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City of Eureka

2005 Community Greenhouse Gas Emissions Inventory

4/22/2014

Prepared for

City of Eureka

In Collaboration With

Pacific Gas and Electric Corporation

and

ICLEI - Local Governments for Sustainability

Striving to develop and implement sustainable energy initiatives that reduce energy demand, increase energy efficiency, and advance the use of clean, efficient and renewable resources available in the region.

www.redwoodenergy.org
633 3rd Street – Eureka, CA 95501
707.269.1700 (local) – 800.931.RCEA (toll-free) – 707.269.1777 (fax)

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City of Eureka
Robert Wall, Planning Director
Lisa Shikany, Principal Environmental Planner

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Redwood Coast Energy Authority
Matthew Marshall, Executive Director
Jerome Carman, Program Assistant

ICLEI - Local Governments for Sustainability USA
J.R. Killigrew, Program Officer

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Executive Summary

This community emissions inventory is the first step towards planning for climate change by providing both information to inform policy decisions as well as a baseline from which to assess the success of future actions. This inventory informs the climate action plan that the City is currently developing.

This community emissions inventory can be used to establish local government initiatives that help the City move towards a more sustainable and resilient community. Tracking of carbon dioxide emissions is considered to be an effective method of measuring the success of the Cities climate action initiatives. Future inventories can be compared with this baseline inventory as one metric of the effectiveness of government initiatives and community action.

There are numerous gases emitted by human activity that have a significant environmental impact. In accordance with version 1.0 of the Community Greenhouse Gas Inventory Protocol drafted by the International Council on Local Environmental Initiatives (ICLEI), three primary greenhouse gases are considered for this inventory: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). There are three other primary greenhouse gases also addressed by the Protocol but are not applicable to the City of Eureka as they are associated only with large industrial processes. Furthermore, in addition to these three primary gases, there are a small handful of refrigerants that are also tracked by this inventory.

These greenhouse gases all vary in their impact on global warming, otherwise known as their global warming potential (GWP). This GWP has to do with the how well these gases absorb and emit heat. The result is that emission of one gas will have a different impact on global warming compared with another gas.

Because of this, all emissions of greenhouse gases are presented as a comparable amount of CO_2, called equivalent CO_2 (CO_2e). This is analogous to possessing different forms of currency and converting the value of all currencies to dollars in order to determine the total value. This means that while there are multiple greenhouse gases tracked in this inventory, all are converted to CO_2e for direct comparison.

All CO_2e emissions are presented as originating either from a source or an activity. Source emissions are those that occur within the jurisdictional boundaries of the City of Eureka. Activity emissions are those associated with actions by Eureka residents and businesses such as the use of electricity or the creation of solid waste. It is useful to make this distinction in order to facilitate meaningful and effective government initiatives and community action.

In addition, emissions are presented in two frameworks: emissions sources and activities that are within significant influence of City government, citizens, and businesses, and those sources and activities that are outside significant influence, referred to as upstream emissions. The first framework highlights those activities and sources that the City of Eureka can have a direct impact on. For example, switching from a gasoline car to an electric car directly impacts the local emissions associated with the transportation sector.

Upstream emissions are considered outside the significant influence of the City since the City has no control over the methods of resource extraction, processing, and shipment. Upstream emissions are included to provide additional information regarding the more global impact of the consumption

associated with the activities of citizens and businesses. This means that while a reduction in consumption of energy and fuel will reduce the emissions locally that are officially "assigned" to the City of Eureka, there will also be an additional and significant change in upstream emissions that do not occur locally and so are not officially assigned to the City.

The results of this inventory are shown in Figure 1 and Figure 2, and summarized in Table 1 and Table 2 below. Results suggest that future climate action initiatives focus primarily on the reduction of fossil fuel use associated both with transportation and with cooking and heating. The next two primary emissions sectors are associated with electricity consumption and the generation of solid waste.

Table 1: Summary of emissions sources and activities that are within significant local influence.

Local Emissions	Quantity of Emissions (Metric Tons of CO_2e)
Activity: Consumption of Electricity	38,741
Source: Stationary Combustion of Fuels	55,111
Source: Mobile Combustion of Gas and Diesel Within City Limits	165,819
Activity: Generation of Solid Waste	41,817
Source: Wastewater Treatment	2,820
Source: Leaked Refrigerants	2,005
Source: Industrial Point Sources	6,192
Total	**312,505**

Table 2: Summary of upstream emissions that occur outside of Eureka as a result of the consumption of these resources within Eureka.

Upstream Emissions	Quantity of Emissions (Metric Tons of CO_2e)
Consumption of Natural Gas and Propane	11,729
Consumption of Gasoline	22,650
Consumption of Electricity	11,087
Consumption of Diesel	16,248
Total	**61,713**

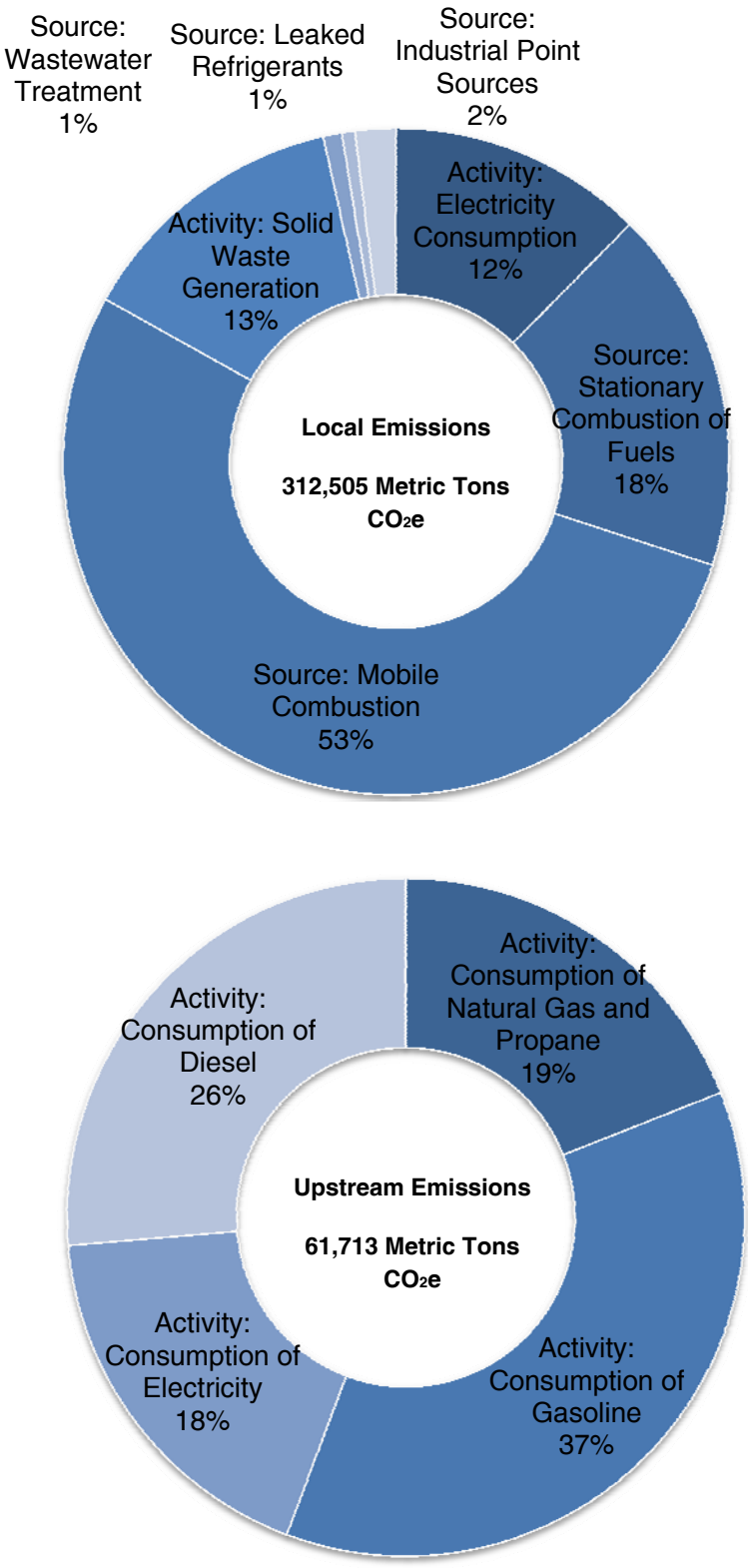

Figure 1: Summary of emissions sources and activities that are within (above) and outside (below) significant local government influence.

The combined result of all emissions from sources and activities both within and outside significant government influence is shown in Figure 2. The overall story conveyed by these results shows that upstream emissions add roughly 16% to those emissions that are within local influence. Furthermore, while local jurisdictions do not have control over the processes that contribute to upstream emissions, they can be reduced directly through a reduction in local consumption.

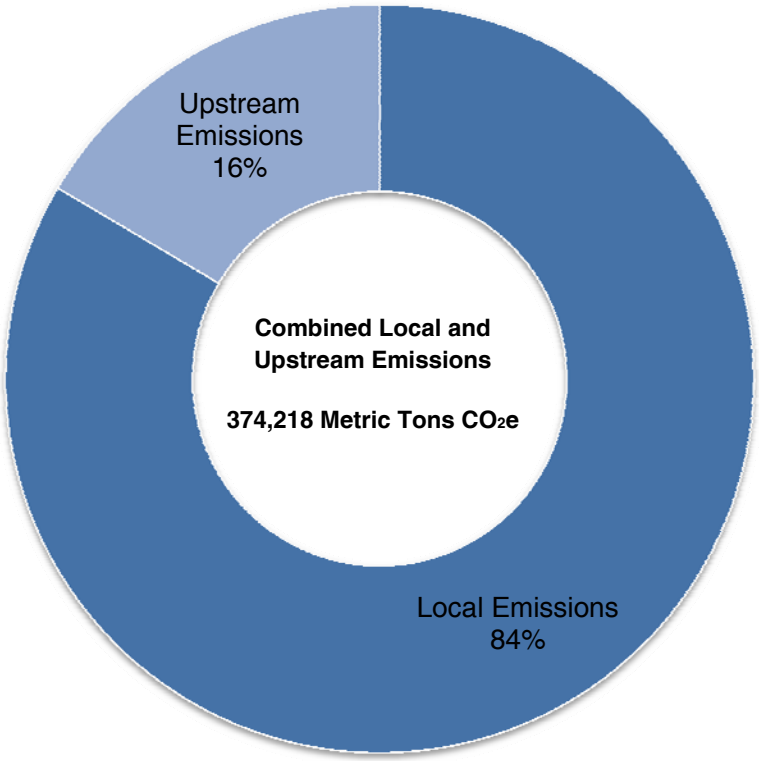

Figure 2: Combined emissions of all sectors both within significant government influence and outside significant government influence. Both direct and upstream emissions are included.

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1 Climate Change Background

Naturally occurring gases dispersed in the atmosphere determine the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Conclusive evidence shows that human activities are increasing the concentration of greenhouse gases and changing the global climate. The most significant contributor is the burning of fossil fuels for transportation, electricity generation and other purposes, which introduces large amounts of carbon dioxide and other greenhouse gases into the atmosphere. Collectively, these gases intensify the natural greenhouse effect, causing global average surface and lower atmospheric temperatures to rise.

Reducing electricity, natural gas, and fossil fuel use in the community can have many benefits in addition to reducing greenhouse gas emissions including;

- more efficient use of energy further decreases utility and transportation costs for residents and businesses,
- money not spent on energy is more likely to be spent at local businesses and add to the local economy
- retrofitting homes and businesses to be more efficient creates local jobs,
- reducing fossil fuel use improves air quality which reduces criteria pollutants that impact the health of the community,
- promoting alternative transportation provides opportunities for walking and bicycling which improves residents' health.

1.1 Climate Adaptation is Insurance Against the Risks of Climate Change

For many of the same reasons that home owners carry fire insurance and car owners carry auto insurance, the City of Eureka has completed this inventory in order to inform decisions that will insure the community against the risks of climate change. Planning for future climate change, and targeting methods of adaptation, will allow Eureka to reap significant benefits in the quality of life, economic health, and environmental stewardship of the community. Regardless of the reasons for climate change, government and community action now will help buffer the citizens of Eureka from future changes in the climate.

1.2 Evidence of Climate Change

There is international scientific consensus that the global climate is changing, and that human actions, primarily the burning of fossil fuels, are a main cause of those changes. The Intergovernmental Panel on Climate Change (IPCC) is the scientific body charged with bringing together the work of thousands of climate scientists. The IPCC's Fourth Assessment Report states that "warming of the climate system is unequivocal."[1] Furthermore, the report finds that "most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas (GHG) concentrations."

[1] IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.

The year 2012 was the hottest year on record for the continental United States, with two dozen cities breaking or tying their all-time high temperature records.[2] Globally, the 12 years from 2001-2012 are among the hottest on record, and 1998 was the only year in the 20th century hotter than 2012.[3] The year 1976 was the last year with a below average global temperature.

In addition to the study of the global impacts of climate change, there has been significant scientific work looking at the potential impacts of climate change at the regional level. Results say that the City of Eureka could be impacted by[4];

- a possible fivefold increase in the number of days above 85 °F,
- an 80% to 90% loss in annual snow pack,
- a 3.6% increase in acreage burned by forest fires,
- a roughly 15% reduction in annual precipitation,
- increased vulnerability to extreme weather events (e.g. flooding),
- increased load and stress on community infrastructure such as roads, power lines, and communication systems.

1.3 California Policy

California has a number of state level policies that serve as regulatory drivers for climate action planning at the local government levels, which are described below.

1.3.1 Global Warming Solutions Act (AB32)

California passed the Global Warming Solutions Act (AB 32) in 2006, which charged the California Air Resources Board (CARB) with implementing a comprehensive statewide program to reduce greenhouse gas emissions. AB 32 established the following greenhouse gas emissions reduction targets for the state of California:

- 2000 levels by 2010
- 1990 levels by 2020

1.3.2 SB 375

SB 375 enhances California's ability to reach its AB 32 goals by promoting good planning with the goal of more sustainable communities. SB 375 requires CARB to develop regional greenhouse gas emission reduction targets for passenger vehicles. CARB is to establish targets for 2020 and 2035 for each region covered by one of the State's 18 metropolitan planning organizations (MPOs).

1.3.3 Executive Order S-3-05

Executive Order S-3-05, issued by Governor Schwarzenegger, reinforces these goals and also sets a schedule for the reporting of both the measured impacts of climate change upon California's

[2] Burt, Christopher C. "2012 a Record Warm Year for Continental U.S". January 2, 2013. http://www.wunderground.com/blog/weatherhistorian/comment.html?entrynum=112

[3] NOAA: State of the Climate 2012 Summary. http://www.ncdc.noaa.gov/sotc/

[4] Local impact estimates obtained from http://cal-adapt.org/ and the California Adaptation Planning Guide available at http://resources.ca.gov/climate_adaptation/docs/APG_Defining_Local_and_Regional_Impacts.pdf

natural environment and the emissions reduction efforts undertaken by a myriad of state, regional, and local groups. Executive Order S-3-05 establishes an additional target of 80% below 1990 levels by 2050. Eureka's GHG emissions inventory is intended to enable the City to develop effective GHG reduction policies and programs to meet these targets and track emissions reduction progress.

1.3.4 California Environmental Quality Act (CEQA)

CEQA requires public agencies to evaluate the environmental impacts of discretionary development plans and projects in their jurisdictions. CEQA guidelines were updated in March 2010 to require analysis of climate change in CEQA documents. Many jurisdictions are finding that climate change impacts from local government activities are "significant" under CEQA, and are identifying emissions reductions targets and Climate Action Plans as mitigation measures to reduce climate change impacts to less-than-significant levels.

1.4 Sustainability and Climate Change Mitigation Activities in the City of Eureka

Eureka has already taken significant steps that have or will lead to ancillary benefits in the form of community resilience, energy conservation and greenhouse gas mitigation. These include:

- electric vehicle charging station installed
- installation of solar power on the Fisherman's Terminal
- installation of solar power on the City Garage
- current development of a Climate Action Plan
- completion of the Hikshari Trail
- development of a tree planting program
- an active Energy Committee
- an active water conservation program

2 Inventory Methodology

The first step toward achieving tangible greenhouse gas emission reductions requires identifying baseline emissions levels and sources and activities generating emissions in the community. This report presents emissions from the Eureka community as a whole; emissions from operations of the Eureka government are presented in the previously released City of Eureka 2005 Government Operations Greenhouse Gas Emissions Inventory. The government operations inventory is mostly a subset of the community inventory, as shown in Figure 3. For example, data on commercial energy use by the community includes energy consumed by municipal buildings, and community vehicle-miles-traveled estimates include miles driven by municipal fleet vehicles.

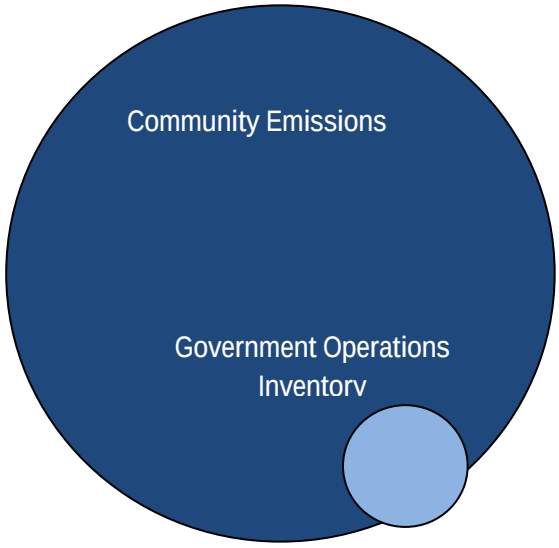

Figure 3: Relationship of community and government operations inventories.

As local governments have continued to join the climate protection movement, the need for a standardized approach to quantify GHG emissions has proven essential. This inventory uses the

approach and methods provided by the Community Greenhouse Gas Emissions Protocol (Community Protocol)[5].

2.1 Community Emissions Protocol

The Community Protocol was released by ICLEI in October 2012, and represents a new national standard in guidance to help U.S. local governments develop effective community GHG emissions inventories. It establishes reporting requirements for all community GHG emissions inventories, provides detailed accounting guidance for quantifying GHG emissions associated with a range of emission sources and community activities, and provides a number of optional reporting frameworks to help local governments customize their community GHG emissions inventory reports based on their local goals and capacities. The State of California Governor's Office of Planning and Research recommends that California local governments follow the Community Protocol when undertaking their greenhouse gas emissions inventories.

2.2 Quantifying Greenhouse Gas Emissions

A summary of the approach and method used to quantify emissions are given below. A more detailed methodology that includes data sources and calculations is available in a separate document entitled Humboldt County Greenhouse Gas Emissions Inventory Tool: Calculation Methodologies. This document is available by request from the Redwood Coast Energy Authority.

2.2.1 Sources and Activities

Communities contribute to greenhouse gas emissions in many ways. Two central categorizations of emissions are used in the community inventory: 1) GHG emissions that are produced by "sources" located within the community boundary, and 2) GHG emissions produced as a consequence of community "activities". Emissions sources and activities are color coded as shown in the following table.

Source	Activity
Any physical process inside the jurisdictional boundary that releases GHG emissions into the atmosphere	The use of energy, materials, and/or services by members of the community that result in the creation of GHG emissions.

By reporting on both GHG emissions "sources" and "activities", local governments can develop and promote a deeper understanding of GHG emissions associated with their communities. A purely source-based emissions inventory could be summed to estimate total emissions released within the community's jurisdictional boundary. In contrast, a purely activity-based emissions inventory could provide perspective on the efficiency of the community, even when the associated emissions occur outside the jurisdictional boundary. The division of emissions into sources and activities replaces the "scopes framework" that is used in government operations inventories, which does not have a clear definition for application to community inventories.

2.2.2 Regional and Upstream Emissions Sources and Activities

In addition to emissions sources and activities that are assigned to the City of Eureka, additional upstream emissions are shown in order to provide a more complete picture of the global impacts from the consumption of energy and fuels. Upstream emissions are those that occur during the

[5] http://www.icleiusa.org/tools/ghg-protocol/community-protocol

manufacture and transportation of raw materials and fuels related to the production of end use products consumed by the City of Eureka. For example, upstream emissions associated with the consumption of electricity is calculated based on the fuels used to produce that electricity. It is possible to estimate the quantity of different petroleum-based fuels used to produce a portion of the electricity consumed. The upstream emissions associated with the production of these fuels (e.g. mining, extraction, and shipping) are estimated and assigned as the upstream emissions for the consumption of electricity. Upstream emissions are color coded as shown in the following table.

Upstream Emissions
Emissions associated with the mining, extraction, and shipping of raw materials required to provide the end use products that are consumed by the City.

2.2.3 Information Items

There are additional emissions sources and activities that are included solely as an information item to further inform policy decisions. Information items can be labeled as such for two possible reasons:

- the emissions source is partially due to the activities of Eureka residences and businesses but there is not enough information to guide a fair allocation to individual jurisdictions,
- or emissions associated with a particular source or activity are already accounted for in another sector.

Information items are labeled separately in the tables throughout this inventory. Information items are not included in the total roll up of emissions for the jurisdiction.

2.2.4 Base Year

The inventory process requires the selection of a base year with which to compare current emissions. Eureka's community greenhouse gas emissions inventory utilizes 2005 as its base year. This year was chosen during the City's Municipal Operations Emissions Inventory due to constraints on data availability for earlier years. This same base year is chosen for this inventory to allow consistency with the municipal operations inventory.

2.2.5 Quantification Methods

Greenhouse gas emissions can be quantified in three ways:

- Measurement-based methodologies refer to the direct measurement of greenhouse gas emissions (from a monitoring system) emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility.
- Report / Survey-based methodologies refer to emissions reported to a regulating agency such as the North Coast Unified Air Quality Management District (NCUAQMD).
- Calculation-based methodologies use activity data and emission factors.

Most emissions sources in this inventory are quantified using calculation based methodologies. Activity data refer to the relevant measurement or modeling of energy use or other greenhouse gas-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled. See the Humboldt County Greenhouse Gas Emissions Inventory Tool: Calculation Methodologies report for additional information.

Some measurement-based data is also used in this inventory. The process emissions from the wastewater treatment plant use recorded biological oxygen demand and average volume of influent. Also, the North Coast Unified Air Quality Management District (NCUAQMD) keeps track of the large emitters in the County. Data from the NCUAQMD is used to estimate emissions from industrial point sources and large refrigeration units.

Only refrigeration units larger than 50 lbs are tracked. No unit larger than 2000 lbs is known to exist within the jurisdictional boundaries of Eureka. Due to the data tracking methods used by the NCUAQMD, the largest refrigeration unit assumed in this report is 200 lbs.

Known emission factors are used to convert energy usage or other activity data into associated quantities of emissions. Emissions factors are usually expressed in terms of emissions per unit of activity data (e.g. metric tons CO_2/kWh of electricity). Emissions factors used for each sector are given for sectors except the transportation sector where complex modeling software was used that uses a large database of emissions factors.

For this inventory, calculations were made using the Humboldt County Greenhouse Gas Emissions Inventory Tool. This tool was developed by the Redwood Coast Energy Authority to establish a consistent calculation methodology for the County of Humboldt and all incorporated jurisdictions. This tool is built upon an Excel spreadsheet template provided by ICLEI. This spreadsheet is used both for data entry and emissions calculations. This tool, along with a user manual, is available by request from the Redwood Coast Energy Authority.

3 Community Emissions Inventory Results

The Community Protocol recommends reporting results in one or more frameworks. Each framework includes a particular set of emissions sources and activities, and each tells a different story about community emissions. This report looks at Eureka's community emissions through two frameworks:

- Local government significant influence: this framework highlights emissions sources over which the City of Eureka has the most significant influence and has the greatest opportunity to address. These emissions are more regional in the location of occurrence.
- Community-wide activities: this framework highlights emissions associated with the activities of residents and businesses that occur in a more global geography. This is intended to provide a broader picture of the impact associated with consumption.

Some emissions sources and activities are reported in both frameworks, so it is important not to add the emissions presented by both frameworks together. The purpose of these two approaches is to provide different perspectives to better inform and guide both local government action and community action.

3.1 Community Profile

To put emissions inventory data in context for comparison with other jurisdictions, it is helpful to have some basic information about the community such as population and number of households. This information is provided in Table 3.

Table 3: City of Eureka 2005 community indicators.

Indicator	Value
Population	25,644
Number of Households	11,604
Number of Jobs	18,575
Service Population (Residents + Jobs)	44,219
Estimated Number of Registered Vehicles	23,067
Average Temperature	52^{+12}_{-14} °F
Total Heating Degree Days	4,863

The community indicators were obtained from various sources. Population and number of households were pulled from the U.S. Census. The number of registered vehicles was pulled from DMV records. Temperature and heating degree days were pulled from www.wunderground.com historical data.

3.2 Emissions from Sources and Activities Under Significant Local Government Influence

This framework emphasizes policy relevance, highlighting a set of emission sources and activities that Eureka has the greatest opportunity to address. This frame includes all of the five Basic Emissions Generating Activities required by the Community Protocol, plus additional sources and activities. These are:

- Electricity Consumption
- Stationary Combustion
- Mobile Combustion
- Solid Waste Generation
- Wastewater Treatment
- Potable Water Consumption
- Refrigerant Leakage
- Industrial Point Sources

The total emissions estimated to be **312,505 metric tons of CO_2e** from all of these sectors are summarized in Figure 4. Details regarding each sector are provided in the following sections.

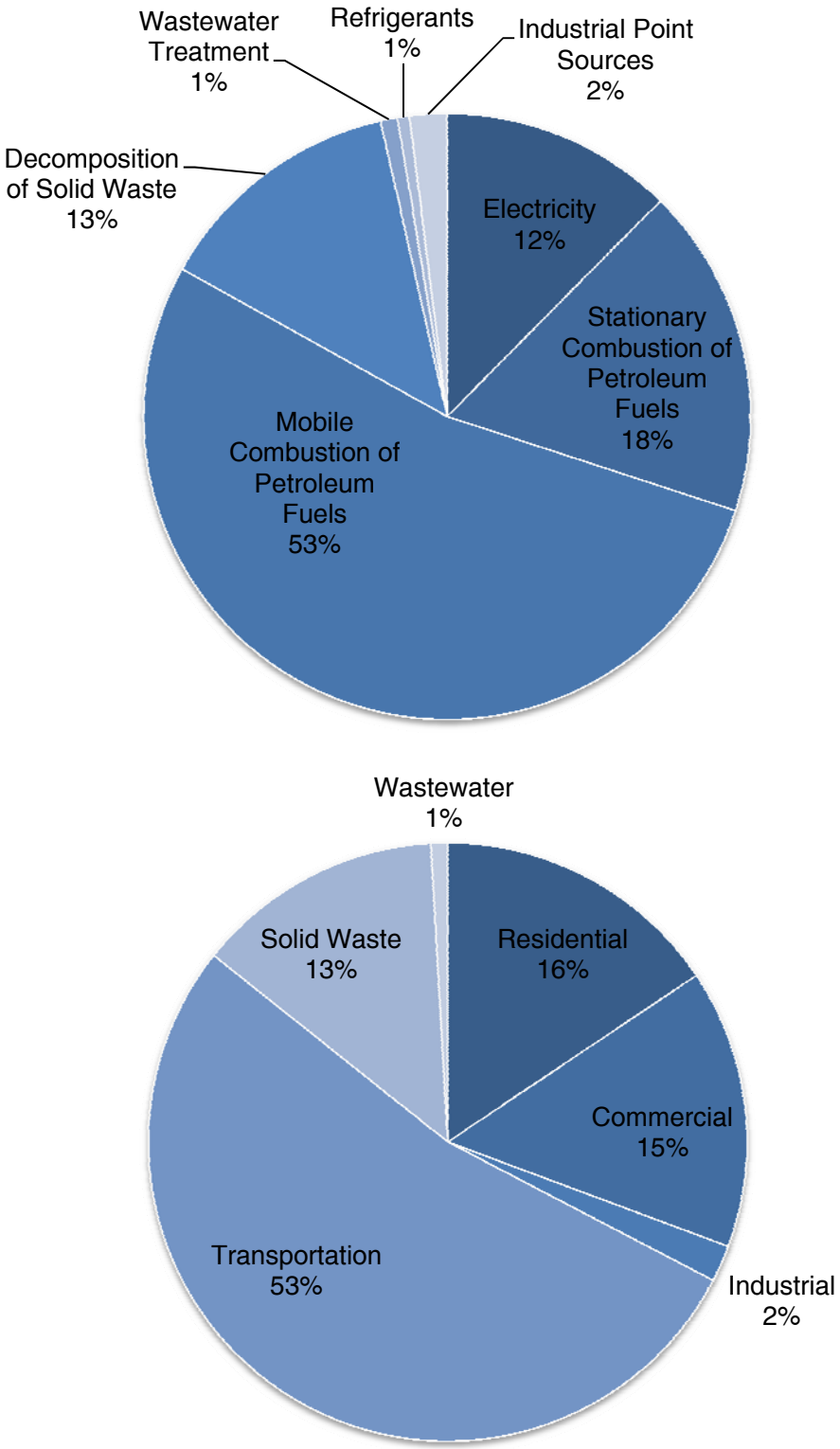

Figure 4: A summary of all emission sources and activities, by energy source (above) and emissions sector (below), that are under significant local government influence.

3.2.1 Activity: Electricity Consumption

Electricity consumption contributes to greenhouse gas emissions indirectly. Emissions are generated at generation plants, usually through the combustion of fuels which generate heat that is then used to drive steam engines. Additional electricity generation fuels, such as hydropower and wind, are also used and are considered to be free of emissions. Emissions factors used are generated by the Climate Registry on an annual basis for PG&E and reflect the average mix of electricity generation fuels for the inventory year. The results are shown in Table 4.

Some electricity is lost during transmission and distribution (T&D) due to resistive loses within the materials used. This lost electricity is also accounted for, the emissions of which are shown in Table 4.

Table 4: Emissions associated with the activity of electricity consumption within jurisdictional boundaries.

Activity: Electricity Consumption	Annual Quantity of Electricity (kWh)		Emissions Factor (annual metric tons CO_2e / kWh)	Annual Emissions (metric tons CO2e)
Residential	Consumption:	57,023,261	0.000221807	12,648
	T&D Losses:	2,758,215	0.000329891	910
	Total:	**59,781,476**	**0.000226794**	**13,558**
Commercial	Consumption:	105,915,988	0.000221807	23,493
	T&D Losses:	5,123,156	0.000329891	1,690
	Total:	**111,039,144**	**0.000226794**	**25,183**
Industrial	Consumption:	0	---	0
	T&D Losses:	0	---	0
	Total:	**0**	**---**	**0**
All Sectors	Consumption:	162,939,249	0.000221807	36,141
	T&D Losses:	7,881,371	0.000329891	2,600
	Total:	**170,820,620**	**0.000226794**	**38,741**

A visual comparison between the residential, commercial, and industrial sectors are shown in Figure 5. This can help Eureka visualize which sector to prioritize during emissions reduction planning efforts.

3.2.2 Source: Stationary Combustion

Stationary combustion is associated with the combustion of fuels at a specific location. This includes the combustion of natural gas, propane, fire wood, etc. The vast majority of these fuels are combusted for cooking and space heating. Emissions associated with the combustion of these fuels can be considered either a source or an activity since the activity usually occurs at the point of combustion. This inventory considers this sector an emissions source. Table 5 shows the results.

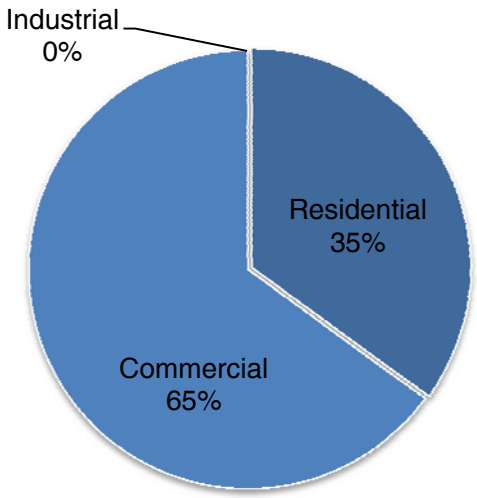

Figure 5: Emissions associated with the activity of electricity consumption within jurisdictional boundaries.

Table 5: Emissions associated with the stationary combustion of fuels within jurisdictional boundaries.

Source: Stationary Combustion	Annual Quantity of Fuel Consumed		Emissions Factor (annual metric tons CO_2e / unit)	Annual Emissions (metric tons CO2e)
Residential	Natural Gas (therm)	5,699,949	0.005307	30,250
	Propane (gal.)	732,187	0.005686	4,163
	Fuel Wood (MMBTU)	85,753	0.009152	785
	Generator Fuel (gal.)	Unknown	0.01027	Unknown
	Total	**---**	**---**	**35,198**
Commercial	Natural Gas (therm)	3,752,253	0.005307	19,913
	Propane (gal.)	0	---	0
	Fuel Wood (MMBTU)	0	---	0
	Generator Fuel (gal.)	Unknown	0.01027	Unknown
	Total	**---**	**---**	**19,913**
Industrial	Natural Gas (therm)	0.00	---	0
	Propane (gal.)	0	---	0
	Fuel Wood (MMBTU)	0	---	0
	Generator Fuel (gal.)	Unknown	0.01027	Unknown
	Total	**---**	**---**	**0**
All Sectors	Natural Gas (therm)	9,452,202	0.005307	50,163
	Propane (gal.)	732,187	0.005686	4,163
	Fuel Wood (MMBTU)	85,753	0.009152	785
	Generator Fuel (gal.)	Unknown	0.01027	Unknown
	Total	**---**	**---**	**55,111**
Info Item **Commercial Generators**	Diesel (gallons)	12,760	0.01021	130

A visual comparison between the residential, commercial, and industrial sectors are shown Figure 6. This can help Eureka visualize which sector to prioritize during emissions reduction planning efforts.

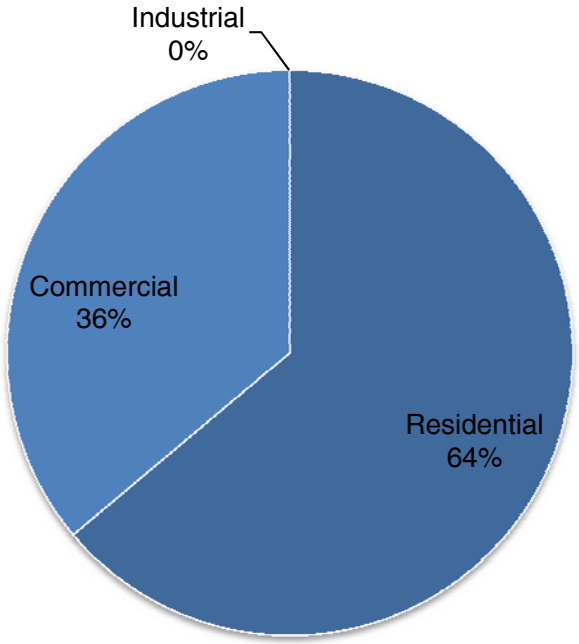

Figure 6: Emissions associated with the stationary combustion of fuels within jurisdictional boundaries.

3.2.3 Source: Mobile Combustion

Mobile emissions are associated with mobile vehicles and equipment. This includes passenger vehicles, freight and service trucks, off-road vehicles, and construction equipment to name a few. Emissions results are shown in Table 6.

These emissions are considered a source due to the inventory methodology used. Eureka is assigned mobile emissions based on whether the emissions occur within the jurisdictional boundaries of Eureka. For example, under this method, a resident of Eureka that commutes between Eureka and Fortuna only contributes emissions to the City for the miles traveled within the jurisdictional boundaries.

The emissions factors used are those associated with two computer models created by the California Air Resources Board (CARB): EMFAC2011-SG and OFFROAD2007. A wide range of emissions factors are used by these models that depend on numerous factors such as vehicle age and type, fuel type, and temperature and humidity to name a few. Refer to the Inventory Methodology Report and the documentation for these computed models for more information.

Table 6: Emissions associated with the combustion of fuels by mobile vehicles and equipment.

Source: Mobile Combustion	Annual Quantity of Fuel Consumed (gallons)		Emissions Factor	Annual Emissions (metric tons CO_2e)
On-Road Passenger Vehicles	Gasoline	8,624,517	EMFAC	80,562
	Diesel	249,703	EMFAC	2,800
	LPG / CNG	Not Modeled		
	Total	**---**	**---**	**83,362**
Retail and Commercial Trucks	Gasoline	875,107	EMFAC	7925.06
	Diesel	3,985,753	EMFAC	44710.74
	LPG / CNG	Not Modeled		
	Total	**---**	**---**	**52,636**
Off-Road Vehicles and Equipment	Gasoline	364,446	OFFROAD2007	2.11E+03
	Diesel	2,737,772	OFFROAD2007	2.72E+04
	LPG / CNG	76,629	OFFROAD2007	4.82E+02
	Total	**---**	**---**	**29,821**
All Sectors	Gasoline	9,864,070	Combined	90,597
	Diesel	6,973,228	Combined	74,740
	LPG / CNG	76,629	Combined	482
	Total	**---**	**---**	**165,819**
Info Item **Public Transit (2010)**	Gasoline	---	---	---
	Diesel	23,787	0.01406	335
	LPG / CNG	---	---	---
	Total	**---**	**---**	**335**

A visual comparison between passenger vehicles, retail and commercial trucks, and off-road vehicles is shown in Figure 7. This can help Eureka visualize which sector to prioritize during emissions reduction planning efforts.

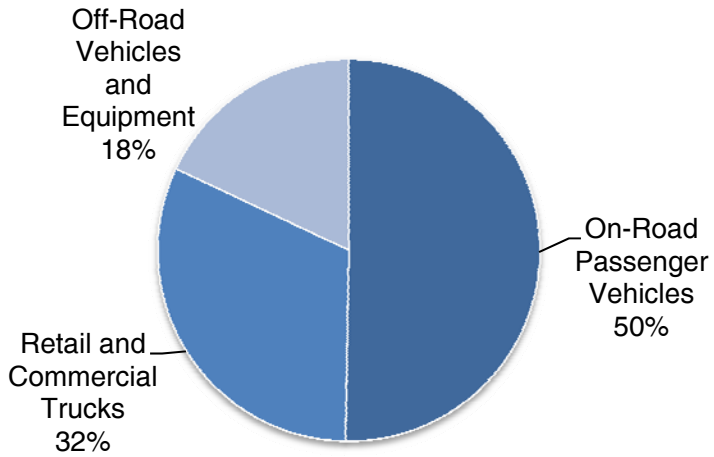

Figure 7: Emissions associated with on- and off-road vehicle travel.

Additional detail regarding the primary contributors to on-road vehicle emissions are shown in Figure 8. Results are disaggregated by vehicle type and fuel. This demonstrates that gasoline fueled passenger vehicles and light duty trucks are the primary contributor to emissions in this sector. Note, however, that this is not the case for the off-road vehicle sector where diesel is the dominant fuel. Definitions of the different vehicle classes are shown in Table 7.

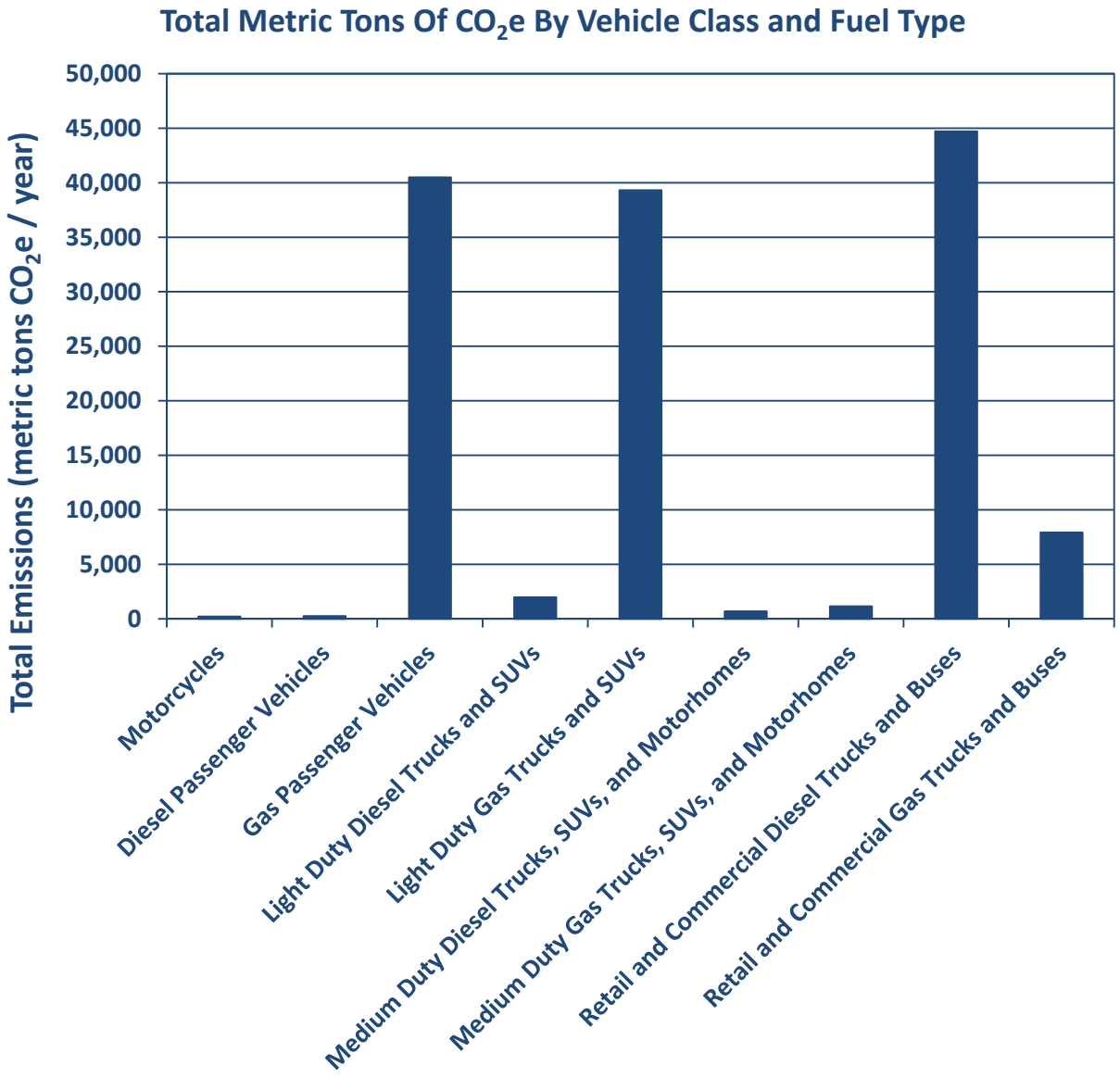

Figure 8: Disaggregation of on-road vehicle emissions by vehicle class and fuel type.

Table 7: Description of vehicle class labels.

Vehicle Class Label	Description
Passenger Vehicles	Passenger vehicles
Light Duty Trucks	Trucks <= 5,750 lbs curb weight
Motorcycles	All motorcycles
Medium Duty Trucks	Trucks between 5,751 and 8,500 lbs curb weight
Retail and Commercial Trucks	All on-road vehicles greater than 8,500 lbs

Off-road transportation emissions are composed of various sectors. These sectors are summarized in Figure 9. What activities compose these different off-road vehicle sectors are described in Table 8.

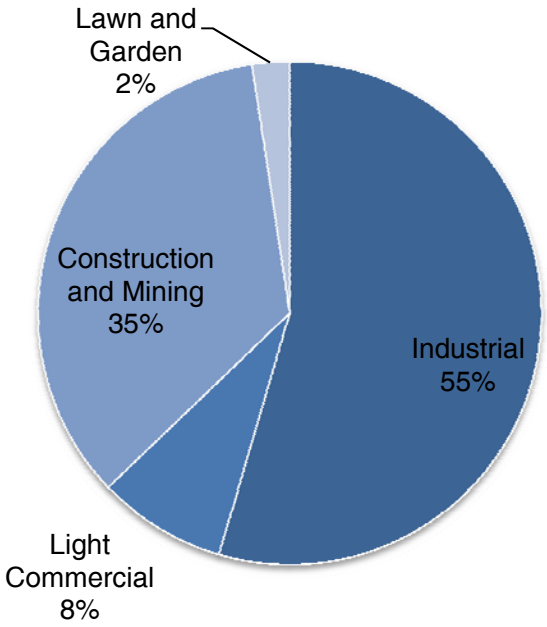

Figure 9: Break down of activity sectors that comprise the off-road transportation emissions sector.

Additional data used to determine emissions from the transportation sector are provided in the Appendices. Refer to the Methodology Report for information regarding how this data is used.

Table 8: Description of the various activities that comprise each off-road vehicle sector.

Off-road Activity Sector	Description
Industrial	Agricultural, industrial, and logging
Construction and Mining	All construction
Light Commercial	Entertainment, light commercial, and recreation
Lawn and Garden	Landscaping and maintenance

3.2.4 Activity: Solid Waste Generation

Emissions are generated by the transportation, processing, and decomposition of solid waste. This inventory estimates the emissions associated with all three.

Emissions from the transportation of waste out of the County from the Humboldt Waste Management Authority (HWMA) distribution center are included as an information item as they should be reasonably modeled within the Mobile Combustion sector (see Section 3.2.3). Note that emissions from self-hauling and from trash trucks are also assumed to be reasonably modeled within the Mobile Combustion sector but are not estimated separately due to lack of information.

Waste processing emissions associated with onsite landfill operations are also included as an information item. Different emissions factors are used based on whether the onsite equipment is fueled by either diesel or compressed natural gas (CNG). All landfills that are used by HWMA utilize diesel equipment with the exception of the Altamont Landfill in Livermore, CA. Only a small fraction of waste is trucked to this site and therefore the large majority of process emissions are associated with diesel equipment.

Emissions from the decomposition of waste is associated with paper, food, plant, animal, wood, and textile wastes. Appropriate emissions factors are used for each type of waste. Results of all emissions are shown in Table 9.

Table 9: Emissions associated with the transportation, processing, and decomposition of solid waste.

	Activity: Solid Waste Generation	Quantity of Waste Generated (wet short ton)		Emissions Factor (metric tons CO_2e / short ton)	Emissions (metric tons CO_2e)
	Paper Waste	Waste Decomposition	9,395	Numerous. Refer to Methodology Report.	18,162
	Food Waste		10,156		14,085
	Plant Waste		6,353		4,954
	Wood / Textile Waste		4,250		4,615
	Other Waste		14,585		0
	All Sectors	Waste Decomposition	44,740	Numerous. Refer to Methodology Report.	41,817
Info Item	**Additional Emissions Sources**	Landfill Process Equipment	44,740	Numerous. Refer to Methodology Report.	734
		On-Road Transportation of Waste	44,740		2,252

A visual comparison between the emissions produced by the various waste types is shown in Figure 10. This can help Eureka visualize which sector to prioritize during emissions reduction planning efforts. Note that transportation to landfills is estimated to comprise roughly 5% of total emissions from the generation of solid waste.

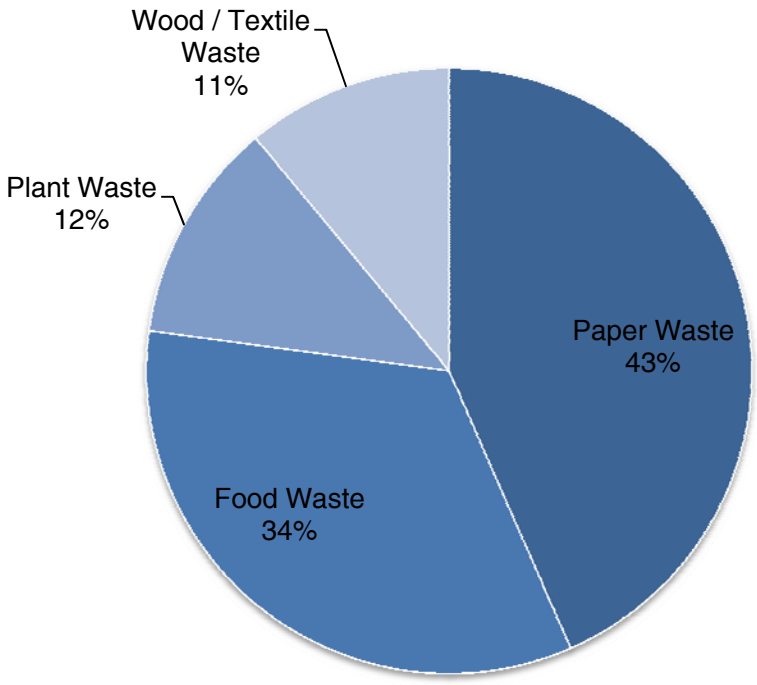

Figure 10: Solid waste emissions by waste type.

3.2.5 Source and Activity: Wastewater Treatment

Greenhouse gases are emitted from processing as well as the energy consumed for processing. Both the central treatment plant and septic systems are considered. Process emissions are considered an emissions source from the central plant.

Central treatment plant process emissions are associated with methane release from anaerobic activity and the creation of nitrous oxide during the conversion of ammonia. Septic system process emissions are associated with methane release from anaerobic conditions. Central treatment plant energy consumption (noted as an information item since this energy consumption is already captured in Sections 3.2.1 and 3.2.2) is associated with the electricity and natural gas required to run the plant. Emissions results are shown in Table 10.

Table 10: Emissions associated with the processing of wastewater from both the central treatment plant and septic systems within jurisdictional boundaries.

Source: Wastewater Treatment		Indicators		Emissions Factor (metric tons CO_2e / unit)	Emissions (metric tons CO_2e)
	Central Treatment Process Emissions	Average influent BOD5 (kg / day)	5,478.33	Numerous. Refer to Methodology Report.	2,291
		Average daily volume of wastewater (gallons)	6,483,723		
		Population served	45,000		
	Fugitive Emissions From Septic	Estimated population served	4,878	0.108 metric tons CO_2e per person per year	529
		Estimated number of permitted septic systems	1,967		
	All Sectors	---	---	---	**2,820**
Info Item	**Central Treatment Energy Consumption**	Consumed electricity (kWh)	1,066,425	0.0002218	237
		Consumed natural gas (therms)	5,938	0.005307	32

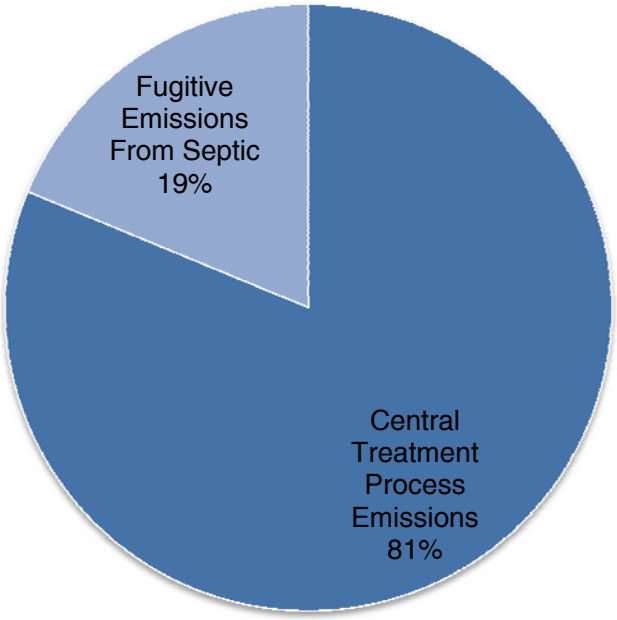

Figure 11: Waste water emissions by type.

3.2.6 Activity: Consumption of Potable Water

The Community Protocol requires reporting of emissions associated with potable water consumption. This sector is highlighted to emphasize the impact that water saving measures can have on reducing a communities emissions. Results of the estimated emissions associated with pumping and treatment of potable water are shown in Table 11.

This emissions source is already accounted for in the Electricity Consumption and Stationary Combustion sectors, so should not be added to these sectors. Instead, this emissions activity should be considered as an information item to guide policy decisions. Note that these emissions primarily occur outside jurisdiction boundaries since much of the extraction, treatment, and transport of water occurs outside the City.

Table 11: Emissions associated with pumping and treatment of potable water served to the City of Eureka.

Activity: Potable Water Consumption		Indicators		Emissions Factor (metric tons CO_2e / million gallons)	Emissions (metric tons CO_2e)
Info Item	**Potable Water Pumping and Treatment Energy Consumption**	Population served	25,644	0.2018	288
		Gallons of water consumed (MG)	1,425		
		Energy Intensity (MWh/MG)	0.8486		

3.2.7 Source: Fugitive Leakage of Refrigerants

Leaked refrigerants can be a significant source of greenhouse gases as many refrigerants have extremely large global warming potential factors. Even though the quantity of leaked refrigerants is generally small, their large global warming potential makes their relative impact significant. This inventory estimates the emissions associated with stationary and mobile refrigeration equipment operated within industrial and commercial sectors. Vehicle air conditioning units are not tracked given the difficulty of the task and the lack of local government influence over the emissions source. The estimated emissions associated with leaked refrigerants are shown in Table 12.

Table 12: Estimated emissions associated with the leakage of refrigerants from commercial and industrial stationary and mobile equipment.

Source: Fugitive Refrigerant Emissions	Number of Refrigeration Units		Emissions Factor (metric tons CO_2e / refrigeration unit)	Emissions (metric tons CO_2e)
Stationary Refrigeration Equipment	Size 50 - 200 lbs	51	14.37	733
	Size 200 - 2000 lbs	20	57.47	1,149
	Size >2000 lbs	0	---	0
	Total	**71**	**---**	**1,882**
Transport Refrigeration Units	3 lbs	80	1.530	122
All Sectors	**All Sizes**	**151**	**Various**	**2,005**

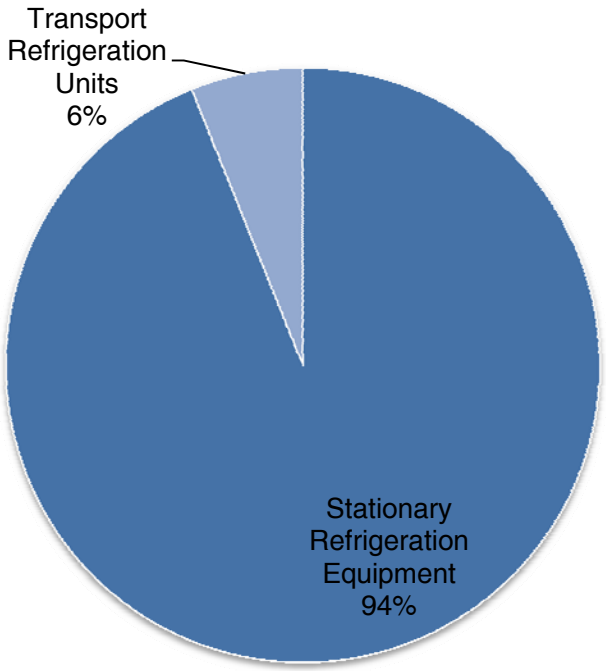

Figure 12: Refrigerant emissions by type.

Data on stationary refrigeration units are obtained from the North Coast Unified Air Quality Management District (NCUAQMD). The size and leakage rate of these units is roughly approximated. See the Methodology Report and the Master Data Workbook for additional information.

Transportation units refer to mobile refrigeration units such as those carried by food delivery trucks. This emissions sector is a rough estimate modeled by the OFFROAD2007 emissions model created by the California Air Resources Board (CARB). This model estimates the emissions from this sector at a County level and allocated to the City of Eureka based on the percentage of jobs within the jurisdiction.

3.2.8 Source: Industrial Point Sources

As required by the state, industrial point sources are tracked by the NCUAQMD given their large contribution to overall emissions. Estimated emissions from all industrial sources within the jurisdictional boundary of Eureka are included. In addition, criteria pollutants associated with environmental and health concerns are also included for information purposes. The results are shown in Table 13.

Table 13: Greenhouse gas and criteria pollutant emissions estimates from industrial point sources.

Source: Industrial Point Sources	Quantity of GHGs and Other Criteria Pollutants (metric tons)		Emissions Factor (metric tons CO_2e / unit)	Emissions (metric tons CO_2e)
Sources Tracked by the NCUAQMD	CO_2	6,192	1	6,192
	CH_4	Unknown	25	Unknown
	N_2O	Unknown	298	Unknown
	CO	232	---	---
	NO_x	866	---	---
	SO_x	3	---	---
	PM	112	---	---
	TOG	54	---	---
Total	**$CO_2 + CH_4 + N_2O$**	---	---	**6,192**

3.3 Additional Emissions Sources Outside of Significant Local Government Influence

Included in these results are additional inventoried sources and activities over which the City of Eureka does not have significant influence. However, consumption of goods and services within the community indirectly contribute to these emissions. Therefore, it is useful to include these sources to provide a more complete picture of the impact the City of Eureka has on global emissions.

Total upstream emissions are estimated to be **61,713 Metric Tons of CO_2e**. The majority of the emissions shown here are upstream emissions of petroleum fuels. These are emissions associated with the production of these fuels. The fuels considered are those used for transportation, those used for stationary combustion, and those used to generate electricity. Also included are estimates of direct emissions, not upstream emissions, associated with commercial and private airplane flights. Figure 13 summarizes these emissions.

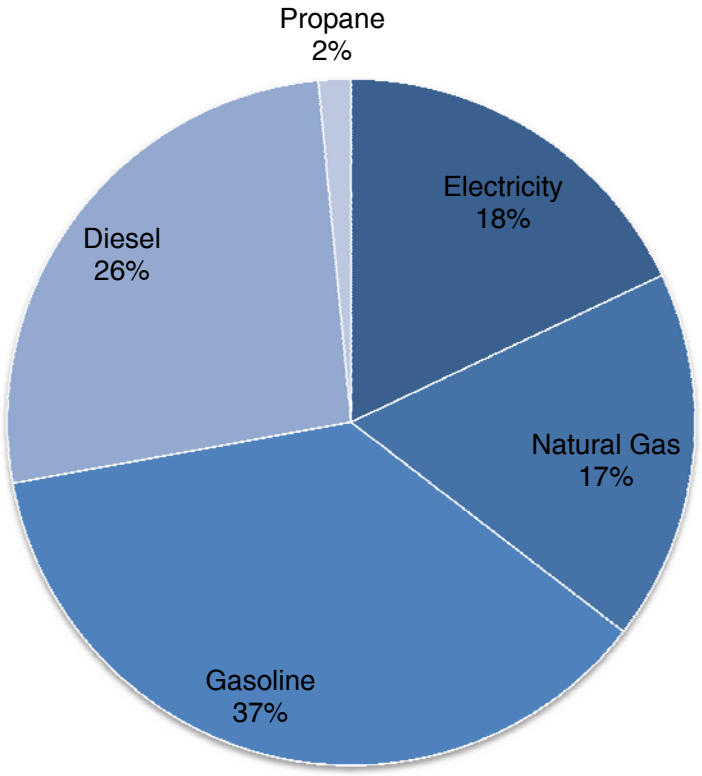

Figure 13: Summary of all emissions outside significant influence by the City of Eureka

3.3.1 Activity: Upstream Emissions from Utility Energy Consumption

In addition to the emissions associated with electricity, natural gas, and propane that are accounted for in Sections 3.2.1 and 3.2.2, there are additional emissions associated with the production of these fuels. These upstream emissions can account for a significant portion of the total emissions associated with the consumption of these fuels, and can often be overlooked since the production of these fuels occurs in places very far removed from the City of Eureka. However, there is a direct connection between the demand for these fuels and the emissions associated with their supply.

Table 14 provides estimates of these upstream emissions. These estimates apply only to the production of fuels, not to the mining of fuels, or to the construction, operation, or decommissioning of fuel processing infrastructure. Hence, while these estimates provide a bigger picture of the impact associated with the consumption of electricity, natural gas, and propane, there are additional emissions not accounted for that further increase this impact.

Table 14: Upstream emissions estimates associated with processing of fuels used to generate electricity and for stationary combustion.

Upstream: Utility Fuel Emissions	Quantity of Fuel Consumed		Emissions Factor (metric tons CO_2e / unit)	Emissions (metric tons CO_2e)
Electricity	Coal (kg)	739,059	0.0001890	140
	Residual Fuel Oil (L)	349,109	0.0005350	187
	Distillate Fuel Oil (L)	223,201	0.0004920	110
	Natural Gas (m^3)	23,934,890	0.0004450	10,651
	Total	**---**	**---**	**11,087**
Stationary Combustion	Natural Gas (therm)	9,452,202	0.001141	10,789
	Propane (gallon)	732,187	0.001162	851
	Generator Fuel (gallon)	Unknown	---	Unknown
	Total	**---**	**---**	**11,640**

3.3.2 Activity: Upstream Emissions from Mobile Combustion of Gasoline and Diesel

As with the utility energy-related fuels, there are also emissions associated with the production of gasoline and diesel used in on- and off-road vehicles. These emissions are important to account for as they form a significant fraction of the overall emissions associated with the demand for these fuels. In 2007 the State acknowledged this fact by enacting the Low Carbon Fuel Standard (LCFS). The purpose of the LCFS is to reduce the lifecycle carbon intensity of all fuels utilized by the State, including gasoline and diesel as well as compressed natural gas, ethanol, hydrogen, and other alternative fuels.

The significance of including these upstream emissions is to emphasize the additional impact that a reduction in fuel consumption will have. By reducing the consumption of gasoline and diesel, not only will greenhouse gas emissions, as well as local criteria pollutants that impact the health of community residents, be reduced locally, these emissions will also be reduced in all regions affected by the production and transportation of these fuels.

Upstream emissions factors, also referred to as well-to-pump emissions factors, were pulled from the GREET model[6] developed by the Argonne National Laboratory. These factors are used to estimate the emissions associated with the consumption of gasoline and diesel by the Eureka community. These factors, along with the resulting emissions, are shown in Table 15. Note that, for 2005, the ethanol content in blended California gasoline was 5.5%[7]. This is also factored in to the total emissions estimate.

[6] Database version 8065 was used to obtain emissions factors.

[7] Determined from historical fuel consumption data obtained from NCUAQMD

Table 15: Upstream emissions associated with gasoline and diesel fuel consumption.

Upstream: Gas and Diesel Emissions	Quantity of Fuel Consumed (gallons)		Emissions Factor (metric tons CO_2e / gallon)	Emissions (metric tons CO_2e)
Gasoline	CARFG	9,316,458	0.002087	19,443
	Ethanol	547,613	0.005855	3,206
Diesel	California Low Sulfur Diesel	6,973,228	0.002330	16,248
LPG / CNG	Liquid Propane Gas	76,629	0.001162	89

3.3.3 Emissions From Air Travel

Commercial air travel is a difficult emissions source to allocate to jurisdictions within a County as it is difficult to determine the origin and destination of passengers. Commercial air flight emissions are estimated for the County using total in-County sales of jet fuel as a proxy. Small private airplane flight emissions are estimated for the County using 100% of in-County fuel sales of 100LL AvGas.

The total emissions are then allocated to Eureka based on the percent of the County population that resides within jurisdictional boundaries. Again, this is neither a reliable nor fair method, but is given here for information purposes and to give a sense of the impact of air travel to a community's over all emissions impact.

Furthermore, aviation fuel sales were obtained only for the year 2012, so are not directly representative of the inventory year. Hence, the numbers provided should be considered only as a ballpark estimate.

Both direct combustion emissions as well as upstream emissions were quantified for the consumption of aviation fuel. Table 16 shows the direct combustion emissions estimates, and Table 17 shows the upstream emissions estimates.

Table 16: Direct CO_2 emissions estimates associated with commercial and private air travel.

Activity: Air Travel Emissions		Quantity of Fuel Consumed Countywide (gallons)		Emissions Factor (metric tons CO_2e / gallon)	Fraction Allocated To Jurisdiction	Emissions (metric tons CO2e)
Info Item	Commercial and Private Jets	Jet Fuel	73,878	0.009637	19.89%	712
	Other Private Small Airplanes	AVGAS (100LL)	14,792	0.008368	19.89%	124

Table 17: Upstream CO_2e emissions estimates associated with commercial and private air travel.

Upstream: Air Travel Emissions		Quantity of Fuel Consumed (gallons)		Emissions Factor (metric tons CO_2e / gallon)	Fraction Allocated To Jurisdiction	Emissions (metric tons CO2e)
Info Item	**Commercial and Private Jets**	Jet Fuel	73,878	0.002377	19.89%	176
	Other Private Small Airplanes	AVGAS (100LL)	14,792	0.002189	19.89%	32

4 Discussion

Two primary classes of emissions are presented in this report: local emissions activities and sources that are within local government significant influence, and upstream emissions activities and sources that are outside local government influence. Furthermore, emissions results are presented as either an activity or a source. This distinction can help guide local government action by targeting either a specific source within jurisdictional boundaries, or the activities of the residents and businesses of Eureka. Additional emissions information items are presented to further inform policy decisions.

The next steps are to set an emissions reduction target, and to develop a climate action plan that identifies specific quantified strategies that can cumulatively meet that target. Eureka is following through on these next steps by currently developing a Climate Action Plan. In addition, Eureka should continue to track key energy use and emissions indicators on an on-going basis by completing a re-inventory at least every five years to measure emissions reduction progress.

According to this Greenhouse Gas (GHG) Inventory, total emissions for the City of Eureka in the baseline inventory year (2005) were approximately 312,505 metric tons of CO_2e from local emissions sources and activities, and an additional 61,713 metric tons of CO_2e from upstream emissions. For most communities in California it is assumed that population and development has increased and therefore so has greenhouse gas (CO_2e) emissions. However, according to the US Census the City of Eureka's population decreased from 1990 to 2000 (by 925 persons) and increased from 2000 to 2010 (by 1,135). Therefore, the emissions generated in 1990 may have been greater than the emissions generated in the baseline inventory year (2005). Due to this, it may not be as useful to set emissions reduction targets such as those established by AB 32 which focus on achieving 1990 emission levels by 2020. It may be more useful to simply focus on reducing emissions by a certain percentage of this 2005 baseline inventory (e.g. 15% by 2020).

Emissions reduction strategies to consider for the climate action plan include energy efficiency, renewable energy, vehicle fuel efficiency, alternative transportation, vehicle trip reduction, land use and transit planning, and waste reduction among others. This inventory shows that transportation fuel consumption and PG&E electricity and natural gas consumption will be particularly important to focus on. Through these efforts and others the City of Eureka can achieve additional benefits beyond reducing emissions, including saving money and improving Eureka's economic vitality and quality of life.

Appendix A Inventory Scope and Reporting Table

The Protocol requires summarizing the primary emissions sectors that were inventoried in this report in the following standardized table.

Emissions Type		Source or Activity?	Required	Included	Explanation if Excluded	Explanatory Notes	Emissions ($MTCO_2e$)
Built Environment							
Use of fuel in residential and commercial stationary combustion equipment		Source AND Activity	●	●			55,111
Industrial stationary combustion sources		Source		●			0
Electricity	Power generation in the community	Source			Not Applicable		
	Use of electricity by the community	Activity	●	●			38,741
District Heating/ Cooling	District heating/cooling facilities in the community	Source			Not Applicable		
	Use of district heating/cooling by the community	Activity			Not Applicable		
Industrial process emissions in the community		Source		●			6,192
Refrigerant leakage in the community		Source		●			2,005
Transportation and Other Mobile Sources							
On-road Passenger Vehicles	On-road passenger vehicles operating within the community boundary	Source	● or	●			83,362

Emissions Type		Source or Activity?	Required	Included	Explanation if Excluded	Explanatory Notes	Emissions ($MTCO_2e$)
	On-road passenger vehicle travel associated with community land uses	Activity	•		Not Estimated		
On-road Freight Vehicles	On-road freight and service vehicles operating within the community boundary	Source		•			52,636
	On-road freight and service vehicle travel associated with community land uses	Activity			Not Estimated		
On-road transit vehicles operating within the community boundary		Source		•			335
Transit Rail	Transit rail vehicles operating within the community boundary	Source			Not Applicable		
	Use of transit rail travel by the community	Activity			Not Applicable		
Inter-city passenger rail vehicles operating within the community boundary		Source			Not Applicable		
Freight rail vehicles operating within the community boundary		Source			Not Applicable		
Marine	Marine vessels operating within the community boundary	Source			Included Elsewhere	Will be Included in future County-wide inventory	
	Use of ferries by the community	Activity			Not Applicable		

Emissions Type		Source or Activity?	Required	Included	Explanation if Excluded	Explanatory Notes	Emissions ($MTCO_2e$)
Off-road surface vehicles and other mobile equipment operating within the community boundary		Source		●			29,821
Use of air travel by the community		Activity		●			836
Solid Waste							
Operation of solid waste disposal facilities in the community		Source			Not Applicable		
Generation and disposal of solid waste by the community		Activity	●	●			41,817
Water and Wastewater							
Potable Water - Energy Use	Operation of water delivery facilities in the community	Source			Not Estimated		
	Use of energy associated with use of potable water by the community	Activity	●	●			288
Use of energy associated with generation of wastewater by the community		Activity	●	●			269
Centralized Wastewater Systems - Process Emissions	Process emissions from operation of wastewater treatment facilities located in the community	Source		●			2,820
	Process emissions associated with generation of wastewater by the community	Activity			Not Applicable		

Emissions Type	Source or Activity?	Required	Included	Explanation if Excluded	Explanatory Notes	Emissions ($MTCO_2e$)
Use of septic systems in the community	Source AND activity		•			529
Agriculture						
Domesticated animal production	Source			Not Estimated		
Manure decomposition and treatment	Source			Not Estimated		
Upstream Impacts of Community-Wide Activities						
Upstream impacts of fuels used in stationary applications by the community	Activity		•			11,640
Upstream and transmission and distribution (T&D) impacts of purchased electricity used by the community	Activity		•			11,087
Upstream impacts of fuels used for transportation in trips associated with the community	Activity		•			38,986
Upstream impacts of fuels used by water and wastewater facilities for water used and wastewater generated within the community boundary	Activity			Not Estimated	Included in electricity and stationary combustion upstream emissions estimate	
Upstream impacts of select materials (concrete, food, paper, carpets, etc.) used by the whole community	Activity			Not Estimated		

Emissions Type	Source or Activity?	Required	Included	Excluded (IE, NA, NO, or NE)	Explanatory Notes	Emissions ($MTCO_2e$)
Independent Consumption-Based Accounting						
Household Consumption (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all households in the community)	Activity			Not Estimated		
Government Consumption (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all governments in the community)	Activity			Not Estimated		
Life cycle emissions of community businesses (e.g., gas & electricity, transportation, and the purchase of all other food, goods and services by all businesses in the community)	Activity			Not Estimated		

Appendix B NCAIS Job Sector Data

As described in the Methodology Report, census data on the number of jobs for a jurisdiction, classified using the North American Industry Classification System (NCAIS), is used to allocate County-wide vehicle miles traveled from retail and commercial to the City. The percentage of County jobs within the City are shown in Table 18.

Table 18: NCAIS employment sectors used to allocate County-wide HPMS VMT to retail and commercial truck vehicle classes.

NCAIS Employment Sectors	% Of County Jobs In Jurisdiction
Agriculture, Forestry, Fishing and Hunting	11.95%
Mining, Quarrying, and Oil and Gas Extraction	0.00%
Utilities	32.27%
Construction	32.99%
Manufacturing	19.47%
Wholesale Trade	44.02%
Retail Trade	48.29%
Transportation and Warehousing	36.01%

Appendix C DMV Vehicle Population Percentage Values

DMV data was used to further localize the allocation of vehicle miles traveled VMT. The percentage values used for this VMT allocation are shown in Table 19. Refer to the Methodology Report for further details.

Table 19: Percent population of vehicles registered to owners that have an address within the jurisdiction.

Vehicle Class and Fuel	% Total Jurisdiction DMV Population
LDA-Diesel	0.336%
LDA-Electric	0.091%
LDA-Gasoline	54.409%
LDA-Gasoline Hybrid	0.203%
LDA-Propane	0.000%
LDT1-Compressed Natural Gas	0.000%
LDT1-Diesel	0.223%
LDT1-Gasoline	20.519%
LDT1-Gasoline Hybrid	0.009%
LDT2- Compressed Natural Gas	0.000%
LDT2-Diesel	2.295%
LDT2-Gasoline	20.830%
LDT2-Gasoline Hybrid	0.000%
MDV-Diesel	0.733%
MDV-Gasoline	0.352%

Appendix D Daily Vehicle Miles Traveled Data Used for EMFAC2011 Emissions Modeling

The following tables list the vehicle miles traveled data (VMT) that was input into the EMFAC2011 model to obtain emissions estimates for the transportation sector. Both the EMFAC2011-SG (SG) and the EMFAC2011-LDV (LDV) sub-models were run. The SG model was used to obtain CO_2 emissions for all vehicle classes[8] as well as total organic gases (TOG) and nitrous oxides (NO_x). The LDV model was used to estimate the CH_4 and N_2O emissions from those vehicle classes modeled by the LDV sub-model. The CH_4 and N_2O emissions from all other vehicle classes were estimated from the TOG and NO_x emissions estimated from the SG model (see the Methodology Report for additional details).

VMT data used for the EMFAC2011-SG sub-model

The following table lists the daily VMT values used to estimate CO_2 emissions for all vehicle classes.

Table 20: Daily VMT values used to estimate CO_2 emissions from the EMFAC2011-SG sub-model. Refer to the Methodology Report for definitions of vehicle classes.

EMFAC2011-SG Vehicle Classes	Daily VMT
All Other Buses-DSL	472.58
LDA-DSL	1832.77
LDA-GAS	298025.93
LDT1-DSL	1213.97
LDT1-GAS	111836.78
LDT2-DSL	12503.46
LDT2-GAS	113480.60
LHD1-DSL	18236.16
LHD1-GAS	10586.94
LHD2-DSL	10949.71
LHD2-GAS	3702.96
MCY-GAS	3588.02
MDV-DSL	3991.47
MDV-GAS	1920.16
MH-DSL	243.19
MH-GAS	2165.99
Motor Coach-DSL	484.61
OBUS-GAS	588.79
PTO-DSL	555.75
SBUS-DSL	907.47
SBUS-GAS	212.83
T6 Ag-DSL	2116.52
T6 CAIRP heavy-DSL	25.45
T6 CAIRP small-DSL	86.90

[8] Refer to the Humboldt County Greenhouse Gas Emissions Inventory Tool: Calculation Methodologies for additional information regarding vehicle class definitions as well as the methods used to estimate CH_4 and N_2O emissions.

EMFAC2011-SG Vehicle Classes	Daily VMT
T6 instate construction heavy-DSL	301.92
T6 instate construction small-DSL	634.40
T6 instate heavy-DSL	2808.24
T6 instate small-DSL	5900.77
T6 OOS heavy-DSL	14.59
T6 OOS small-DSL	49.82
T6 Public-DSL	365.43
T6 utility-DSL	43.21
T6TS-GAS	2944.55
T7 Ag-DSL	4960.01
T7 CAIRP-DSL	9967.92
T7 CAIRP construction-DSL	159.81
T7 NNOOS-DSL	11213.54
T7 NOOS-DSL	3630.06
T7 other port-DSL	828.96
T7 POAK-DSL	0.00
T7 POLA-DSL	0.00
T7 Public-DSL	540.59
T7 Single-DSL	4571.70
T7 single construction-DSL	413.42
T7 SWCV-DSL	255.50
T7 tractor-DSL	5481.34
T7 tractor construction-DSL	308.23
T7 utility-DSL	23.86
T7IS-GAS	1072.32
UBUS-DSL	788.98
UBUS-GAS	203.89
Total Daily VMT =	**657,212.11**

VMT data used for the EMFAC2011-LDV sub-model

The following VMT values were used to estimated CH4 and N2O emissions using the EMFAC2011-LDV sub-model. Only a subset of vehicle classes are modeled by this sub-model. Note that while the EMFAC2011-LDV and EMFAC2011-SG sub-models do not use the same names for vehicle classes, there is a direct correlation. This correlation is provided by the EMFAC2011 model documentation.

Table 21: Daily VMT values used to estimate CH4 and N2O emissions from the EMFAC2011-LDV sub-model. Refer to the Methodology Report for definitions of vehicle classes.

EMFAC2011-LDV Vehicle Classes	Daily VMT
01 - Light-Duty Autos (PC)	299,858.70
02 - Light-Duty Trucks (T1)	113,050.75
03 - Light-Duty Trucks (T2)	125,984.06
04 - Medium-Duty Trucks (T3)	5,911.63
05 - Light HD Trucks (T4)	28,823.11
06 - Light HD Trucks (T5)	14,652.67
07 - CAIRP+OOS+IS Trc/Sngl (T6)	2,944.55
08 - Agriculture (T6)	-
09 - Public + Utility (T6)	-

EMFAC2011-LDV Vehicle Classes	Daily VMT
10 - Out of State (T7)	-
11 - CAIRP (T7)	-
12 - Instate Tractor (T7)	-
13 - Instate Single (T7)	1,072.32
14 - Port (Drayage) (T7)	-
15 - Agriculture (T7)	-
16 - Public+Util+SolidWaste(T7)	-
17 - Other Buses	472.58
18 - Urban Buses	992.87
19 - Motorcycles	3,588.02
20 - School Buses	1,120.30
21 - Motor Homes	2,409.18
Total Daily VMT =	**12,101.84**