,670,646
Mobile Off-road	150,957	117,371	—	—	268,328
Mobile On-road	—	1,291,531	—	793,146	2,084,677
Other	—	—	2,681,840	—	2,681,840
Solid Waste	—	66,954	—	140,441	207,395
Stationary Energy	—	194,183	8,043,100	178,004	8,415,287
Wastewater	—	88,651	—	—	88,651
Water	239,440	6,051	—	—	245,491
Total	2,110,916	1,874,925	13,024,992	1,372,003	18,382,836

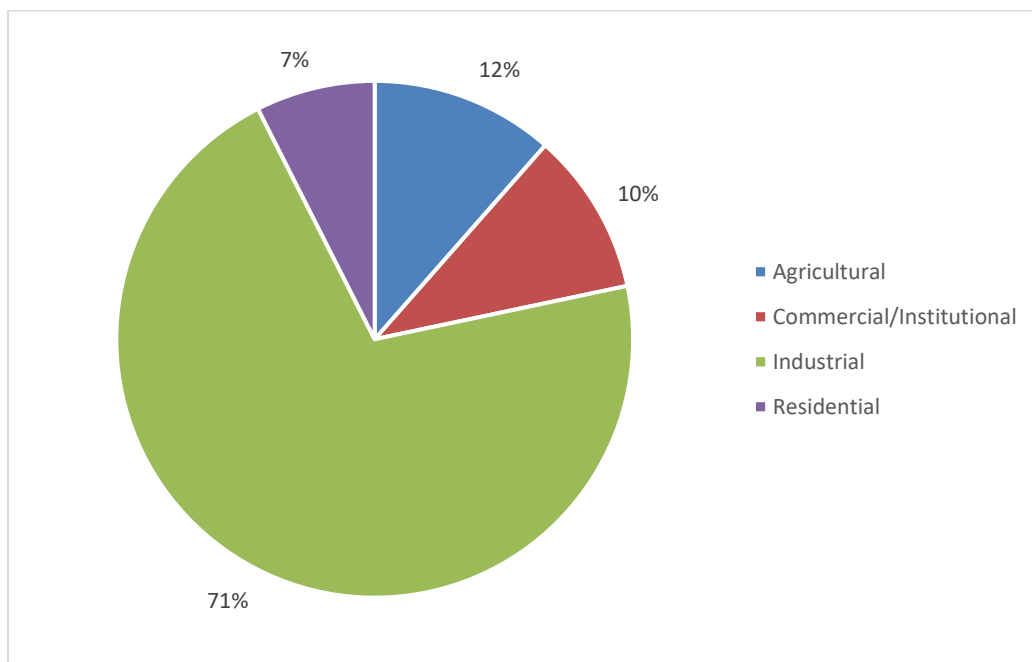
Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 1 Unincorporated County 2022 GHG Emissions Inventory by Emissions Sources



Source: Analysis conducted by Ascent in 2025.

Figure 2 Unincorporated County 2022 GHG Emissions Inventory by Emissions Sectors

Source: Analysis conducted by Ascent in 2025.

2.2 GREENHOUSE GAS EMISSIONS FORECAST RESULTS

Table 2 below shows the projected future GHG emissions for the unincorporated county for the forecast years 2030, 2040 and 2045 under both a business-as-usual (BAU) scenario, as well as a legislative-adjusted BAU (ABAU) scenario, broken down by both emissions sources and sector. The BAU GHG emissions forecasts estimate how community-generated emissions would change over time without additional actions at the State, federal, regional, or local levels, based solely on projected population and employment growth. The ABAU forecasts incorporate the effects of adopted State and federal policies, such as vehicle fuel efficiency standards and increased renewable energy in the electricity grid, but assume no additional local measures.

Table 2 Unincorporated County Greenhouse Gas Emissions Forecast for 2030, 2040 and 2045 by Emissions Source and Sector (MTCO₂e)

Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Stationary Energy	Residential	185,364	182,962	194,159	189,198	196,787	191,061
Stationary Energy	Commercial/Institutional	198,844	198,844	214,994	214,994	223,186	223,186
Stationary Energy	Industrial	8,236,152	8,236,152	8,905,081	8,905,081	9,244,415	9,244,415
Electricity	Residential	272,521	220,057	285,451	28,961	289,315	—
Electricity	Commercial/Institutional	113,386	91,073	122,595	12,309	127,267	—
Electricity	Industrial	2,366,911	1,901,134	2,559,149	256,943	2,656,667	—
Other Industrial	Industrial	2,760,036	2,760,036	2,984,202	2,984,202	3,097,917	3,097,917
Agriculture – Fertilizer Application	Agricultural	289,855	289,855	289,855	289,855	289,855	289,855
Solid Waste	Residential	215,877	215,877	228,447	228,447	233,370	233,370
Wastewater	Commercial/Institutional	92,343	92,343	97,598	97,598	99,607	99,607
Imported Water	Commercial/Institutional	6,303	5,062	6,661	669	6,798	—

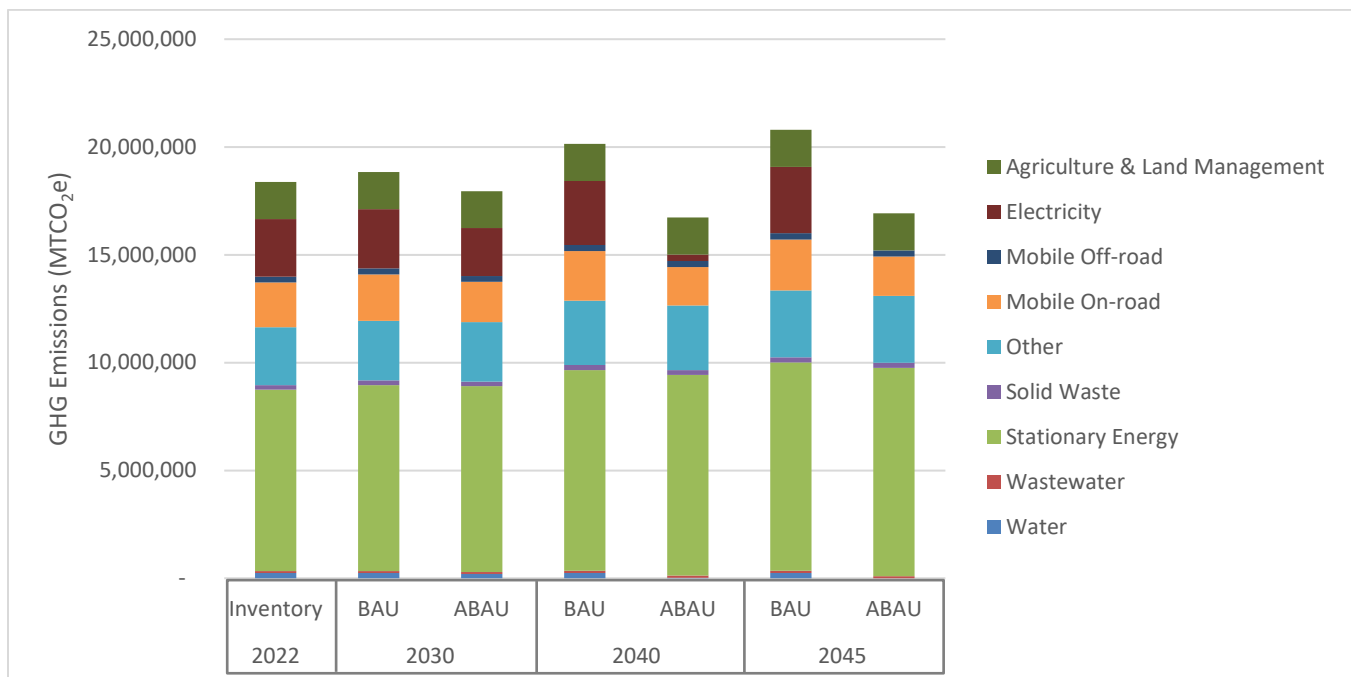
Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Imported Water	Agricultural	239,419	192,304	239,419	24,038	239,419	—
Mobile On-road	Residential	830,098	674,918	869,483	627,425	881,255	625,035
Mobile On-road	Commercial/Institutional	1,329,189	1,192,531	1,437,144	1,156,749	1,491,907	1,201,294
Mobile Off-road	Commercial/Institutional	120,794	120,794	130,604	130,604	135,581	135,581
Mobile Off-road	Agricultural	150,957	150,957	150,957	150,957	150,957	150,957

Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 3 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the unincorporated county's 2022 GHG emissions inventory for comparison, all categorized by emissions sources.

Figure 3 Unincorporated County 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sources (MTCO₂e)

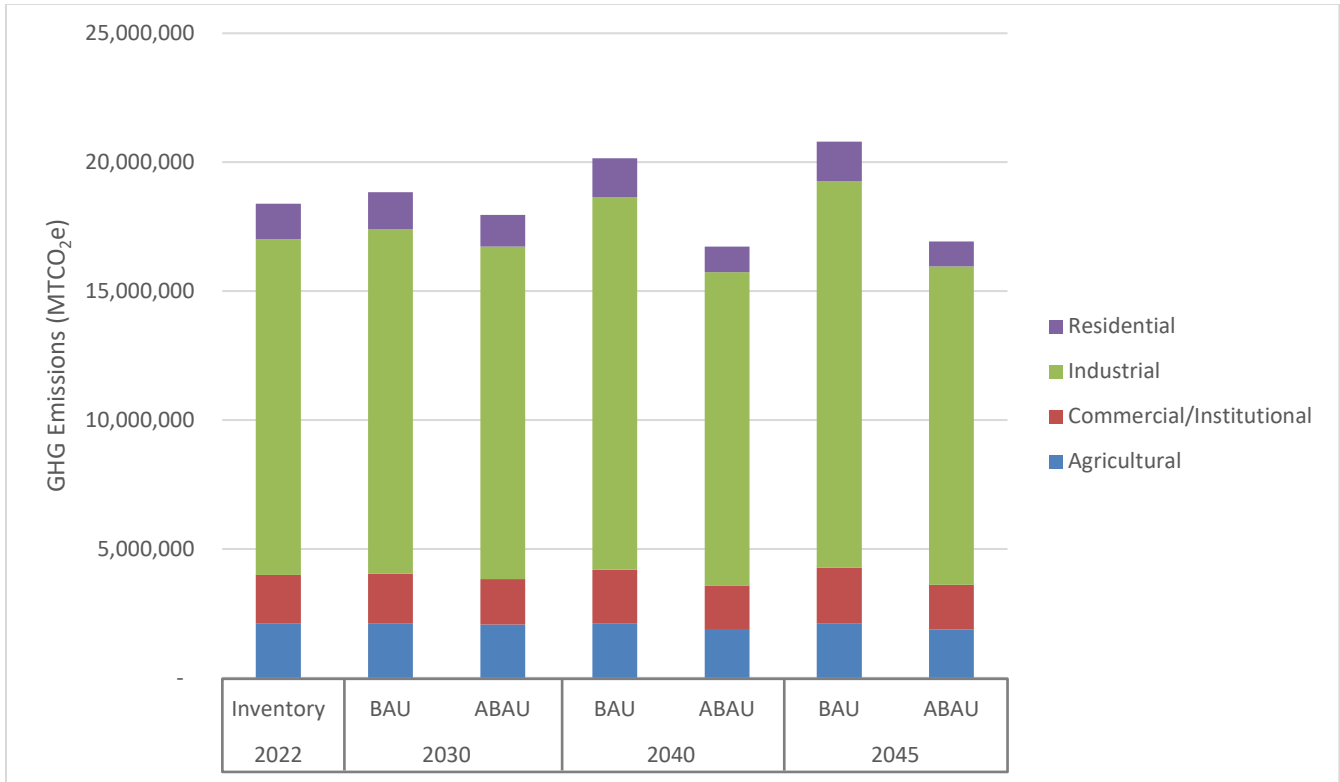


Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 4 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the unincorporated county's 2022 GHG emissions inventory for comparison, all categorized by emissions sectors.

Figure 4 Unincorporated County 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sectors (MTCO₂e)



Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

3 GREENHOUSE GAS EMISSIONS INVENTORY METHODS

This section of the report details the methods used to develop the GHG emissions inventory for the unincorporated county. It includes descriptions of the data sources and data processing, and the inputs and outputs for the GHG emissions calculations. The methods are organized by GHG emissions sources (stationary energy, electricity, etc.) for the unincorporated county, based on the EPA Local GHG Inventory Tool.

The EPA Local GHG Inventory Tool was primarily used for GHG emissions calculations. Activity data (e.g., energy consumed, tons of waste landfilled, etc.) inputs for the unincorporated county were entered into the tool and parameters were set to represent local conditions (e.g., annual electricity consumption data was imported into the tool as the input to calculate unincorporated county’s GHG emissions associated with electricity, and the appropriate electricity grid was selected to represent local conditions). GHG emissions from on-road transportation were calculated externally to the EPA Local GHG Inventory Tool, due to data format inconsistencies. All other GHG emissions sources were calculated within, or entered into the tool. The tool also categorizes GHG emissions into different sectors: residential, commercial/institutional, industrial, and agricultural. Industrial and agricultural sectors were only used when explicitly differentiated in the available datasets. In all other cases, sector categorization followed the classifications provided by the EPA Local GHG Inventory Tool or as defined by the underlying data sources.

This report only documents data processing and calculations that were performed outside of the EPA Local GHG Inventory Tool and provides the GHG emissions outputs from the tool; it does not expand on the calculation methods within the tool. Documentation for the EPA Local GHG Inventory Tool can be found on the EPA website at: <https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool>.

3.1 GREENHOUSE GASES AND GLOBAL WARMING POTENTIAL

GHG emissions other than carbon dioxide (CO₂) 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). CO₂ has a GWP factor of one, while all other GHGs have GWP factors measured in multiples of one relative to the GWP of CO₂. This conversion of non-CO₂ gases to one unit enables the reporting of all emissions in terms of carbon dioxide equivalent (CO₂e), 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 (MTCO₂e). For this emissions inventory and forecast, the three primary and most abundant GHGs were accounted for: CO₂, methane (CH₄) and nitrous oxide (N₂O).

Consistent with the best available science, the inventory uses GWP factors published in the Fifth Assessment Report (AR5) from Intergovernmental Panel on Climate Change (IPCC), where CH₄ and N₂O have GWP factors of 28 and 265, respectively (IPCC 2014). These values represent the GWP of GHG on a 100-year time horizon. This means that CH₄ is approximately 28 times stronger than CO₂ and N₂O is 265 times stronger than CO₂ in their potential to warm Earth's atmosphere over the course of 100 years. The use of 100-year GWP values is consistent with the California Air Resources Board (CARB) and EPA GHG accounting methods.

3.2 DATA REVIEW

The general approach for developing the GHG emissions inventory involved the collection of total activity and/or emissions data for Kern county for the year 2022 for each relevant GHG emissions source and then apportioning that data to individual jurisdictions and sectors using appropriate attribution metrics. These metrics include the unincorporated county's contribution to total countywide population, commercial building floor space, and agricultural land acreage. In some cases, such as for landfilled solid waste and industrial facilities, jurisdiction-specific data were available from publicly available resources.

The primary data sources used to compile activity and emissions data for all of Kern county are listed in Table 3.

Table 3 Data Sources for Countywide Activity and Emissions Data

GHG Emission Source	Data Source(s)
Mobile On-road	CARB EMFAC2021 on-road emission inventory model (CARB 2022a)
Mobile Off-road	CARB OFFROAD2021 off-road emission inventory model (CARB 2022b)
Stationary Energy	CEC energy database (CEC 2023), EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases
Electricity	CEC energy database (CEC 2022), Pacific Gas & Electric Co (PG&E)
Imported Water	Water Association of Kern County
Agriculture	CDFA's fertilizing materials tonnage report (CDFA 2025)
Other Industrial Sources	EPA FLIGHT database (EPA 2023)

Notes: CARB = California Air Resources Board; ; CDFA = California's Department of Food & Agriculture CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

Attribution metrics were used to apportion countywide activity and/or emissions data to individual jurisdictions by the appropriate GHG emissions sector. These attribution metrics include:

- ▶ population share for allocating activity associated with the residential sector (US Census Bureau 2025),
- ▶ commercial building floor space share for activity associated with the commercial/institutional sector (Open Energy Data Initiative 2020), and
- ▶ farmland, grazing land, and other agricultural land cover types share for the agricultural sector (DOC 2022).

These attribution metrics and the associated values for each jurisdiction in Kern county are shown in Table 4 below.

Table 4 Attribution Metrics Used to Apportion Countywide Activities and GHG Emissions

Jurisdiction	Population	Population %	Agricultural Land Acreage	Agricultural Land Acreage %	Commercial Building Floor Space in Square Footage	Commercial Building Floor Space in Square Footage %
Delano	19,613	2.2%	1,487	0.1%	1,400	0.9%
Bakersfield	404,321	44.6%	41,684	1.5%	79,800	50.7%
California City	15,002	1.7%	112	0.0%	1,000	0.6%
Delano	50,498	5.6%	4,141	0.2%	5,800	3.7%
Maricopa	1,217	0.1%	558	0.0%	—	0.0%
McFarland	13,971	1.5%	2,754	0.1%	600	0.4%
Ridgecrest	28,118	3.1%	62	0.0%	4,000	2.5%
Shafter	20,162	2.2%	19,419	0.7%	10,700	6.8%
Taft	7,414	0.8%	4,507	0.2%	1,000	0.6%
Tehachapi	12,855	1.4%	2,764	0.1%	1,700	1.1%
Wasco	26,317	2.9%	3,421	0.1%	1,800	1.1%
Unincorporated County	307,395	33.9%	2,666,205	97.1%	49,700	31.6%
Kern County Total	906,883	100%	2,747,115	100%	157,500	100%

Note: Population and agricultural land acreage data reflect conditions in 2022. The most recent data available for commercial building floor space was from 2019, which was used as the attribution metric in this analysis. Because the calculations relied on percentage shares rather than absolute floor space values, using 2019 data was considered appropriate for consistency across jurisdictions.

Sources: US Census Bureau 2025; DOC 2022; Open Energy Data Initiative 2020; analysis conducted by Ascent in 2025.

For the wastewater and solid waste emissions sources, as well as the industrial emissions sector, data and information were collected at the jurisdiction level to calculate associated GHG emissions.

For wastewater, jurisdiction-specific data were obtained from a variety of sources, including any publicly available data about wastewater treatment plant operations. When such data were not publicly available, default values from the EPA Local GHG Inventory Tool and the Local Governments for Sustainability *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* were used to fill data gaps.

For solid waste, jurisdiction-specific disposal data were sourced from the California Department of Resources Recycling and Recovery (CalRecycle), specifically from the Jurisdiction Disposal and Beneficial Reuse by Destination database.

For the industrial emissions sector, jurisdiction-specific emissions data were also obtained directly from the EPA FLIGHT and CARB MRR databases, which report facility-level emissions for large industrial sources.

Data sources for jurisdiction-specific activity and emissions data are shown in Table 5 below.

Table 5 Data Sources for Jurisdiction-Specific Activity and Emissions Data

GHG Emission Source/Sector	Data Source(s)
Wastewater	ICLEI (ICLEI 2019)
Solid Waste	CalRecycle's Jurisdiction Disposal and Beneficial Reuse by Destination database (CalRecycle 2025), EPA FLIGHT database (EPA 2023)
Industrial Sector	EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases

Notes: ICLEI = Local Governments for Sustainability; CalRecycle = California Department of Resources Recycling and Recovery; CARB = California Air Resources Board; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

3.3 INVENTORY METHODS BY GHG EMISSIONS SOURCE

This section details the data and methods used to calculate GHG emissions in the 2022 inventory, organized by emissions source. It presents the corresponding data inputs into the EPA Local GHG Inventory Tool, any data processing that was performed, and the resulting emissions estimates by source and sector for the unincorporated county. All calculations of GHG emissions use the IPCC AR5 GWP values to convert GHG emissions results to CO₂e.

3.3.1 Mobile On-road

The Mobile On-road 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.” The estimation of these emissions relies on EMFAC2021, a statewide mobile source emissions inventory model developed by CARB. EMFAC2021 was used instead of the EPA Local GHG Inventory Tool to calculate mobile on-road GHG emissions because EMFAC2021 provides GHG emissions estimates that more closely represent the vehicle fleet operating on roadways in Kern County. The EPA Local GHG Inventory Tool utilizes national fuel efficiency averages for a select number of vehicle types to calculate GHG emissions, whereas EMFAC2021 considers fuel efficiency by vehicle type and model, providing more accurate estimates of fuel consumption and GHG emissions.

To calculate emissions for the 2022 inventory year, total countywide vehicle miles traveled (VMT) were first obtained from EMFAC2021. These VMT figures were then allocated to emission sectors defined by the EPA’s Local GHG Inventory Tool based on vehicle class, specifically, the residential and commercial/institutional sectors. For the purposes of sector-specific emissions calculations, light-duty vehicles were attributed to the residential sector, as they primarily reflect personal vehicle use by residents. In contrast, medium- and heavy-duty trucks were attributed to the commercial/institutional sector, as these vehicle types are more commonly associated with goods movement, service fleets, and business operations. Sector-specific VMT totals were then apportioned to each jurisdiction based on appropriate attribution metrics: population share for residential VMT and commercial building square footage share for commercial/institutional VMT.

EMFAC2021 was also used to generate countywide GHG emissions factors for the two sectors, expressed in MTCO₂e per vehicle mile traveled. These factors accounted for all vehicle classes, model years, speeds, and fuel types. The sector-specific factors were derived by dividing total countywide emissions of CO₂, CH₄, and N₂O (converted to CO₂e using the appropriate GWP) by the corresponding sector-specific countywide total VMT, with emissions and VMT categorized into the residential and commercial/institutional sectors based on vehicle class.

Finally, each jurisdiction’s total Mobile On-road emissions by sector were calculated by multiplying the jurisdiction’s sector-specific VMT by the respective countywide sector-specific MTCO₂e per VMT emissions factors. Table 6 presents the unincorporated county’s total Mobile On-road VMT, associated sector-specific GHG emissions factors, and the resulting total GHG emissions by sector.

Table 6 Unincorporated County Mobile On-road Data Inputs and Results

Vehicle Sector	Total Activity (VMT)	GHG Emissions Factor (MTCO ₂ e/VMT)	GHG Emissions (MTCO ₂ e)
Residential	2,465,570,400	0.00035	793,146
Commercial/Institutional	1,288,880,001	0.0011	1,291,531

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: CARB 2022a; analysis conducted by Ascent in 2025.

3.3.2 Mobile Off-road

Emissions from Mobile Off-road sources result from the combustion of fuel in various types of off-road vehicles and equipment (e.g. agricultural tractors, construction equipment). Emissions data for these sources were obtained from

CARB's OFFROAD2021 model, which provides detailed estimates for Kern county for the 2022 inventory year. The data include, but are not limited to, information on equipment categories, fuel types, and the amount of fuel consumed.

Using the off-road vehicle categories in OFFROAD2021, the emissions data were organized into two relevant sectors defined by the EPA Local GHG Inventory Tool: agricultural and commercial/institutional. Sector-specific off-road fuel consumption totals were then apportioned to each jurisdiction using appropriate attribution metrics. Specifically, the share of farmland, grazing land, and other agricultural land was used to allocate agricultural emissions, while the commercial building square footage share was used to distribute commercial/institutional emissions.

Finally, each jurisdiction's sector-specific off-road fuel consumption data were entered into the "Mobile-Data" sheet of the EPA Local GHG Inventory Tool to calculate Mobile Off-road emissions. The EPA Local GHG Inventory Tool includes emissions factors by fuel type. Table 7 presents the unincorporated county's total Mobile Off-road fuel consumption by fuel type and the resulting total GHG emissions by sector.

Table 7 Unincorporated County Mobile Off-road Data Inputs and Results

Vehicle Sector	Diesel Consumption (gallons)	Gasoline Consumption (gallons)	Liquefied Natural Gas (LNG) Consumption (gallons)	Total Fuel Consumption (gallons)	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	8,087,153	3,538,237	195,256	11,820,645	117,371
Agricultural	14,109,618	260,801	—	14,370,419	150,957

Notes: GHG = greenhouse Gas; LNG = liquefied natural gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CARB 2022b, analysis conducted by Ascent in 2025.

3.3.3 Stationary Energy

The stationary energy source of GHG emissions includes natural gas combustion in residential, commercial/institutional and industrial uses. Residential uses primarily consume natural gas for space and water heating, and cooking. Commercial/institutional uses may include space heating and cooling, cooking in restaurants, and smaller boilers or generators. Industrial uses are often process-specific uses tied to manufacturing or heavy operations such as process heating, steam generation, and boiler systems. Propane fuel usage was not included in the stationary energy-related calculations as propane usage data for these various uses was not available at the same level of detail or consistency as other stationary energy data sources at the county scale.

RESIDENTIAL AND COMMERCIAL/INSTITUTIONAL

Total countywide natural gas usage data for the 2022 inventory year was obtained from the CEC Energy Reports: Gas Consumption by County, which categorizes usage into residential and non-residential sectors. Residential natural gas consumption was allocated to each jurisdiction based on its share of the county's population.

To isolate commercial/institutional usage, countywide industrial natural gas consumption, sourced from the EPA FLIGHT database and CARB MRR database, was subtracted from the CEC total non-residential usage. The resulting commercial/institutional natural gas usage was then apportioned to each jurisdiction using commercial building floor space share as the attribution metric.

Finally, each jurisdiction's residential and commercial/institutional natural gas usage data were entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate residential and commercial/institutional stationary energy emissions. Table 8 below shows the unincorporated county's total stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions in residential and commercial/institutional sectors.

Table 8 Unincorporated County Residential and Commercial/Institutional Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Residential	3,237,260	178,004
Commercial/Institutional	3,531,504	194,183

Notes: mcf = thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

INDUSTRIAL

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the unincorporated county. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the unincorporated county. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

Jurisdiction-specific emissions data were then converted into estimates of natural gas consumption using IPCC Fourth Assessment Report (AR4) GWP values and Subpart C Tier 1 GHG emissions factors, given that the emissions data obtained from the EPA FLIGHT and CARB MRR databases were calculated using AR4 GWP values. This approach was taken to ensure consistency with the emissions data obtained from the EPA FLIGHT and CARB MRR databases, which were originally calculated using AR4 GWP values. These converted fuel usage estimates were subsequently entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate industrial stationary energy emissions for each jurisdiction.

Table 9 below shows the unincorporated county's industrial stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions.

Table 9 Unincorporated County Industrial Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Industrial	146,275,429	8,043,100

Notes: mcf = one thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

The list of industrial facilities from which data was used to estimate jurisdiction-specific industrial stationary energy emissions is provided in Table 10. In some cases, a facility may use a separate address for reporting purposes than where the facility is physically located. The reporting addresses and physical locations of facilities were reviewed such that GHG emissions could be allocated to jurisdictions based on the physical location within the jurisdiction's boundary. Note that the GHG emission totals provided in Table 10 are obtained directly from the CARB or EPA data sources and have not been converted to AR5 GWPs. As such, these totals may not match those reported in Table 10 above.

Table 10 Unincorporated County Industrial Facilities Located in Geographical Boundary

Facility Name	GHG Emissions (MTCO ₂ e)	Physical Location Notes
Aera Energy 25 Hill	58,940	Physical location is different from the reporting location.
Aera Energy Alberta Finley Shale	105,345	Physical location is the same as the reporting location.
Aera Energy Anderson Fitzgerald	222,660	Physical location is the same as the reporting location.
Aera Energy Belridge	1,411,280	Physical location is the same as the reporting location.
Aera Energy Buena Fe	12,203	Physical location is different from the reporting location.
Aera Energy Calso	43,574	Physical location is the same as the reporting location.
Aera Energy Lockwood	7,053	Physical location is different from the reporting location.
Aera Energy Lost Hills	132,807	Physical location is the same as the reporting location.
Aera Energy Moco	115,682	Physical location is different from the reporting location.
Aera Energy Metson	21,001	Physical location is different from the reporting location.
Aera Energy Wier Gore Maxwell	47,422	Physical location is the same as the reporting location.
Badger Creek Limited	16,528	Physical location is different from the reporting location.
Bear Mountain Limited	49,250	Physical location is different from the reporting location.
Chalk Cliff Cogen	6,793	Physical location is different from the reporting location.
Calportland Company Mojave Plant	837	Physical location is the same as the reporting location.
California Resources Elk Hills, LLC - Gas Processing and Power Generation	1,307,379	Physical location is the same as the reporting location.
Double C Limited	22,827	Physical location is different from the reporting location.
Frito-Lay Cogen Plant	34,243	Physical location is different from the reporting location.
High Sierra Limited	23,625	Physical location is different from the reporting location.
J.G. Boswell Tomato Company Kern LLC	40,356	Physical location is the same as the reporting location.
Kern Front Limited	12,751	Physical location is different from the reporting location.
Kern Energy	34,045	Physical location is different from the reporting location.

Facility Name	GHG Emissions (MTCO ₂ e)	Physical Location Notes
Kern River Cogeneration Facility	291,762	Physical location is different from the reporting location.
Live Oak Limited	37,876	Physical location is different from the reporting location.
Lone Star Gas Liquids	25	Physical location is different from the reporting location.
La Paloma Generating Plant	696,469	Physical location is the same as the reporting location.
Mckittrick Limited	5,871	Physical location is different from the reporting location.
Midstream Energy Partners North Coles Levee Gas Plant	28,808	Physical location is the same as the reporting location.
Midway-Sunset Cogeneration Co.	36,049	Physical location is the same as the reporting location.
National Cement Co of California Inc	1,596	Physical location is the same as the reporting location.
Pastoria Energy Facility	1,365,023	Physical location is the same as the reporting location.
Sycamore Cogeneration Facility	299,782	Physical location is different from the reporting location.
Southern California Gas Co Wheeler Ridge Station	19,555	Physical location is the same as the reporting location.
Sunrise Power Company	1,062,075	Physical location is the same as the reporting location.
Tricor Refining LLC	28,528	Physical location is different from the reporting location.
Tehachapi Cement Plant	80	Physical location is different from the reporting location.
U.S. Borax Inc.	349,205	Physical location is the same as the reporting location.
Wm Bolthouse Farms, Inc.	30,689	Physical location is different from the reporting location.
Wonderful Pistachios & Almonds	34,839	Physical location is the same as the reporting location.
Crimson Renewable Energy - Bakersfield Plant	20,826	Physical location is different from the reporting location.
Delano Growers Grape Products	15,144	Physical location is different from the reporting location.
JP Oil	15,463	Physical location is different from the reporting location.
Plains Lpg Services/ Lone Star Frac & Isom Facility	319	Physical location is different from the reporting location.
Revol Greens Ca, LLC	12,795	Physical location is different from the reporting location.

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

3.3.4 Electricity

The electricity source addresses energy-related indirect GHG emissions resulting from the consumption of grid-supplied electricity within the unincorporated county's boundary. Consumption of grid-supplied electricity is considered an "indirect" GHG emissions source, because GHG emissions occur at the source of electricity generation, which is usually outside of a jurisdiction's boundary. The location-based method was used to calculate electricity GHG emissions, which uses regional grid-average emission factors. In the United States, these factors are provided by the EPA's Emissions & Generation Resource Integrated Database (eGRID). Specifically, emission factors for the CAMX eGRID subregion were applied, as this subregion encompasses the geographic area of Kern county.

Total electricity usage data for Kern county in 2022 was obtained from CEC Energy Reports: Electricity by County, which categorized usage into residential and non-residential sectors (CEC 2023). Electricity usage data for the City of Bakersfield, which was also separated into residential and non-residential categories, was acquired directly from the Pacific Gas and Electric Company (PG&E). To estimate electricity usage for the rest of the county (i.e., all jurisdictions excluding Bakersfield), the City of Bakersfield's electricity data was subtracted from the total Kern county data.

Residential electricity usage outside of Bakersfield was apportioned to each jurisdiction based on its share of the county's total population. For non-residential electricity usage, estimates were further categorized into industrial and commercial/institutional sectors using attribution metrics derived from natural gas consumption data previously calculated under stationary energy. In 2022, 93.1 percent of the county's stationary natural gas combustion was attributed to industrial use and 6.9 percent to commercial/institutional use. These same ratios were applied to the county's total non-residential electricity usage, under the assumption that the sectoral split in electricity usage mirrors that of natural gas usage. This assumption was validated using available industrial electricity and natural gas usage data in PG&E's service territory, from the CEC Energy Reports. The electricity-to-gas ratio, expressed as gigawatt-hour per million therms, was calculated by dividing total industrial electricity usage by industrial natural gas consumption for the service territory. The resulting value closely aligns with the assumptions applied in this here, supporting its validity.

The unincorporated county's share of commercial building square footage was used to attribute commercial/institutional electricity usage. Industrial electricity usage was attributed based on the proportion of countywide industrial natural gas within the unincorporated county. Finally, the sector-specific electricity usage data for each jurisdiction was entered into the "Electricity-Data" sheet of the EPA Local GHG Inventory Tool to calculate associated GHG emissions.

Table 11 below shows the unincorporated county's electricity activity data and the associated GHG emissions by emission sectors.

Table 11 Unincorporated County Electricity Energy Data Inputs and Results

Sector	Total Activity (kWh of Electricity Consumed)	GHG Emissions (MTCO _{2e})
Residential	1,149,729,817	260,412
Commercial/Institutional	486,463,095	110,183
Industrial	10,154,834,523	2,300,051

Notes: kWh = kilowatt-hour; GHG = greenhouse gas; MTCO_{2e} = metric tons of carbon dioxide equivalent.

Source: CEC 2023; PG&E 2025; analysis conducted by Ascent in 2025.

3.3.5 Imported Water

The water source category captures GHG emissions from energy use associated with the conveyance, treatment, and distribution of water within a jurisdiction. In Kern county, the WAKC reports that approximately 166,000 acre-feet of water are used annually for municipal and industrial purposes, and 2,294,000 acre-feet for agricultural purposes.

In addition to local surface water, Kern county draws water from several sources. Among these, only water supplied through the State Water Project (SWP) and the federal Central Valley Project (CVP) is considered imported, and

therefore potentially results in GHG emissions due to long-distance conveyance. All other sources are classified as local. It was assumed that energy used for extracting, conveying, treating, and distributing local water is captured under the emissions estimates for stationary energy and electricity, since these activities occur within the county. In addition, upon further review, it was also determined that the federal CVP does not consume energy for water delivery to Kern County, as water is primarily conveyed using gravity (Friant Water Authority 2019). As a result, only the SWP, which accounts for 26 percent of the county's water supply, contributes to GHG emissions. Table 12 provides a summary of the water sources in Kern county and their contribution to the total water supply.

Table 12 Kern County Water Sources

Source	Percentage
Kern River	20%
State Water Project (California Aqueduct)	26%
Federal Central Valley Project (Friant-Kern Canal)	12%
Local Streams and Other Sources (Poso Creek, Kern River, etc.)	6%
Groundwater	36%
Total	100%

Source: WAKC n.d.

Water use in Kern County is characterized into municipal and industrial, and agricultural sectors in data obtained from WAKC. It is assumed that water included in "municipal" uses is delivered to both commercial and residential customers. However, sufficient data was not available to disaggregate the water consumption between industrial, commercial, and residential customers. For the purpose of this GHG emissions inventory, all non-agricultural water consumption was categorized under the commercial/institutional sector.

To allocate sector-specific water usage to individual jurisdictions, the following attribution metrics were used:

- ▶ Agricultural water use was apportioned based on each jurisdiction's share of farmland, grazing land, and other agricultural land.
- ▶ Commercial/institutional water use was distributed according to the share of commercial building square footage in each jurisdiction.

These apportioned figures were then entered into the "Imported Water" sheet of the EPA Local GHG Inventory Tool, applying a universal 26 percent imported water rate, to estimate the associated GHG emissions from water conveyance and use. Table 13 presents the unincorporated county's activity data related to imported water, including the percentage of total water supply that is imported and the associated GHG emissions.

Table 13 Unincorporated County Imported Water Energy Data Inputs and Results

Sector	Total Activity (Gallons of Water)	Percentage of Water Imported	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	4,767,009,664	26%	6,051
Agricultural	188,626,409,734		239,440

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: WAKC n.d.; analysis conducted by Ascent in 2025.

3.3.6 Wastewater

The wastewater source accounts for GHG emissions resulting from the treatment of sewage. To support this analysis, a review of publicly available wastewater treatment characteristics was conducted to collect the data required for completing the "Wastewater-Control" tab of the EPA's Local GHG Inventory Tool. The data sources and corresponding assumptions for the unincorporated county's wastewater treatment systems are summarized in Table

12. Where jurisdiction-specific data were not publicly available, the default input values provided by the EPA tool were used.

To estimate GHG emissions, population data for each jurisdiction were subsequently entered into the “Wastewater-Entry” tab of the tool. The resulting emissions estimates are also presented in Table 14, alongside the data sources and assumptions used.

Table 14 Unincorporated County Wastewater Treatment Assumptions

Wastewater Process/Treatment Type	Conditions Assumed	Data Source	GHG Emissions (MTCO ₂ e)
Population served by septic systems	90 percent of the unincorporated county's population	ICLEI's default proportion of population that utilizes septic tanks for a rural area (Box WW.11(alt).2).	88,651
One or more wastewater treatment plants (WWTPs) where wastewater is treated in aerobic or anaerobic conditions	Anerobic	No public information is available. The default value is anerobic.	
One or more WWTPs conduct or do not conduct nitrification/denitrification	No nitrification/denitrification	No public information is available. The default value is no nitrification/denitrification.	

Notes: WWTP = wastewater treatment plant; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; ICLEI = Local Governments for Sustainability.

Sources: ICLEI 2019; analysis conducted by Ascent in 2025.

3.3.7 Solid Waste

Community-generated solid waste emissions are primarily associated with the decomposition of solid waste in landfills. There are two methods for accounting for GHG emissions associated with waste disposal:

- Waste generation method – Accounts for the total GHG emissions that would be generated over time as municipal solid waste (MSW) that is sent to a landfill in only the inventory year decomposes.
- Waste-in-place method – Accounts for the total GHG emissions generated in a given year at a specific landfill location by the decomposition of all MSW previously disposed at the landfill.

Generally, there is some risk of double counting GHG emissions when combining both of these methods, as a portion of the emissions accounted for using the waste generation method may occur at an in-boundary landfill that has emissions reported using the waste-in-place method. However, the scale of the overlapping GHG emissions between the two methods would be expected as very small in comparison to total emission using either accounting method.

WASTE GENERATION

Landfill tonnage data for 2022 was obtained from CalRecycle's Jurisdiction Disposal and Beneficial Reuse by Destination database. This data was entered into the EPA's Waste Reduction Model (WARM Tool) as “mixed MSW” to estimate waste generation emissions. The default national average values were used in the WARM Tool, except for Question 7, where the k value was set to “dry” based on the county's annual precipitation (less than 20 inches) (NCEI 2025). The WARM output was then imported into the EPA Local GHG Inventory Tool's “Waste Production” tab, with solid-waste associated emissions attributed to the residential sector by default.

The total activity for solid waste disposal and the resulting waste generation GHG emissions results from the WARM Tool are provided in Table 15.

Table 15 Unincorporated County Waste Generation Data Inputs and Results

Sector	Total Activity (tons of MSW disposed)	GHG Emissions (MTCO ₂ e) (WARM Output)
Residential	486,568	140,441

Notes: MSW = mixed municipal solid waste; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; WARM = Waste Reduction Model.

Source: CalRecycle 2025; analysis conducted by Ascent in 2025.

WASTE-IN-PLACE

EPA's FLIGHT database was reviewed to determine emissions from landfills located within the unincorporated county's geopolitical boundary, which would provide emissions data for any landfills that generated emissions greater than 25,000 MTCO₂e in 2022. Two landfills in the unincorporated county were identified during this review. Their emissions were entered into the "Solid Waste" tab of the EPA Local GHG Inventory Tool, assuming no landfill gas (LFG) collection systems. These emissions were attributed to the commercial/institutional sector by default.

The emissions reported from landfill facilities located in the unincorporated county, categorized as waste-in-place GHG emissions, are provided in Table 16.

Table 16 Unincorporated County Waste-in-Place Data Results

Sector	Facility	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	Clean Harbors Buttonwillow, LLC	25,913
Commercial/Institutional	Bakersfield Metropolitan Sanitary Landfill	41,041

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: EPA 2023; analysis conducted by Ascent in 2025.

3.3.8 Agriculture

The agriculture emissions source captures GHG emissions generated from fertilizer application, as well as enteric fermentation and manure from livestock.

FERTILIZER APPLICATION

Fertilizer application results in GHG emissions primarily due to the release of N₂O, a potent GHG with a global warming potential nearly 300 times greater than CO₂. When nitrogen-based fertilizers are applied to soil, a portion of the nitrogen undergoes microbial processes (nitrification and denitrification), which convert it into N₂O. These emissions can occur directly from the soil or indirectly through leaching and runoff.

The total tonnage of nitrogen in synthetic fertilizers applied in Kern county during the 2022 inventory year was obtained from CDFA's fertilizing materials tonnage report. This countywide total was then apportioned to individual jurisdictions based on each jurisdiction's proportional share of farmland, grazing land, and other agricultural land. Only data for synthetic fertilizers was publicly available for calculation, although other organic or manure-based fertilizers may be used.

The resulting tonnage of nitrogen in synthetic fertilizers estimated for the unincorporated county was entered into the "Agriculture & Land Management" sheet of the EPA's Local GHG Inventory Tool to calculate the associated emissions. Table 17 provides the estimated total tons of nitrogen applied and resulting GHG emissions.

Table 17 Unincorporated County Fertilizer Application Data Inputs and Results

Sector	Total Activity (tons of nitrogen applied)	GHG Emissions (MTCO ₂ e)
Agricultural	40,382	289,855

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CDFA 2025; analysis conducted by Ascent in 2025.

LIVESTOCK ENTERIC FERMENTATION AND MANURE MANAGEMENT

The livestock enteric fermentation and manure management GHG emissions source accounts for GHG emissions generated by livestock farming. Because most livestock-related agricultural activity in Kern county occurs within unincorporated areas, it is assumed that these emissions fall entirely within the geopolitical boundary of the unincorporated county.

GHG emissions from livestock were derived from the State of California’s 2022 GHG Inventory, published by CARB (CARB 2024). To estimate emissions at the county level, statewide livestock population values were scaled to Kern county using livestock population data from the US Department of Agriculture’s NASS (USDA 2024).

It is important to note that the EPA’s Local GHG Inventory Tool does not include livestock-related emissions; therefore, this source was calculated independently of the tool.

Table 18 provides a summary of the statewide GHG emissions in enteric fermentation and manure management, the total statewide livestock populations and Kern county livestock populations as obtained from the US Department of Agriculture’s NASS, and the resulting GHG emissions attributed to the unincorporated county.

Table 18 Unincorporated County Livestock Enteric Fermentation and Manure Data Inputs and Results

Livestock Type	Statewide Livestock Head	Kern County Livestock Head	Percent of State Total Livestock Head in Kern County	Statewide GHG Emissions (MTCO ₂ e)	Kern County GHG Emissions (MTCO ₂ e)
Enteric Fermentation (Digestive Process)					
Broiler and others	50,781,157	250	<0.001%	—	—
Cattle and calves	5,239,070	326,215	6.23%	11,773,368	733,078
Goats	126,863	1,890	1.49%	17,761	265
Hogs and pigs	82,010	1,704	2.08%	3,444	72
Horses and ponies	92,831	2,849	3.07%	388,310	11,917
Layers	13,454,544	Data unavailable	0.00%	—	—
Pullets	3,794,018	Data unavailable	0.00%	—	—
Sheep and lambs	532,849	110,321	20.70%	119,358	24,712
Turkeys	2,186,868	418	0.02%	—	—
Total	76,290,210	443,647	34%	12,302,241	770,044
Manure Management					
Broiler and others	50,781,157	250	<0.001%	10,338	0
Cattle and calves	5,239,070	326,215	6.23%	10,454,760	650,974
Goats	126,863	1,890	1.49%	2,504	37
Hogs and pigs	82,010	1,704	2.08%	45,368	943
Horses and ponies	92,831	2,849	3.07%	92,784	2,848
Layers	13,454,544	Data unavailable	0.00%	87,764	—
Pullets	3,794,018	Data unavailable	0.00%	23,636	—
Sheep and lambs	532,849	110,321	20.70%	28,092	5,816
Turkeys	2,186,868	418	0.02%	16,149	3
Total	76,290,210	443,647	34%	10,761,393	660,621

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CARB 2024; USDA 2024; analysis conducted by Ascent in 2025.

3.3.9 Other Industrial Sources

The Other Industrial Source category includes non-natural gas combustion emissions and process emissions from large industrial facilities. These emissions include the combustion of fuels such as propane or refinery gas, as well as emissions from chemical and mechanical industrial processes. Emissions data for this source were obtained from the EPA's FLIGHT database. As noted previously, the FLIGHT database reports emissions from facilities that emit 25,000 MTCO₂e or more per year.

FLIGHT provides geographic location data for each reporting facility, enabling emissions to be accurately assigned to the corresponding jurisdictions. According to the database, all facilities that emit significant non-natural gas combustion and process emissions within Kern county are located in the unincorporated area, and therefore, emissions from this source are attributed solely to the unincorporated county. Table 19 provides a summary of non-natural gas combustion emissions and process emissions obtained from the FLIGHT database.

Table 19 Unincorporated County Other Industrial Emissions Results

Sector	Source	GHG Emissions (MTCO ₂ e)
Industrial	Non-Natural Gas Combustion Emissions	108,255
Industrial	Process Emissions	2,573,586

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

4 GREENHOUSE GAS EMISSIONS FORECAST METHODS

This section provides the methods and data used to project future GHG emissions under a BAU scenario, as well as the calculations of reductions from adopted legislation and regulations under an ABAU scenario.

The BAU GHG emissions forecasts assess how emissions generated by community activities will change over time without further State, federal, regional, or local action. The BAU scenario forecast accounts for the changes in population and employment that can influence communitywide GHG emissions. The ABAU scenario forecast includes adopted policies and regulations at the State and federal levels that would affect emissions without any local action, such as regulatory requirements to increase vehicle fuel efficiency and increase renewable energy sources in grid electricity portfolios. These forecasts provide the unincorporated county with information needed to understand specific GHG emissions sources with the greatest opportunities for reduction with future plans, projects, or programs. It is important to note that the ABAU forecasts only account for emissions reductions associated with adopted policies and regulations; they do not account for proposed and/or unadopted GHG reduction actions established by regional, State, and federal agencies or executive orders outside of adopted legislation and regulations.

The GHG emissions forecasts project GHG emissions for the years 2030, 2040, and 2045 to align with key regulatory timelines for the State. Two key legislative actions establish statewide GHG reduction targets for the years 2030 and 2045, including:

- ▶ Senate Bill (SB) 32 of 2016, which sets a statewide GHG reduction target for the year 2030, and
- ▶ Assembly Bill 1279 of 2022, which sets a statewide GHG reduction target for the year 2045.

The forecast years selected do not necessarily align with the targets established by adopted legislation, but they do provide an analysis of emissions that aligns with the relevant horizon years. The year 2040 was also included in the analysis as an interim year between the 2030 and 2045 forecast years.

4.1 GROWTH PROJECTIONS

GHG emissions forecasts were developed based on projected changes in Kern county’s demographics, specifically population, employment, and service population (defined as residents plus employees), between 2022 and 2045. These projections were obtained from the Regional Growth Forecast and Demographic Forecast prepared by the Kern COG (Kern COG 2024). It is assumed that the incorporated cities and the unincorporated county will experience demographic growth at the same rate as the county overall, as jurisdiction-specific growth projections were not available at the time of this analysis.

Between 2022 and 2045, Kern county’s population and employment are projected to increase by approximately 11.1 and 15.5 percent, respectively. The service population is expected to grow by 12.4 percent. These growth factors were applied to forecast GHG emissions for the years 2030, 2040, and 2045 across various emissions sources included in the inventory. The values used for population, employment, and service population to project future emissions are provided in Table 20.

Table 20 Kern County Demographics and Calculated Growth Rates for Future Emissions Forecasts

Calculation Factor	2022	2030	2040	2045
Population				
Total Kern County	906,883	949,134	994,167	1,007,627
Kern County Growth from 2022	N/A	4.7%	9.6%	11.1%
Employment				
Total Kern County	358,961	369,427	399,432	414,652
Kern County Growth from 2022	N/A	2.9%	11.3%	15.5%
Service Population				
Total Kern County	1,265,844	1,318,561	1,393,598	1,422,279
Kern County Growth from 2022	N/A	4.2%	10.1%	12.4%

Note: N/A = Not Applicable.

Source: US Census Bureau 2025; Kern COG 2024; analysis conducted by Ascent in 2025.

Additional details on how growth factors were applied to individual sources are provided in the following sections. It is important to note that agricultural emissions, including those from fertilizer application, as well as livestock enteric fermentation and manure management, are assumed to remain constant throughout the forecast period, with no projected increase in activity levels. Agricultural activities are difficult to project in any detail, with production intensities, number of livestock, and crop types being highly susceptible to global markets and local climate patterns. As such, projections of agriculture GHG emissions-generating activities are not attempted.

4.2 BUSINESS-AS-USUAL SCENARIO FORECAST

The BAU forecast represents a projection of future GHG emissions based solely on expected demographic and economic growth (e.g., population, employment, and service population) between 2022 and 2045. It does not account for the potential impacts of future policies, programs, or actions that may reduce emissions, such as energy efficiency improvements, renewable energy adoption, or transportation electrification.

In the BAU scenario, GHG emissions factors are held constant at the levels used in the 2022 GHG inventory, meaning the carbon intensity of electricity, fuels, and other activities is assumed not to change over time. As a result, any changes in future emissions are driven entirely by growth in activity levels, not by improvements in emissions performance.

4.2.1 Business-As-Usual Scenario Forecast Results

Table 21 presents the projected activity data for the unincorporated county across all forecast years, organized by emissions source and sector. Table 18 also indicates which sources and sectors used population, employment, or service population as a growth metric.

Table 21 Unincorporated County BAU Scenario Projected Activity Data for All Forecast Years

Source	Sector	Growth Metric	Units	2030	2040	2045
Stationary Energy	Residential	Population	scf	3,388,081	3,548,833	3,596,881
Stationary Energy	Commercial/Institutional	Employment	scf	3,634,474	3,929,661	4,079,403
Stationary Energy	Industrial	Employment	scf	150,540,452	162,767,147	168,969,491
Electricity	Residential	Population	kWh	1,203,294,615	1,260,386,382	1,277,450,980
Electricity	Commercial/Institutional	Employment	kWh	500,647,135	541,309,027	561,935,948
Electricity	Industrial	Employment	kWh	10,450,923,959	11,299,734,044	11,730,317,518
Other Industrial	Industrial	Employment	MTCO ₂ e	2,760,036	2,984,202	3,097,917
Agriculture – Fertilizer Application	Agricultural ¹	N/A	ton	40,382	40,382	40,382
Solid Waste	Residential	Population	ton	578,143	607,901	617,962
Wastewater	Commercial/Institutional	Service Population	MTCO ₂ e	92,343	97,598	99,607
Imported Water	Commercial/Institutional	Service Population	Gallon	4,965,536,024	5,248,116,704	5,356,124,998
Imported Water	Agricultural ¹	N/A	Gallon	188,626,409,734	188,626,409,734	188,626,409,734
Mobile On-road	Residential	Population	VMT	2,580,438,935	2,702,870,979	2,739,465,634
Mobile On-road	Commercial/Institutional	Employment	VMT	1,326,460,500	1,434,193,851	1,488,844,709
Mobile Off-road	Commercial/Institutional	Employment	MTCO ₂ e	120,794	130,604	135,581
Mobile Off-road	Agricultural ¹	N/A	MTCO ₂ e	150,957	150,957	150,957

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; scf = standard cubic foot.

¹ Activity levels for the agricultural sector are assumed to remain constant over the forecast period; therefore, growth metrics are listed as “N/A.”

Source: Analysis conducted by Ascent in 2025.

Table 22 below presents the projected GHG emissions for the unincorporated county across all forecast years, also organized by emissions source and sector.

Table 22 Unincorporated County BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	185,364	194,159	196,787
Stationary Energy	Commercial/Institutional	MTCO ₂ e	198,844	214,994	223,186
Stationary Energy	Industrial	MTCO ₂ e	8,236,152	8,905,081	9,244,415
Electricity	Residential	MTCO ₂ e	272,521	285,451	289,315
Electricity	Commercial/Institutional	MTCO ₂ e	113,386	122,595	127,267
Electricity	Industrial	MTCO ₂ e	2,366,911	2,559,149	2,656,667
Other Industrial	Industrial	MTCO ₂ e	2,760,036	2,984,202	3,097,917

Source	Sector	Units	2030	2040	2045
Agriculture – Fertilizer Application	Agricultural	MTCO ₂ e	289,855	289,855	289,855
Solid Waste	Residential	MTCO ₂ e	215,877	228,447	233,370
Wastewater	Commercial/Institutional	MTCO ₂ e	92,343	97,598	99,607
Imported Water	Commercial/Institutional	MTCO ₂ e	6,303	6,661	6,798
Imported Water	Agricultural	MTCO ₂ e	239,419	239,419	239,419
Mobile On-road	Residential	MTCO ₂ e	830,098	869,483	881,255
Mobile On-road	Commercial/Institutional	MTCO ₂ e	1,329,189	1,437,144	1,491,907
Mobile Off-road	Commercial/Institutional	MTCO ₂ e	120,794	130,604	135,581
Mobile Off-road	Agricultural	MTCO ₂ e	150,957	150,957	150,957

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

4.3 LEGISLATIVE-ADJUSTED BUSINESS-AS-USUAL SCENARIO FORECAST

ABAU emissions forecasts were prepared using the same demographic data that were used for the BAU forecasts, while also accounting for State and federal policies and regulations that would affect local emissions. These forecasts provide the unincorporated county with a more robust understanding of future community emissions based on the GHG reduction efforts at the state and federal level. A summary of applicable legislative reductions is provided in Table 23.

Table 23 Legislative Reductions Summary

Source	Legislative Reduction	Description	Sources Applied
State	Renewable Energy and Zero-Carbon Electricity Requirements [SB 1020 and SB 100]	Requires California energy utilities to procure 60 percent of electricity from eligible renewable and zero-carbon sources by 2030, 95 percent by 2040, and 100 percent by 2045.	Electricity, Imported Water
State	California's Building Energy Efficiency Standards (2019 and 2022 Title 24, Part 6)	Requires all new buildings in California to comply with energy efficiency standards established by CEC. Accounts for the energy efficiency gains in new residential and nonresidential buildings.	Stationary Energy, Electricity
State	Advanced Clean Car I Regulation	Establishes GHG emission reduction standards for model years 2017 through 2025 that are more stringent than federal CAFE standards.	Mobile On-road
State	Truck and Bus Regulation	Requires diesel trucks and buses that operate in California to be upgraded to reduce GHG emissions.	Mobile On-road
Federal	Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles	Establishes fuel efficiency standards for medium- and heavy-duty engines and vehicles.	Mobile On-road

Notes: CAFE = Corporate Average Fuel Economy; CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; SUV = sports utility vehicle; SB = Senate Bill.

4.3.1 Title 24 Adjustments

Future energy use was adjusted to reflect increased emissions-intensity stringency under California's Building Energy Efficiency Standards (California Code of Regulations Title 24 Part 6, hereafter referred to as "Title 24"). Although Title 24 applies to both new residential and nonresidential construction, for the purposes of this forecast, adjustments were applied only to residential construction for reasons described below.

This approach accounts for uncertainties in energy consumption patterns and end uses in nonresidential buildings, and uncertainty in the non-residential building types that would be constructed in the future. Title 24 primarily regulates energy efficiency in building envelopes and lighting systems. This is expected to substantially reduce energy consumption for building types where the primary end uses of energy are lighting and heating, ventilation, and air conditioning, such as new office, institutional, and hotel buildings. However, Title 24 may not significantly affect other high-energy-consuming uses in nonresidential facilities, such as process loads or specialized equipment. As such, limiting adjustments to residential construction provides a more conservative and reliable estimate of future energy-related GHG emissions.

The 2019 Title 24 standards apply to projects constructed after January 1, 2020, while the 2022 standards apply after January 1, 2023. The 2025 Title 24 will go into effect statewide in January of 2026; however, detailed data on the changes in building-level energy consumption between the 2025 code and previous code cycles was not available at the time of this analysis. To estimate changes in future energy consumption under the 2022 standards, electricity and natural gas adjustment factors were calculated based on differences in average residential energy use between buildings built to the 2019 and 2022 standards. These factors were derived from CEC's data specific to the 2019 and 2022 standards and climate zone-based energy usage rates. For the unincorporated county, Climate Zone 13 was used in the analysis.

These adjustment factors were then applied to the ABAU forecasts of energy consumption activity for both stationary energy and electricity use to reflect the impact of legislative energy efficiency improvements on future development. The adjustment factors, presented in Table 24, show the percentage change in energy use for buildings built to 2022 standards relative to those built to 2019 standards. Positive values indicate an anticipated increase in energy use, while negative values indicate an anticipated decrease in energy use.

As shown in Table 24:

- ▶ ABAU electricity activity is projected to be higher than BAU in each forecast year due to positive adjustment factors.
- ▶ ABAU stationary energy activity is projected to be lower than BAU due to negative adjustment factors.

Importantly, these adjustments were applied only to energy use growth occurring after the 2022 baseline, reflecting new development that would be subject to the 2022 Title 24, or a later cycle of standards. In addition, it is important to note that although average electricity use in new residential buildings is anticipated to rise under 2022 Title 24 (due to an increase in electrical demand associated with electric appliances installed instead of natural gas appliances), emissions from new residential buildings are expected to be lower than they would be under 2019 Title 24 as a result of overall lower building emissions intensities (due to lower emissions factors associated with electricity compared to natural gas).

Table 24 Stationary Energy and Electricity Adjustment Factors and Activity Forecast Results for Residential Buildings

Energy Type	Forecast Scenario	Adjustment Factor	Activity Units	2022	2030	2040	2045
Electricity	BAU	—	kWh	1,149,729,817	1,203,294,615	1,260,386,382	1,277,450,980
Electricity	ABAU	+12%	kWh	1,149,729,817	1,209,700,353	1,273,619,643	1,292,724,971
Stationary Energy (Natural Gas)	BAU	—	mcf	3,237,260	3,388,081	3,548,833	3,596,881
Stationary Energy (Natural Gas)	ABAU	-29%	mcf	3,237,260	3,344,188	3,458,156	3,492,221

Notes: BAU = Business-as-Usual; ABAU = legislative-adjusted BAU; mcf = one thousand cubic feet; kWh = kilowatt-hour.

Source: Analysis conducted by Ascent in 2025.

4.3.2 Senate Bill 100 and Senate Bill 1020 Adjustments

SB 100 requires that 100 percent of retail electricity sales in California come from renewable and zero-carbon resources by 2045. This legislation builds upon the state’s existing Renewables Portfolio Standard (RPS) by increasing the required percentage of RPS-eligible renewable electricity over time. SB 1020 builds on SB 100 by introducing interim targets for GHG-free electricity for the years 2035 and 2040. As shown in Table 25, SB 100 and SB 1020 require utility providers to supply electricity that is 60 percent GHG-free by 2030, 95 percent by 2040, and 100 percent by 2045. The emissions sources affected by these adjustments include electricity and imported water, both of which are estimated based on the carbon intensity of the electricity grid.

To estimate future GHG emissions factors, the 2022 GHG-free electricity percentage and GHG emissions factors for the CAMX eGRID subregion were first obtained from the EPA’s eGRID database. Using these 2022 values as a baseline, emissions factors for the forecast years (2030, 2040, and 2045) were calculated based on the GHG-free electricity targets established by SB 100 and SB 1020.

Table 25 below demonstrates these GHG-free electricity percentage baseline values and targets, as well as the baseline and calculated emissions factors for the forecast years. Given 2045’s 100 percent GHG-free electricity percentage target, the emissions factor for 2045 is 0. In contrast to the ABAU forecast, the CAMX eGRID emissions factors under the BAU scenario are assumed to remain constant at their 2022 baseline values throughout the forecast years.

Table 25 CAMX eGRID Electricity GHG Emissions Factors Adjusted for SB100 and SB1020

Calculation Factor	Units	2022	2030	2040	2045
SB 100 and SB 1020 GHG-free electricity percentage targets	Percent GHG-free	N/A	60%	95%	100%
CAMX eGRID GHG-free electricity percentage baseline and targets	Percent GHG-free	50%	60%	95%	100%
CAMX eGRID baseline and interpolated emissions factors	MTCO ₂ e/MWh	0.2265	0.1819	0.0227	0

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MWh = megawatt-hour; N/A = Not Applicable.

Source: Analysis conducted by Ascent in 2025.

4.3.3 On-road Vehicle Emissions Standards

State and federal regulations are expected to significantly reduce on-road GHG emissions by requiring improvements in vehicle fuel efficiency and accelerating the transition to zero-emission vehicles (ZEVs). The ABAU forecast for the Mobile On-road source takes into consideration the following State and federal regulations:

- ▶ Innovative Clean Transit Regulation, which requires all California public transit agencies to begin phasing in zero-emission buses (ZEB) starting in 2023 and transition to 100 percent ZEB fleets by 2040 and
- ▶ Advanced Clean Trucks Regulation, which requires truck and van manufacturers to sell a growing share of ZEVs beginning in model year 2024.

All these regulations are reflected in EMFAC2021’s emissions data for the forecast years (2030, 2040 and 2045), which serve as the basis for the Mobile On-road source’s ABAU forecast. In addition to these regulations, EMFAC2021’s data also takes into consideration future increases in light-duty ZEV sales, which would be influenced by California’s Advanced Clean Cars I regulation.

Accordingly, EMFAC2021’s VMT and emissions estimates for forecast years were used to calculate Mobile On-road emissions under the legislative adjustment scenario. As with the inventory methodology, sector-specific emissions factors for each forecast year were calculated by dividing sector-specific VMT by sector-specific emissions for each forecast year. These emissions factors were then multiplied by projected future VMT, which were scaled by relevant activity growth factors (population for the residential sector and employment for the commercial/institutional sector)

to estimate future emissions. The baseline and projected future emissions factors calculated using EMFAC2021 are shown in Table 26.

In contrast, under the BAU scenario, Mobile On-road emissions factors are held constant at their 2022 baseline values for all forecast years, reflecting no change in vehicle efficiency or fleet composition.

Table 26 Mobile On-road Baseline and Projected GHG Emissions Factors

Sector	Units	2022	2030	2040	2045
Commercial Institutional	MTCO ₂ e/VMT	0.0010	0.00090	0.00081	0.00081
Residential	MTCO ₂ e/VMT	0.00032	0.00026	0.00023	0.00023

Notes: MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: Analysis conducted by Ascent in 2025.

4.3.4 Legislative-Adjusted Business-as-Usual Scenario Forecast Results

Table 27 presents the projected GHG emissions for the unincorporated county across all forecast years under the ABAU scenario, organized by emissions source and sector. Emissions sources and sectors not impacted by legislative adjustments are excluded from this table, as their projected GHG emissions are assumed to remain unchanged from the BAU scenario. The full results for projected GHG emissions for the unincorporated county across all forecast years under both the BAU and ABAU scenarios, organized by emissions source and sector, can be found in Table 2.

Table 27 Unincorporated County Legislative-Adjusted BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	182,962	189,198	191,061
Electricity	Residential	MTCO ₂ e	220,057	28,961	—
Imported Water	Commercial/Institutional	MTCO ₂ e	5,062	669	—
Imported Water	Agricultural	MTCO ₂ e	192,304	24,038	—
Mobile On-road	Residential	MTCO ₂ e	674,918	627,425	625,035
Mobile On-road	Commercial/Institutional	MTCO ₂ e	1,192,531	1,156,749	1,201,294

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

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Greenhouse Gas Emissions Inventory and Forecast for the City of Wasco

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June 2025

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LIST OF ABBREVIATIONS

ABAU	legislative-adjusted BAU
AR5	Fifth Assessment Report
BAU	business-as-usual
CalRecycle	California Department of Resources Recycling and Recovery
CARB	California Air Resources Board
CH ₄	methane
CO ₂	carbon dioxide
CVP	Central Valley Project
eGRID	Emissions & Generation Resource Integrated Database
EPA Local GHG Inventory Tool	EPA Local Greenhouse Gas Inventory Tool: Community Module version 2025.1
EPA	US Environmental Protection Agency
GHG	greenhouse gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
Kern COG	Kern Council of Governments
MRR	Mandatory Greenhouse Gas Reporting Regulation
MSW	municipal solid waste
MTCO _{2e}	metric tons of carbon dioxide equivalent
N ₂ O	nitrous oxide
PG&E	Pacific Gas and Electric Company
RPS	Renewables Portfolio Standard
SB	Senate Bill
SWP	State Water Project
VMT	vehicle miles traveled
WARM Tool	Waste Reduction Model
ZEB	zero-emission buses
ZEV	zero-emission vehicle

1 INTRODUCTION

This report contains the methods and results for a greenhouse gas (GHG) emissions inventory and GHG emissions forecast for the City of Wasco. A GHG emissions inventory provides estimates of emissions generated within a defined geographic boundary during a single year. It identifies the sectors, sources, and activities that produce these emissions and their relative contribution, while also providing a baseline to forecast future emissions trends. A GHG emissions forecast evaluates how GHG emissions may change in the future due to growth and the effects of adopted state and federal legislation and regulations. This information can be used for various purposes, including monitoring GHG emissions trends over time, or as the technical basis for planning efforts to reduce GHG emissions, such as a general plan or greenhouse gas reduction plan.

This report was developed as part of a grant provided to the City of Bakersfield by the US Environmental Protection Agency (EPA) as part of the Climate Pollution Reduction Grants program. The grant was provided to support climate pollution reduction planning in the Bakersfield Metropolitan Statistical Area, which includes the entirety of Kern county. Under this grant, funding was allocated to produce GHG emissions inventories and forecasts for each of the 12 jurisdictions in Kern county, including the City of Bakersfield, unincorporated Kern County, and all incorporated cities. These GHG emissions inventories and forecasts will be provided to the subject jurisdiction, the San Joaquin Valley Air Pollution Control District, and Kern Council of Governments (Kern COG).

The GHG emissions inventory and forecast are intended to provide an accounting of GHG emissions generating activities within the City of Wasco geographical boundary for the year 2022, and projections of future emissions based on countywide growth patterns and the effects of adopted state and federal legislation and regulations. This report is accompanied by an Excel-based tool used to develop the GHG emissions inventory, the EPA *Local Greenhouse Gas Inventory Tool: Community Module version 2025.1* (the EPA Local GHG Inventory Tool). The GHG emissions inventory uses only publicly available data sets, many of which provide countywide estimates of GHG emissions generating activity, such as mobile on-road travel, energy consumption, and fertilizer use. This countywide data was scaled down to the jurisdiction level based on various attribution metrics, including population, commercial building floor space, and acres of agricultural use. GHG emissions were then forecasted using countywide growth projections for vehicle travel, population, and employment.

Because countywide data was used and scaled using attribution metrics, rather than jurisdiction-specific data, the GHG emissions inventory and forecast are intended to provide a general scale of GHG emissions for City of Wasco's contribution to countywide GHG emissions and serve as a starting point for more detailed GHG emissions analyses. The Excel-based tool can be updated with more locally specific and operational data that can be obtained from relevant departments and direct requests to utility providers. GHG emissions forecasts can be replicated using more locally specific growth projections for population and employment. The results can also be used to set local GHG reduction targets and develop and quantify locally specific measures for reducing GHG emissions. Sufficient detail is provided in this report to ensure that the analyses are replicable, and data inputs can be replaced with more detailed data, if desired.

2 SUMMARY RESULTS

This section presents the results of the GHG emissions inventory and forecast for the City of Wasco, providing a comprehensive overview of historical (2022 as the inventory year) and projected (2030, 2040, and 2045 as the forecast years) emissions. The results are organized by emissions sources, including stationary energy, electricity, Mobile On-road, wastewater, solid waste, and others, as well as by sectors, including residential, commercial/institutional, industrial, and agricultural.

This breakdown enables an understanding of the emissions sources and sectors that contribute most significantly to the City of Wasco's overall emissions. Section 3 of this report provides additional context and methodology related to each emissions source and sector, including key assumptions, data sources, and allocation methods used in the inventory and forecast development.

2.1 2022 GREENHOUSE GAS EMISSIONS INVENTORY RESULTS

Table 1 below shows the 2022 GHG emissions inventory results for the City of Wasco, categorized by emissions sources and sectors. Figure 1 shows the inventory categorized by emission sources, while Figure 2 shows the inventory categorized by emission sectors.

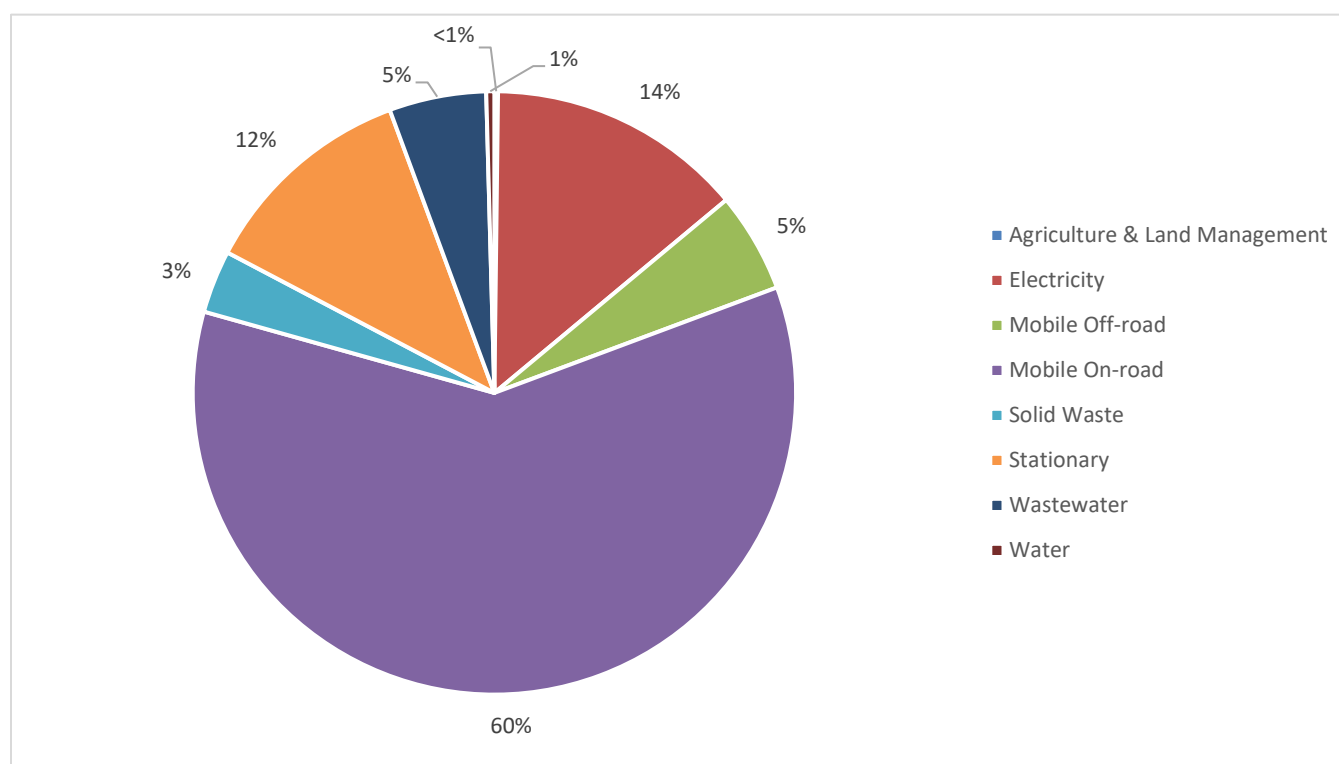
Table 1 City of Wasco 2022 GHG Emissions Inventory Results (MTCO₂e)

Emissions Sources	Emissions Sectors				
	Agricultural	Commercial/Institutional	Industrial	Residential	Total
Agriculture & Land Management	372	—	—	—	372
Electricity	—	3,991	—	22,295	26,285
Mobile Off-road	194	10,049	—	—	10,242
Mobile On-road	—	46,776	—	67,904	114,679
Solid Waste	—	—	—	6,425	6,425
Stationary Energy	—	7,033	—	15,239	22,272
Wastewater	—	9,940	—	—	9,940
Water	307	518	—	—	825
Total	873	78,306	—	111,863	191,041

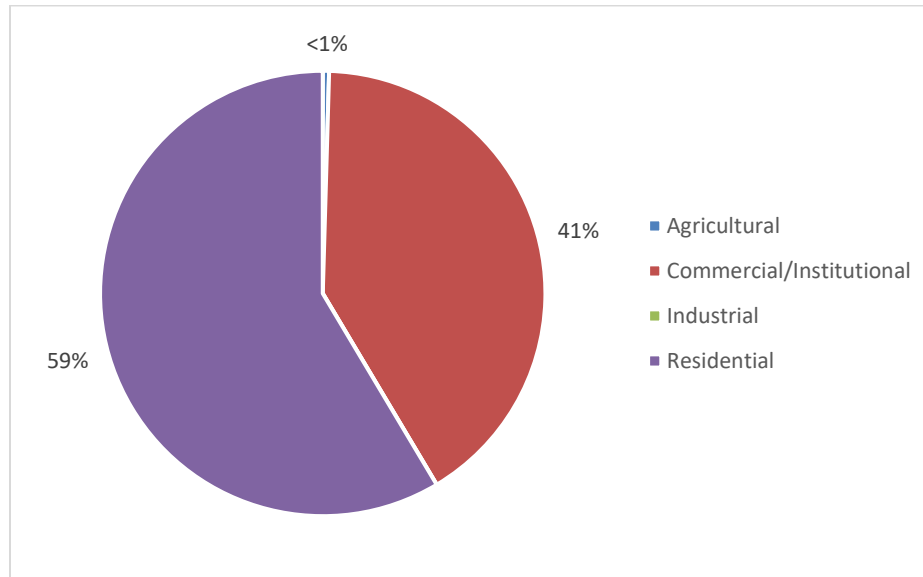
Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 1 City of Wasco 2022 GHG Emissions Inventory by Emissions Sources



Source: Analysis conducted by Ascent in 2025.

Figure 2 City of Wasco 2022 GHG Emissions Inventory by Emissions Sectors

Note: The City of Wasco had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure. Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

2.2 GREENHOUSE GAS EMISSIONS FORECAST RESULTS

Table 2 below shows the projected future GHG emissions for the City of Wasco for the forecast years 2030, 2040 and 2045 under both a business-as-usual (BAU) scenario, as well as a legislative-adjusted BAU (ABAU) scenario, broken down by both emissions sources and sector. The BAU GHG emissions forecasts estimate how community-generated emissions would change over time without additional actions at the State, federal, regional, or local levels, based solely on projected population and employment growth. The ABAU forecasts incorporate the effects of adopted State and federal policies, such as vehicle fuel efficiency standards and increased renewable energy in the electricity grid, but assume no additional local measures.

Table 2 City of Wasco Greenhouse Gas Emissions Forecast for 2030, 2040 and 2045 by Emissions Source and Sector (MTCO_{2e})

Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Stationary Energy	Residential	15,870	15,664	16,622	16,198	16,848	16,357
Stationary Energy	Commercial/Institutional	7,202	7,202	7,787	7,787	8,083	8,083
Stationary Energy	Industrial	—	—	—	—	—	—
Electricity	Residential	23,331	18,840	24,438	2,479	24,769	—
Electricity	Commercial/Institutional	4,107	3,298	4,440	446	4,609	—
Electricity	Industrial	—	—	—	—	—	—
Other Industrial	Industrial	—	—	—	—	—	—
Agriculture – Fertilizer Application	Agricultural	372	372	372	372	372	372
Solid Waste	Residential	6,724	6,724	7,043	7,043	7,138	7,138
Wastewater	Commercial/Institutional	10,764	10,764	11,377	11,377	11,611	11,611
Imported Water	Commercial/Institutional	540	433	570	57	582	—

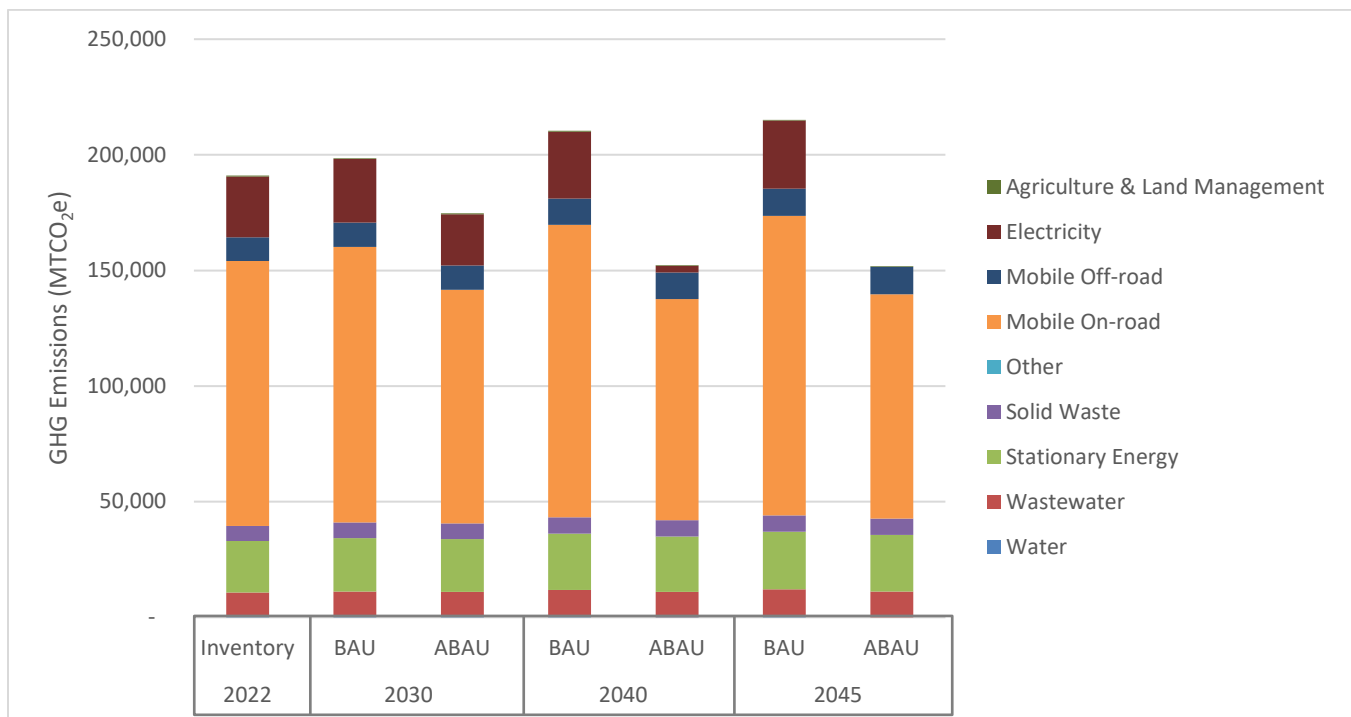
Source	Sector	2030		2040		2045	
		BAU	ABAU	BAU	ABAU	BAU	ABAU
Imported Water	Agricultural	307	247	307	31	307	—
Mobile On-road	Residential	71,067	57,782	74,439	53,716	75,447	53,511
Mobile On-road	Commercial/Institutional	48,140	43,190	52,049	41,894	54,033	43,508
Mobile Off-road	Commercial/Institutional	10,342	10,342	11,181	11,181	11,608	11,608
Mobile Off-road	Agricultural	194	194	194	194	194	194

Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 3 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Wasco's 2022 GHG emissions inventory for comparison, all categorized by emissions sources.

Figure 3 City of Wasco 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sources (MTCO₂e)

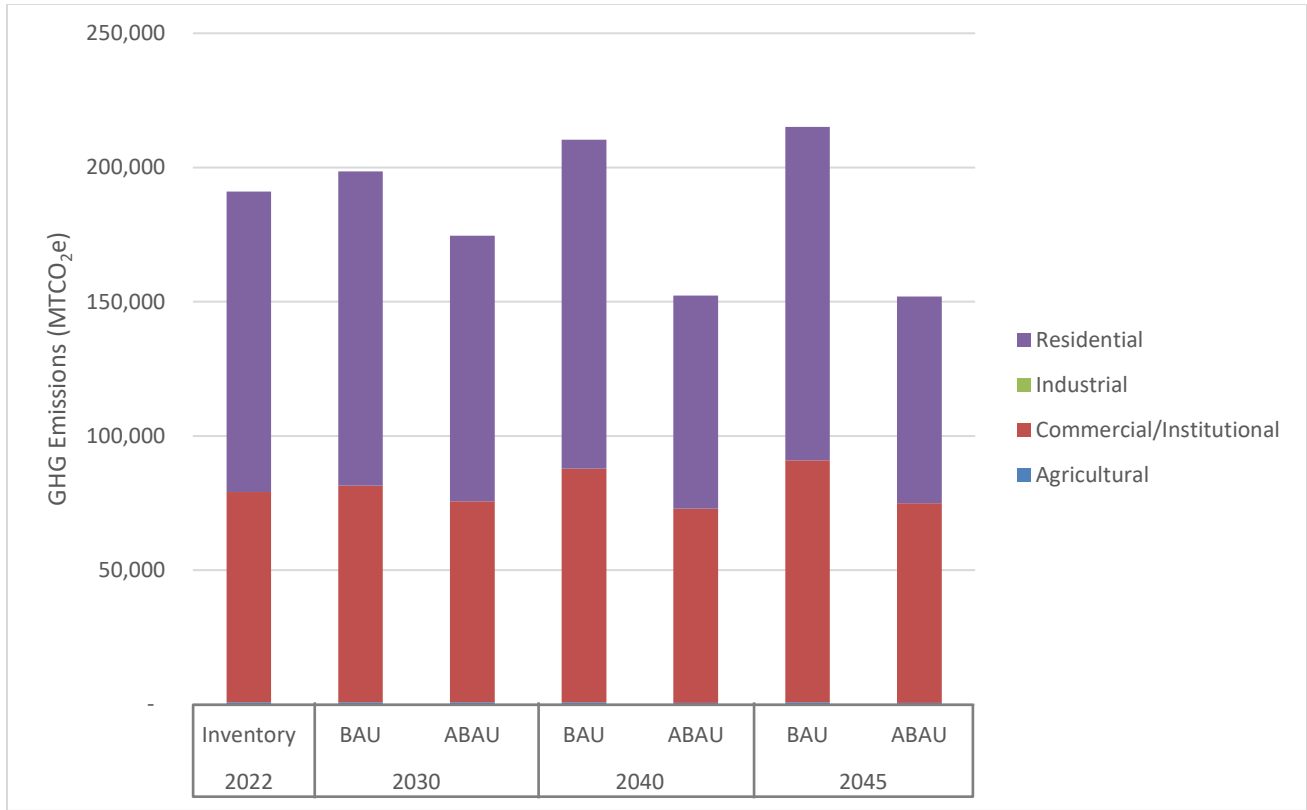


Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

Figure 4 below illustrates the GHG emissions forecasts for 2030, 2040, and 2045 under both the BAU and ABAU scenarios, alongside the City of Wasco's 2022 GHG emissions inventory for comparison, all categorized by emissions sectors.

Figure 4 City of Wasco 2022 GHG Emissions Inventory & Forecasts for 2030, 2040 and 2045 by Emissions Sectors (MTCO₂e)



Notes: ABAU = legislative-adjusted BAU; BAU = Business-as-Usual; MTCO₂e = metric tons of carbon dioxide equivalent. The City of Wasco had zero emissions in the industrial sector in 2022, therefore, the industrial sector is not shown in the figure. Emissions from the agricultural sector were too small to be visually distinguishable on the figure.

Source: Analysis conducted by Ascent in 2025.

3 GREENHOUSE GAS EMISSIONS INVENTORY METHODS

This section of the report details the methods used to develop the GHG emissions inventory for the City of Wasco. It includes descriptions of the data sources and data processing, and the inputs and outputs for the GHG emissions calculations. The methods are organized by GHG emissions sources (stationary energy, electricity, etc.) for the City of Wasco, based on the EPA Local GHG Inventory Tool.

The EPA Local GHG Inventory Tool was primarily used for GHG emissions calculations. Activity data (e.g., energy consumed, tons of waste landfilled, etc.) inputs for the City of Wasco were entered into the tool and parameters were set to represent local conditions (e.g., annual electricity consumption data was imported into the tool as the input to calculate City of Wasco’s GHG emissions associated with electricity, and the appropriate electricity grid was selected to represent local conditions). GHG emissions from on-road transportation were calculated externally to the EPA Local GHG Inventory Tool, due to data format inconsistencies. All other GHG emissions sources were calculated within, or entered into the tool. The tool also categorizes GHG emissions into different sectors: residential, commercial/institutional, industrial, and agricultural. Industrial and agricultural sectors were only used when explicitly differentiated in the available datasets. In all other cases, sector categorization followed the classifications provided by the EPA Local GHG Inventory Tool or as defined by the underlying data sources.

This report only documents data processing and calculations that were performed outside of the EPA Local GHG Inventory Tool and provides the GHG emissions outputs from the tool; it does not expand on the calculation methods

within the tool. Documentation for the EPA Local GHG Inventory Tool can be found on the EPA website at: <https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool>.

3.1 GREENHOUSE GASES AND GLOBAL WARMING POTENTIAL

GHG emissions other than carbon dioxide (CO₂) 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). CO₂ has a GWP factor of one, while all other GHGs have GWP factors measured in multiples of one relative to the GWP of CO₂. This conversion of non-CO₂ gases to one unit enables the reporting of all emissions in terms of carbon dioxide equivalent (CO₂e), 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 (MTCO₂e). For this emissions inventory and forecast, the three primary and most abundant GHGs were accounted for: CO₂, methane (CH₄) and nitrous oxide (N₂O).

Consistent with the best available science, the inventory uses GWP factors published in the Fifth Assessment Report (AR5) from Intergovernmental Panel on Climate Change (IPCC), where CH₄ and N₂O have GWP factors of 28 and 265, respectively (IPCC 2014). These values represent the GWP of GHG on a 100-year time horizon. This means that CH₄ is approximately 28 times stronger than CO₂ and N₂O is 265 times stronger than CO₂ in their potential to warm Earth's atmosphere over the course of 100 years. The use of 100-year GWP values is consistent with the California Air Resources Board (CARB) and EPA GHG accounting methods.

3.2 DATA REVIEW

The general approach for developing the GHG emissions inventory involved the collection of total activity and/or emissions data for Kern county for the year 2022 for each relevant GHG emissions source and then apportioning that data to individual jurisdictions and sectors using appropriate attribution metrics. These metrics include the City of Wasco's contribution to total countywide population, commercial building floor space, and agricultural land acreage. In some cases, such as for landfilled solid waste and industrial facilities, jurisdiction-specific data were available from publicly available resources.

The primary data sources used to compile activity and emissions data for all of Kern county are listed in Table 3.

Table 3 Data Sources for Countywide Activity and Emissions Data

GHG Emission Source	Data Source(s)
Mobile On-road	CARB EMFAC2021 on-road emission inventory model (CARB 2022a)
Mobile Off-road	CARB OFFROAD2021 off-road emission inventory model (CARB 2022b)
Stationary Energy	CEC energy database (CEC 2023), EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases
Electricity	CEC energy database (CEC 2022), Pacific Gas & Electric Co (PG&E)
Imported Water	Water Association of Kern County
Agriculture	CDFA's fertilizing materials tonnage report (CDFA 2025)
Other Industrial Sources	EPA FLIGHT database (EPA 2023)

Notes: CARB = California Air Resources Board; ; CDFA = California's Department of Food & Agriculture CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

Attribution metrics were used to apportion countywide activity and/or emissions data to individual jurisdictions by the appropriate GHG emissions sector. These attribution metrics include:

- population share for allocating activity associated with the residential sector (US Census Bureau 2025),

- ▶ commercial building floor space share for activity associated with the commercial/institutional sector (Open Energy Data Initiative 2020), and
- ▶ farmland, grazing land, and other agricultural land cover types share for the agricultural sector (DOC 2022).

These attribution metrics and the associated values for each jurisdiction in Kern county are shown in Table 4 below.

Table 4 Attribution Metrics Used to Apportion Countywide Activities and GHG Emissions

Jurisdiction	Population	Population %	Agricultural Land Acreage	Agricultural Land Acreage %	Commercial Building Floor Space in Square Footage	Commercial Building Floor Space in Square Footage %
Wasco	19,613	2.2%	1,487	0.1%	1,400	0.9%
Bakersfield	404,321	44.6%	41,684	1.5%	79,800	50.7%
California City	15,002	1.7%	112	0.0%	1,000	0.6%
Delano	50,498	5.6%	4,141	0.2%	5,800	3.7%
Maricopa	1,217	0.1%	558	0.0%	—	0.0%
McFarland	13,971	1.5%	2,754	0.1%	600	0.4%
Ridgecrest	28,118	3.1%	62	0.0%	4,000	2.5%
Shafter	20,162	2.2%	19,419	0.7%	10,700	6.8%
Taft	7,414	0.8%	4,507	0.2%	1,000	0.6%
Tehachapi	12,855	1.4%	2,764	0.1%	1,700	1.1%
Wasco	26,317	2.9%	3,421	0.1%	1,800	1.1%
Unincorporated County	307,395	33.9%	2,666,205	97.1%	49,700	31.6%
Kern County Total	906,883	100%	2,747,115	100%	157,500	100%

Note: Population and agricultural land acreage data reflect conditions in 2022. The most recent data available for commercial building floor space was from 2019, which was used as the attribution metric in this analysis. Because the calculations relied on percentage shares rather than absolute floor space values, using 2019 data was considered appropriate for consistency across jurisdictions.

Sources: US Census Bureau 2025; DOC 2022; Open Energy Data Initiative 2020; analysis conducted by Ascent in 2025.

For the wastewater and solid waste emissions sources, as well as the industrial emissions sector, data and information were collected at the jurisdiction level to calculate associated GHG emissions.

For wastewater, jurisdiction-specific data were obtained from a variety of sources, including any publicly available data about wastewater treatment plant operations. When such data were not publicly available, default values from the EPA Local GHG Inventory Tool and the Local Governments for Sustainability *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* were used to fill data gaps.

For solid waste, jurisdiction-specific disposal data were sourced from the California Department of Resources Recycling and Recovery (CalRecycle), specifically from the Jurisdiction Disposal and Beneficial Reuse by Destination database.

For the industrial emissions sector, jurisdiction-specific emissions data were also obtained directly from the EPA FLIGHT and CARB MRR databases, which report facility-level emissions for large industrial sources.

Data sources for jurisdiction-specific activity and emissions data are shown in Table 5 below.

Table 5 Data Sources for Jurisdiction-Specific Activity and Emissions Data

GHG Emission Source/Sector	Data Source(s)
Wastewater	ICLEI (ICLEI 2019)
Solid Waste	CalRecycle's Jurisdiction Disposal and Beneficial Reuse by Destination database (CalRecycle 2025), EPA FLIGHT database (EPA 2023)

GHG Emission Source/Sector	Data Source(s)
Industrial Sector	EPA FLIGHT (EPA 2023), CARB MRR (CARB 2023) databases

Notes: ICLEI = Local Governments for Sustainability; CalRecycle = California Department of Resources Recycling and Recovery; CARB = California Air Resources Board; EPA = U.S. Environmental Protection Agency; FLIGHT = Facility Level Information on Greenhouse Gases Tool; MRR = Mandatory Reporting Regulation.

3.3 INVENTORY METHODS BY GHG EMISSIONS SOURCE

This section details the data and methods used to calculate GHG emissions in the 2022 inventory, organized by emissions source. It presents the corresponding data inputs into the EPA Local GHG Inventory Tool, any data processing that was performed, and the resulting emissions estimates by source and sector for the City of Wasco. All calculations of GHG emissions use the IPCC AR5 GWP values to convert GHG emissions results to CO₂e.

3.3.1 Mobile On-road

The Mobile On-road 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." The estimation of these emissions relies on EMFAC2021, a statewide mobile source emissions inventory model developed by CARB. EMFAC2021 was used instead of the EPA Local GHG Inventory Tool to calculate mobile on-road GHG emissions because EMFAC2021 provides GHG emissions estimates that more closely represent the vehicle fleet operating on roadways in Kern County. The EPA Local GHG Inventory Tool utilizes national fuel efficiency averages for a select number of vehicle types to calculate GHG emissions, whereas EMFAC2021 considers fuel efficiency by vehicle type and model, providing more accurate estimates of fuel consumption and GHG emissions.

To calculate emissions for the 2022 inventory year, total countywide vehicle miles traveled (VMT) were first obtained from EMFAC2021. These VMT figures were then allocated to emission sectors defined by the EPA's Local GHG Inventory Tool based on vehicle class, specifically, the residential and commercial/institutional sectors. For the purposes of sector-specific emissions calculations, light-duty vehicles were attributed to the residential sector, as they primarily reflect personal vehicle use by residents. In contrast, medium- and heavy-duty trucks were attributed to the commercial/institutional sector, as these vehicle types are more commonly associated with goods movement, service fleets, and business operations. Sector-specific VMT totals were then apportioned to each jurisdiction based on appropriate attribution metrics: population share for residential VMT and commercial building square footage share for commercial/institutional VMT.

EMFAC2021 was also used to generate countywide GHG emissions factors for the two sectors, expressed in MTCO₂e per vehicle mile traveled. These factors accounted for all vehicle classes, model years, speeds, and fuel types. The sector-specific factors were derived by dividing total countywide emissions of CO₂, CH₄, and N₂O (converted to CO₂e using the appropriate GWP) by the corresponding sector-specific countywide total VMT, with emissions and VMT categorized into the residential and commercial/institutional sectors based on vehicle class.

Finally, each jurisdiction's total Mobile On-road emissions by sector were calculated by multiplying the jurisdiction's sector-specific VMT by the respective countywide sector-specific MTCO₂e per VMT emissions factors. Table 6 presents the City of Wasco's total Mobile On-road VMT, associated sector-specific GHG emissions factors, and the resulting total GHG emissions by sector.

Table 6 City of Wasco Mobile On-road Data Inputs and Results

Vehicle Sector	Total Activity (VMT)	GHG Emissions Factor (MTCO ₂ e/VMT)	GHG Emissions (MTCO ₂ e)
Residential	211,084,813	0.00035	67,904
Commercial/Institutional	46,679,759	0.0011	46,776

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: CARB 2022a; analysis conducted by Ascent in 2025.

3.3.2 Mobile Off-road

Emissions from Mobile Off-road sources result from the combustion of fuel in various types of off-road vehicles and equipment (e.g. agricultural tractors, construction equipment). Emissions data for these sources were obtained from CARB's OFFROAD2021 model, which provides detailed estimates for Kern county for the 2022 inventory year. The data include, but are not limited to, information on equipment categories, fuel types, and the amount of fuel consumed.

Using the off-road vehicle categories in OFFROAD2021, the emissions data were organized into two relevant sectors defined by the EPA Local GHG Inventory Tool: agricultural and commercial/institutional. Sector-specific off-road fuel consumption totals were then apportioned to each jurisdiction using appropriate attribution metrics. Specifically, the share of farmland, grazing land, and other agricultural land was used to allocate agricultural emissions, while the commercial building square footage share was used to distribute commercial/institutional emissions.

Finally, each jurisdiction's sector-specific off-road fuel consumption data were entered into the "Mobile-Data" sheet of the EPA Local GHG Inventory Tool to calculate Mobile Off-road emissions. The EPA Local GHG Inventory Tool includes emissions factors by fuel type. Table 7 presents the City of Wasco's total Mobile Off-road fuel consumption by fuel type and the resulting total GHG emissions by sector.

Table 7 City of Wasco Mobile Off-road Data Inputs and Results

Vehicle Sector	Diesel Consumption (gallons)	Gasoline Consumption (gallons)	Liquefied Natural Gas (LNG) Consumption (gallons)	Total Fuel Consumption (gallons)	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	692,365	302,919	16,716	1,012,001	10,049
Agricultural	18,104	335	—	18,438	194

Notes: GHG = greenhouse Gas; LNG = liquefied natural gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CARB 2022b, analysis conducted by Ascent in 2025.

3.3.3 Stationary Energy

The stationary energy source of GHG emissions includes natural gas combustion in residential, commercial/institutional and industrial uses. Residential uses primarily consume natural gas for space and water heating, and cooking. Commercial/institutional uses may include space heating and cooling, cooking in restaurants, and smaller boilers or generators. Industrial uses are often process-specific uses tied to manufacturing or heavy operations such as process heating, steam generation, and boiler systems. Propane fuel usage was not included in the stationary energy-related calculations as propane usage data for these various uses was not available at the same level of detail or consistency as other stationary energy data sources at the county scale.

RESIDENTIAL AND COMMERCIAL/INSTITUTIONAL

Total countywide natural gas usage data for the 2022 inventory year was obtained from the CEC Energy Reports: Gas Consumption by County, which categorizes usage into residential and non-residential sectors. Residential natural gas consumption was allocated to each jurisdiction based on its share of the county's population.

To isolate commercial/institutional usage, countywide industrial natural gas consumption, sourced from the EPA FLIGHT database and CARB MRR database, was subtracted from the CEC total non-residential usage. The resulting commercial/institutional natural gas usage was then apportioned to each jurisdiction using commercial building floor space share as the attribution metric.

Finally, each jurisdiction's residential and commercial/institutional natural gas usage data were entered into the "Stationary-Data" sheet of the EPA Local GHG Inventory Tool to calculate residential and commercial/institutional stationary energy emissions. Table 8 below shows the City of Wasco's total stationary energy activities (natural gas consumption) in 2022 and the associated GHG emissions in residential and commercial/institutional sectors.

Table 8 City of Wasco Residential and Commercial/Institutional Stationary Energy Data Inputs and Results

Sector	Total Activity (mcf of natural gas consumed)	GHG Emissions (MTCO ₂ e)
Residential	277,151	15,239
Commercial/Institutional	127,902	7,033

Notes: mcf = thousand cubic feet; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; EPA 2023; CARB 2023; analysis conducted by Ascent in 2025.

INDUSTRIAL

Industrial stationary energy data from the EPA FLIGHT and CARB MRR databases were reviewed to determine if large industrial facilities exist within the City of Wasco. The EPA FLIGHT database includes emissions from large industrial facilities emitting 25,000 MTCO₂e or more per year, while the CARB MRR database captures facilities with emissions of 10,000 MTCO₂e or more annually. Both data sources provide geographic information, allowing emissions to be assigned to the appropriate jurisdictions.

For the City of Wasco, the databases showed that no large industrial facilities are located within its geographic boundary, therefore, there is no reported industrial stationary energy associated activity or GHG emissions for the City of Wasco.

3.3.4 Electricity

The electricity source addresses energy-related indirect GHG emissions resulting from the consumption of grid-supplied electricity within the City of Wasco's boundary. Consumption of grid-supplied electricity is considered an "indirect" GHG emissions source, because GHG emissions occur at the source of electricity generation, which is usually outside of a jurisdiction's boundary. The location-based method was used to calculate electricity GHG emissions, which uses regional grid-average emission factors. In the United States, these factors are provided by the EPA's Emissions & Generation Resource Integrated Database (eGRID). Specifically, emission factors for the CAMX eGRID subregion were applied, as this subregion encompasses the geographic area of Kern county.

Total electricity usage data for Kern county in 2022 was obtained from CEC Energy Reports: Electricity by County, which categorized usage into residential and non-residential sectors (CEC 2023). Electricity usage data for the City of Bakersfield, which was also separated into residential and non-residential categories, was acquired directly from the Pacific Gas and Electric Company (PG&E). To estimate electricity usage for the rest of the county (i.e., all jurisdictions excluding Bakersfield), the City of Bakersfield's electricity data was subtracted from the total Kern county data.

Residential electricity usage outside of Bakersfield was apportioned to each jurisdiction based on its share of the county's total population. For non-residential electricity usage, estimates were further categorized into industrial and commercial/institutional sectors using attribution metrics derived from natural gas consumption data previously calculated under stationary energy. In 2022, 93.1 percent of the county's stationary natural gas combustion was attributed to industrial use and 6.9 percent to commercial/institutional use. These same ratios were applied to the county's total non-residential electricity usage, under the assumption that the sectoral split in electricity usage mirrors that of natural gas usage. This assumption was validated using available industrial electricity and natural gas usage data in PG&E's service territory, from the CEC Energy Reports. The electricity-to-gas ratio, expressed as gigawatt-hour per million therms, was calculated by dividing total industrial electricity usage by industrial natural gas consumption for the service territory. The resulting value closely aligns with the assumptions applied in this here, supporting its validity.

The City of Wasco's share of commercial building square footage was used to attribute commercial/institutional electricity usage. Industrial electricity usage was attributed based on the proportion of countywide industrial natural gas within the City of Wasco. No industrial facilities exist in the City of Wasco; therefore, no industrial electricity usage is attributed to the City of Wasco. Finally, the sector-specific electricity usage data for each jurisdiction was entered into the "Electricity-Data" sheet of the EPA Local GHG Inventory Tool to calculate associated GHG emissions.

Table 9 below shows the City of Wasco's electricity activity data and the associated GHG emissions by emission sectors.

Table 9 City of Wasco Electricity Energy Data Inputs and Results

Sector	Total Activity (kWh of Electricity Consumed)	GHG Emissions (MTCO ₂ e)
Residential	98,431,788	22,295
Commercial/Institutional	17,618,382	3,991
Industrial	—	—

Notes: kWh = kilowatt-hour; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CEC 2023; PG&E 2025; analysis conducted by Ascent in 2025.

3.3.5 Imported Water

The water source category captures GHG emissions from energy use associated with the conveyance, treatment, and distribution of water within a jurisdiction. In Kern county, the WAKC reports that approximately 166,000 acre-feet of water are used annually for municipal and industrial purposes, and 2,294,000 acre-feet for agricultural purposes.

In addition to local surface water, Kern county draws water from several sources. Among these, only water supplied through the State Water Project (SWP) and the federal Central Valley Project (CVP) is considered imported, and therefore potentially results in GHG emissions due to long-distance conveyance. All other sources are classified as local. It was assumed that energy used for extracting, conveying, treating, and distributing local water is captured under the emissions estimates for stationary energy and electricity, since these activities occur within the county. In addition, upon further review, it was also determined that the federal CVP does not consume energy for water delivery to Kern County, as water is primarily conveyed using gravity (Friant Water Authority 2019). As a result, only the SWP, which accounts for 26 percent of the county's water supply, contributes to GHG emissions. Table 10 provides a summary of the water sources in Kern county and their contribution to the total water supply.

Table 10 Kern County Water Sources

Source	Percentage
Kern River	20%
State Water Project (California Aqueduct)	26%
Federal Central Valley Project (Friant-Kern Canal)	12%
Local Streams and Other Sources (Poso Creek, Kern River, etc.)	6%
Groundwater	36%
Total	100%

Source: WAKC n.d.

Water use in Kern County is characterized into municipal and industrial, and agricultural sectors in data obtained from WAKC. It is assumed that water included in "municipal" uses is delivered to both commercial and residential customers. However, sufficient data was not available to disaggregate the water consumption between industrial, commercial, and residential customers. For the purpose of this GHG emissions inventory, all non-agricultural water consumption was categorized under the commercial/institutional sector.

To allocate sector-specific water usage to individual jurisdictions, the following attribution metrics were used:

- ▶ Agricultural water use was apportioned based on each jurisdiction's share of farmland, grazing land, and other agricultural land.
- ▶ Commercial/institutional water use was distributed according to the share of commercial building square footage in each jurisdiction.

These apportioned figures were then entered into the “Imported Water” sheet of the EPA Local GHG Inventory Tool, applying a universal 26 percent imported water rate, to estimate the associated GHG emissions from water conveyance and use. Table 11 presents the City of Wasco’s activity data related to imported water, including the percentage of total water supply that is imported and the associated GHG emissions.

Table 11 City of Wasco Imported Water Energy Data Inputs and Results

Sector	Total Activity (Gallons of Water)	Percentage of Water Imported	GHG Emissions (MTCO ₂ e)
Commercial/Institutional	408,117,872	26%	518
Agricultural	242,021,553		307

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: WAKC n.d.; analysis conducted by Ascent in 2025.

3.3.6 Wastewater

The wastewater source accounts for GHG emissions resulting from the treatment of sewage. To support this analysis, a review of publicly available wastewater treatment characteristics was conducted to collect the data required for completing the “Wastewater-Control” tab of the EPA’s Local GHG Inventory Tool. The data sources and corresponding assumptions for the City of Wasco’s wastewater treatment systems are summarized in Table 12. Where jurisdiction-specific data were not publicly available, the default input values provided by the EPA tool were used.

To estimate GHG emissions, population data for each jurisdiction were subsequently entered into the “Wastewater-Entry” tab of the tool. The resulting emissions estimates are also presented in Table 12, alongside the data sources and assumptions used.

Table 12 City of Wasco Wastewater Treatment Assumptions

Wastewater Process/Treatment Type	Conditions Assumed	Data Source	GHG Emissions (MTCO ₂ e)
Population served by septic systems	5 percent of the city’s population	ICLEI’s default proportion of population that utilizes septic tanks for an urban area (Box WW.11(alt).2).	10,334
One or more wastewater treatment plants (WWTPs) where wastewater is treated in aerobic or anaerobic conditions	Anerobic	No public information is available. The default value is anerobic.	
One or more WWTPs conduct or do not conduct nitrification/denitrification	No nitrification/denitrification	No public information is available. The default value is no nitrification/denitrification.	

Notes: WWTP = wastewater treatment plant; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; ICLEI = Local Governments for Sustainability.

Sources: ICLEI 2019; analysis conducted by Ascent in 2025.

3.3.7 Solid Waste

Community-generated solid waste emissions are primarily associated with the decomposition of solid waste in landfills. There are two methods for accounting for GHG emissions associated with waste disposal:

- ▶ Waste generation method – Accounts for the total GHG emissions that would be generated over time as municipal solid waste (MSW) that is sent to a landfill in only the inventory year decomposes.
- ▶ Waste-in-place method – Accounts for the total GHG emissions generated in a given year at a specific landfill location by the decomposition of all MSW previously disposed at the landfill.

Generally, there is some risk of double counting GHG emissions when combining both of these methods, as a portion of the emissions accounted for using the waste generation method may occur at an in-boundary landfill that has emissions reported using the waste-in-place method. However, the scale of the overlapping GHG emissions between the two methods would be expected as very small in comparison to total emission using either accounting method.

WASTE GENERATION

Landfill tonnage data for 2022 was obtained from CalRecycle’s Jurisdiction Disposal and Beneficial Reuse by Destination database. This data was entered into the EPA’s Waste Reduction Model (WARM Tool) as “mixed MSW” to estimate waste generation emissions. The default national average values were used in the WARM Tool, except for Question 7, where the k value was set to “dry” based on the county’s annual precipitation (less than 20 inches) (NCEI 2025). The WARM output was then imported into the EPA Local GHG Inventory Tool’s “Waste Production” tab, with solid-waste associated emissions attributed to the residential sector by default.

The total activity for solid waste disposal and the resulting waste generation GHG emissions results from the WARM Tool are provided in Table 13.

Table 13 City of Wasco Waste Generation Data Inputs and Results

Sector	Total Activity (tons of MSW disposed)	GHG Emissions (MTCO ₂ e) (WARM Output)
Residential	22,261	6,425

Notes: MSW = mixed municipal solid waste; GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent; WARM = Waste Reduction Model.

Source: CalRecycle 2025; analysis conducted by Ascent in 2025.

WASTE-IN-PLACE

EPA’s FLIGHT database was reviewed to determine emissions from landfills located within the City of Wasco’s geopolitical boundary, which would provide emissions data for any landfills that generated emissions greater than 25,000 MTCO₂e in 2022. No reporting landfills were identified for the City of Wasco.

3.3.8 Agriculture

The agriculture emissions source captures GHG emissions generated from fertilizer application.

FERTILIZER APPLICATION

Fertilizer application results in GHG emissions primarily due to the release of N₂O, a potent GHG with a global warming potential nearly 300 times greater than CO₂. When nitrogen-based fertilizers are applied to soil, a portion of the nitrogen undergoes microbial processes (nitrification and denitrification), which convert it into N₂O. These emissions can occur directly from the soil or indirectly through leaching and runoff

The total tonnage of nitrogen in synthetic fertilizers applied in Kern county during the 2022 inventory year was obtained from CDFA’s fertilizing materials tonnage report. This countywide total was then apportioned to individual jurisdictions based on each jurisdiction’s proportional share of farmland, grazing land, and other agricultural land. Only data for synthetic fertilizers was publicly available for calculation, although other organic or manure-based fertilizers may be used.

The resulting tonnage of nitrogen in synthetic fertilizers estimated for the City of Wasco was entered into the “Agriculture & Land Management” sheet of the EPA’s Local GHG Inventory Tool to calculate the associated emissions. Table 14 provides the estimated total tons of nitrogen applied and resulting GHG emissions.

Table 14 City of Wasco Fertilizer Application Data Inputs and Results

Sector	Total Activity (tons of nitrogen applied)	GHG Emissions (MTCO ₂ e)
Agricultural	52	372

Notes: GHG = greenhouse gas; MTCO₂e = metric tons of carbon dioxide equivalent.

Source: CDFA 2025; analysis conducted by Ascent in 2025.

4 GREENHOUSE GAS EMISSIONS FORECAST METHODS

This section provides the methods and data used to project future GHG emissions under a BAU scenario, as well as the calculations of reductions from adopted legislation and regulations under an ABAU scenario.

The BAU GHG emissions forecasts assess how emissions generated by community activities will change over time without further State, federal, regional, or local action. The BAU scenario forecast accounts for the changes in population and employment that can influence communitywide GHG emissions. The ABAU scenario forecast includes adopted policies and regulations at the State and federal levels that would affect emissions without any local action, such as regulatory requirements to increase vehicle fuel efficiency and increase renewable energy sources in grid electricity portfolios. These forecasts provide the City of Wasco with information needed to understand specific GHG emissions sources with the greatest opportunities for reduction with future plans, projects, or programs. It is important to note that the ABAU forecasts only account for emissions reductions associated with adopted policies and regulations; they do not account for proposed and/or unadopted GHG reduction actions established by regional, State, and federal agencies or executive orders outside of adopted legislation and regulations.

The GHG emissions forecasts project GHG emissions for the years 2030, 2040, and 2045 to align with key regulatory timelines for the State. Two key legislative actions establish statewide GHG reduction targets for the years 2030 and 2045, including:

- ▶ Senate Bill (SB) 32 of 2016, which sets a statewide GHG reduction target for the year 2030, and
- ▶ Assembly Bill 1279 of 2022, which sets a statewide GHG reduction target for the year 2045.

The forecast years selected do not necessarily align with the targets established by adopted legislation, but they do provide an analysis of emissions that aligns with the relevant horizon years. The year 2040 was also included in the analysis as an interim year between the 2030 and 2045 forecast years.

4.1 GROWTH PROJECTIONS

GHG emissions forecasts were developed based on projected changes in Kern county's demographics, specifically population, employment, and service population (defined as residents plus employees), between 2022 and 2045. These projections were obtained from the Regional Growth Forecast and Demographic Forecast prepared by the Kern COG (Kern COG 2024). It is assumed that the incorporated cities and the unincorporated county will experience demographic growth at the same rate as the county overall, as jurisdiction-specific growth projections were not available at the time of this analysis.

Between 2022 and 2045, Kern county's population and employment are projected to increase by approximately 11.1 and 15.5 percent, respectively. The service population is expected to grow by 12.4 percent. These growth factors were applied to forecast GHG emissions for the years 2030, 2040, and 2045 across various emissions sources included in the inventory. The values used for population, employment, and service population used to project future emissions are provided in Table 15.

Table 15 Kern County Demographics and Calculated Growth Rates for Future Emissions Forecasts

Calculation Factor	2022	2030	2040	2045
Population				
Total Kern County	906,883	949,134	994,167	1,007,627
Kern County Growth from 2022		4.7%	9.6%	11.1%
Employment				
Total Kern County	358,961	369,427	399,432	414,652
Kern County Growth from 2022		2.9%	11.3%	15.5%
Service Population				
Total Kern County	1,265,844	1,318,561	1,393,598	1,422,279
Kern County Growth from 2022		4.2%	10.1%	12.4%

Source: US Census Bureau 2025; Kern COG 2024; analysis conducted by Ascent in 2025.

Additional details on how growth factors were applied to individual sources are provided in the following sections. It is important to note that agricultural emissions, including those from fertilizer application, as well as livestock enteric fermentation and manure management, are assumed to remain constant throughout the forecast period, with no projected increase in activity levels. Agricultural activities are difficult to project in any detail, with production intensities, number of livestock, and crop types being highly susceptible to global markets and local climate patterns. As such, projections of agriculture GHG emissions-generating activities are not attempted.

4.2 BUSINESS-AS-USUAL SCENARIO FORECAST

The BAU forecast represents a projection of future GHG emissions based solely on expected demographic and economic growth (e.g., population, employment, and service population) between 2022 and 2045. It does not account for the potential impacts of future policies, programs, or actions that may reduce emissions, such as energy efficiency improvements, renewable energy adoption, or transportation electrification.

In the BAU scenario, GHG emissions factors are held constant at the levels used in the 2022 GHG inventory, meaning the carbon intensity of electricity, fuels, and other activities is assumed not to change over time. As a result, any changes in future emissions are driven entirely by growth in activity levels, not by improvements in emissions performance.

4.2.1 Business-As-Usual Scenario Forecast Results

Table 16 presents the projected activity data for the City of Wasco across all forecast years, organized by emissions source and sector. Table 16 also indicates which sources and sectors used population, employment, or service population as a growth metric.

Table 16 City of Wasco BAU Scenario Projected Activity Data for All Forecast Years

Source	Sector	Growth Metric	Units	2030	2040	2045
Stationary Energy	Residential	Population	scf	290,064	303,826	307,940
Stationary Energy	Commercial/Institutional	Employment	scf	131,631	142,322	147,745
Stationary Energy	Industrial	Employment	scf	—	—	—
Electricity	Residential	Population	kWh	103,017,630	107,905,426	109,366,377
Electricity	Commercial/Institutional	Employment	kWh	18,132,089	19,604,753	20,351,805
Electricity	Industrial	Employment	kWh	—	—	—
Other Industrial	Industrial	Employment	MTCO ₂ e	—	—	—

Source	Sector	Growth Metric	Units	2030	2040	2045
Agriculture – Fertilizer Application	Agricultural ¹	N/A	ton	52	52	52
Solid Waste	Residential	Population	ton	23,298	24,403	24,733
Wastewater	Commercial/Institutional	Service Population	MTCO ₂ e	10,764	11,377	11,611
Imported Water	Commercial/Institutional	Service Population	Gallon	425,114,304	449,306,876	458,553,788
Imported Water	Agricultural ¹	N/A	Gallon	242,021,553	242,021,553	242,021,553
Mobile On-road	Residential	Population	VMT	220,919,050	231,400,822	234,533,799
Mobile On-road	Commercial/Institutional	Employment	VMT	48,040,823	51,942,634	53,921,941
Mobile Off-road	Commercial/Institutional	Employment	MTCO ₂ e	10,342	11,181	11,608
Mobile Off-road	Agricultural ¹	N/A	MTCO ₂ e	194	194	194

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; scf = standard cubic foot.

¹ Activity levels for the agricultural sector are assumed to remain constant over the forecast period; therefore, growth metrics are listed as “N/A.”

Source: Analysis conducted by Ascent in 2025.

Table 17 below presents the projected GHG emissions for the City of Wasco across all forecast years, also organized by emissions source and sector.

Table 17 City of Wasco BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	15,870	16,622	16,848
Stationary Energy	Commercial/Institutional	MTCO ₂ e	7,202	7,787	8,083
Stationary Energy	Industrial	MTCO ₂ e	—	—	—
Electricity	Residential	MTCO ₂ e	23,331	24,438	24,769
Electricity	Commercial/Institutional	MTCO ₂ e	4,107	4,440	4,609
Electricity	Industrial	MTCO ₂ e	—	—	—
Other Industrial	Industrial	MTCO ₂ e	—	—	—
Agriculture – Fertilizer Application	Agricultural	MTCO ₂ e	372	372	372
Solid Waste	Residential	MTCO ₂ e	6,724	7,043	7,138
Wastewater	Commercial/Institutional	MTCO ₂ e	10,764	11,377	11,611
Imported Water	Commercial/Institutional	MTCO ₂ e	540	570	582
Imported Water	Agricultural	MTCO ₂ e	307	307	307
Mobile On-road	Residential	MTCO ₂ e	71,067	74,439	75,447
Mobile On-road	Commercial/Institutional	MTCO ₂ e	48,140	52,049	54,033
Mobile Off-road	Commercial/Institutional	MTCO ₂ e	10,342	11,181	11,608
Mobile Off-road	Agricultural	MTCO ₂ e	194	194	194

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

4.3 LEGISLATIVE-ADJUSTED BUSINESS-AS-USUAL SCENARIO FORECAST

ABAU emissions forecasts were prepared using the same demographic data that were used for the BAU forecasts, while also accounting for State and federal policies and regulations that would affect local emissions. These forecasts provide the City of Wasco with a more robust understanding of future community emissions based on the GHG reduction efforts at the state and federal level. A summary of applicable legislative reductions is provided in Table 18.

Table 18 Legislative Reductions Summary

Source	Legislative Reduction	Description	Sources Applied
State	Renewable Energy and Zero-Carbon Electricity Requirements [SB 1020 and SB 100]	Requires California energy utilities to procure 60 percent of electricity from eligible renewable and zero-carbon sources by 2030, 95 percent by 2040, and 100 percent by 2045.	Electricity, Imported Water
State	California's Building Energy Efficiency Standards (2019 and 2022 Title 24, Part 6)	Requires all new buildings in California to comply with energy efficiency standards established by CEC. Accounts for the energy efficiency gains in new residential and nonresidential buildings.	Stationary Energy, Electricity
State	Advanced Clean Car I Regulation	Establishes GHG emission reduction standards for model years 2017 through 2025 that are more stringent than federal CAFE standards.	Mobile On-road
State	Truck and Bus Regulation	Requires diesel trucks and buses that operate in California to be upgraded to reduce GHG emissions.	Mobile On-road
Federal	Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles	Establishes fuel efficiency standards for medium- and heavy-duty engines and vehicles.	Mobile On-road

Notes: CAFE = Corporate Average Fuel Economy; CEC = California Energy Commission; EPA = U.S. Environmental Protection Agency; GHG = greenhouse gas; SUV = sports utility vehicle; SB = Senate Bill.

4.3.1 Title 24 Adjustments

Future energy use was adjusted to reflect increased emissions-intensity stringency under California's Building Energy Efficiency Standards (California Code of Regulations Title 24 Part 6, hereafter referred to as "Title 24"). Although Title 24 applies to both new residential and nonresidential construction, for the purposes of this forecast, adjustments were applied only to residential construction for reasons described below.

This approach accounts for uncertainties in energy consumption patterns and end uses in nonresidential buildings, and uncertainty in the non-residential building types that would be constructed in the future. Title 24 primarily regulates energy efficiency in building envelopes and lighting systems. This is expected to substantially reduce energy consumption for building types where the primary end uses of energy are lighting and heating, ventilation, and air conditioning, such as new office, institutional, and hotel buildings. However, Title 24 may not significantly affect other high-energy-consuming uses in nonresidential facilities, such as process loads or specialized equipment. As such, limiting adjustments to residential construction provides a more conservative and reliable estimate of future energy-related GHG emissions.

The 2019 Title 24 standards apply to projects constructed after January 1, 2020, while the 2022 standards apply after January 1, 2023. The 2025 Title 24 will go into effect statewide in January of 2026; however, detailed data on the changes in building-level energy consumption between the 2025 code and previous code cycles was not available at the time of this analysis. To estimate changes in future energy consumption under the 2022 standards, electricity and natural gas adjustment factors were calculated based on differences in average residential energy use between buildings built to the 2019 and 2022 standards. These factors were derived from CEC's data specific to the 2019 and 2022 standards and climate zone-based energy usage rates. For the City of Wasco, Climate Zone 13 was used in the analysis.

These adjustment factors were then applied to the ABAU forecasts of energy consumption activity for both stationary energy and electricity use to reflect the impact of legislative energy efficiency improvements on future development.

The adjustment factors, presented in Table 19, show the percentage change in energy use for buildings built to 2022 standards relative to those built to 2019 standards. Positive values indicate an anticipated increase in energy use, while negative values indicate an anticipated decrease in energy use.

As shown in Table 19:

- ▶ ABAU electricity activity is projected to be higher than BAU in each forecast year due to positive adjustment factors.
- ▶ ABAU stationary energy activity is projected to be lower than BAU due to negative adjustment factors.

Importantly, these adjustments were applied only to energy use growth occurring after the 2022 baseline, reflecting new development that would be subject to the 2022 Title 24, or a later cycle of standards. In addition, it is important to note that although average electricity use in new residential buildings is anticipated to rise under 2022 Title 24 (due to an increase in electrical demand associated with electric appliances installed instead of natural gas appliances), emissions from new residential buildings are expected to be lower than they would be under 2019 Title 24 as a result of overall lower building emissions intensities (due to lower emissions factors associated with electricity compared to natural gas).

Table 19 Stationary Energy and Electricity Adjustment Factors and Activity Forecast Results for Residential Buildings

Energy Type	Forecast Scenario	Adjustment Factor	Activity Units	2022	2030	2040	2045
Electricity	BAU	—	kWh	98,431,788	103,017,630	107,905,426	109,366,377
Electricity	ABAU	+12%	kWh	98,431,788	103,566,044	109,038,365	110,674,029
Stationary Energy (Natural Gas)	BAU	—	mcf	277,151	290,064	303,826	307,940
Stationary Energy (Natural Gas)	ABAU	-29%	mcf	277,151	286,306	296,063	298,979

Notes: BAU = Business-as-Usual; ABAU = legislative-adjusted BAU; mcf = one thousand cubic feet; kWh = kilowatt-hour.

Source: Analysis conducted by Ascent in 2025.

4.3.2 Senate Bill 100 and Senate Bill 1020 Adjustments

SB 100 requires that 100 percent of retail electricity sales in California come from renewable and zero-carbon resources by 2045. This legislation builds upon the state's existing Renewables Portfolio Standard (RPS) by increasing the required percentage of RPS-eligible renewable electricity over time. SB 1020 builds on SB 100 by introducing interim targets for GHG-free electricity for the years 2035 and 2040. As shown in Table 20, SB 100 and SB 1020 require utility providers to supply electricity that is 60 percent GHG-free by 2030, 95 percent by 2040, and 100 percent by 2045. The emissions sources affected by these adjustments include electricity and imported water, both of which are estimated based on the carbon intensity of the electricity grid.

To estimate future GHG emissions factors, the 2022 GHG-free electricity percentage and GHG emissions factors for the CAMX eGRID subregion were first obtained from the EPA's eGRID database. Using these 2022 values as a baseline, emissions factors for the forecast years (2030, 2040, and 2045) were calculated based on the GHG-free electricity targets established by SB 100 and SB 1020.

Table 20 below demonstrates these GHG-free electricity percentage baseline values and targets, as well as the baseline and calculated emissions factors for the forecast years. Given 2045's 100 percent GHG-free electricity percentage target, the emissions factor for 2045 is 0. In contrast to the ABAU forecast, the CAMX eGRID emissions factors under the BAU scenario are assumed to remain constant at their 2022 baseline values throughout the forecast years.

Table 20 CAMX eGRID Electricity GHG Emissions Factors Adjusted for SB100 and SB1020

Calculation Factor	Units	2022	2030	2040	2045
SB 100 and SB 1020 GHG-free electricity percentage targets	Percent GHG-free	N/A	60%	95%	100%
CAMX eGRID GHG-free electricity percentage baseline and targets	Percent GHG-free	50%	60%	95%	100%
CAMX eGRID baseline and interpolated emissions factors	MTCO ₂ e/MWh	0.2265	0.1819	0.0227	0

Notes: kWh = kilowatt-hour; MTCO₂e = metric tons of carbon dioxide equivalent; MWh = megawatt-hour; N/A = Not Applicable.

Source: Analysis conducted by Ascent in 2025.

4.3.3 On-road Vehicle Emissions Standards

State and federal regulations are expected to significantly reduce on-road GHG emissions by requiring improvements in vehicle fuel efficiency and accelerating the transition to zero-emission vehicles (ZEVs). The ABAU forecast for the Mobile On-road source takes into consideration the following State and federal regulations:

- ▶ Innovative Clean Transit Regulation, which requires all California public transit agencies to begin phasing in zero-emission buses (ZEB) starting in 2023 and transition to 100 percent ZEB fleets by 2040 and
- ▶ Advanced Clean Trucks Regulation, which requires truck and van manufacturers to sell a growing share of ZEVs beginning in model year 2024.

All these regulations are reflected in EMFAC2021's emissions data for the forecast years (2030, 2040 and 2045), which serve as the basis for the Mobile On-road source's ABAU forecast. In addition to these regulations, EMFAC2021's data also takes into consideration future increases in light-duty ZEV sales, which would be influenced by California's Advanced Clean Cars I regulation.

Accordingly, EMFAC2021's VMT and emissions estimates for forecast years were used to calculate Mobile On-road emissions under the legislative adjustment scenario. As with the inventory methodology, sector-specific emissions factors for each forecast year were calculated by dividing sector-specific VMT by sector-specific emissions for each forecast year. These emissions factors were then multiplied by projected future VMT, which were scaled by relevant activity growth factors (population for the residential sector and employment for the commercial/institutional sector) to estimate future emissions. The baseline and projected future emissions factors calculated using EMFAC2021 are shown in Table 21.

In contrast, under the BAU scenario, Mobile On-road emissions factors are held constant at their 2022 baseline values for all forecast years, reflecting no change in vehicle efficiency or fleet composition.

Table 21 Mobile On-road Baseline and Projected GHG Emissions Factors

Sector	Units	2022	2030	2040	2045
Commercial Institutional	MTCO ₂ e/VMT	0.0010	0.00090	0.00081	0.00081
Residential	MTCO ₂ e/VMT	0.00032	0.00026	0.00023	0.00023

Notes: MTCO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

Source: Analysis conducted by Ascent in 2025.

4.3.4 Legislative-Adjusted Business-as-Usual Scenario Forecast Results

Table 22 presents the projected GHG emissions for the City of Wasco across all forecast years under the ABAU scenario, organized by emissions source and sector. Emissions sources and sectors not impacted by legislative

adjustments are excluded from this table, as their projected GHG emissions are assumed to remain unchanged from the BAU scenario. The full results for projected GHG emissions for the City of Wasco across all forecast years under both the BAU and ABAU scenarios, organized by emissions source and sector, can be found in Table 2.

Table 22 City of Wasco Legislative-Adjusted BAU Scenario Forecast GHG Emissions

Source	Sector	Units	2030	2040	2045
Stationary Energy	Residential	MTCO ₂ e	15,664	16,198	16,357
Electricity	Residential	MTCO ₂ e	18,840	2,479	—
Imported Water	Commercial/Institutional	MTCO ₂ e	433	57	—
Imported Water	Agricultural	MTCO ₂ e	247	31	—
Mobile On-road	Residential	MTCO ₂ e	57,782	53,716	53,511
Mobile On-road	Commercial/Institutional	MTCO ₂ e	43,190	41,894	43,508

Notes: MTCO₂e = metric tons of carbon dioxide equivalent.

Source: Analysis conducted by Ascent in 2025.

5 REFERENCES

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