Humboldt Regional Climate Action Plan

Greenhouse Gas Inventory, Forecast, and Targets Report

prepared by

County of Humboldt
Humboldt County Planning and Building Department
3015 H Street
Eureka, California 95501
Contact: John Ford, Director of Planning and Building

prepared with the assistance of

Rincon Consultants, Inc.
4825 J Street, Suite 200
Sacramento, California 95819

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RINCON CONSULTANTS, INC.
Environmental Scientists | Planners | Engineers
rinconconsultants.com

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1 Introduction

To guide the development of the Humboldt County Regional Climate Action Plan, the County of Humboldt (Humboldt) developed a 2022 greenhouse gas (GHG) emissions inventory from regional community-wide activities within the incorporated and unincorporated jurisdictions within the County (Humboldt County Regional GHG Inventory). The Humboldt County Regional GHG Inventory estimates GHG emissions from residents and businesses within the region, including GHG emissions from municipal buildings and operations.

This document presents the data, methods, and results for the 2022 GHG emissions inventory, forecast, and targets for the County of Humboldt. The county, situated in the northern part of California, is a diverse and geographically varied region that offers a blend of natural landscapes including coastal areas, mountainous terrain, forests, rangeland, and agricultural crops. Humboldt is predominantly rural, characterized by a dispersed population. The incorporated city areas within Humboldt exhibit a considerable range, hosting populations varying from approximately 450 to 26,000 residents. The 2022 Humboldt County Regional GHG Inventory comprehensively covers the entire county, incorporating emissions data from both the incorporated cities and the unincorporated regions of Humboldt.

California (the State) has established statewide GHG emissions reduction goals to mitigate negative climate change impacts and transition the State to a low-carbon economy. In particular, the State has established goals to reduce statewide GHG emissions 40 percent below 1990 levels by 2030, as established by Senate Bill (SB) 32 and achieve net zero GHG emissions as soon as possible, but no later than 2045, as established by Assembly Bill (AB) 1279.[1]The California Air Resources Board (CARB) is the agency responsible for addressing these goals and developing strategies to achieve them. Many local jurisdictions are completing their own GHG inventories, forecasts, and CAPs to align with SB 32 and AB 1279.

Local governments play a fundamental role in reducing local GHG emissions and preparing for a more resilient future. Local government policies can influence high-emissions behavior and mitigate climate change effects.[2] To this end, Humboldt is developing a regional CAP for its incorporated and unincorporated communities to align with SB 32 and AB 1279 goals, increase resilience and climate change preparedness, maintain healthy air and water resources, and improve community health and the local economy across the county.

To support the development of regionally specific GHG reduction targets, the County has developed a back-cast of Humboldt's GHG emissions to 1990 to set emissions targets in alignment with the State's goals as well as a forecasted emission levels in 2030, 2035, 2040, and 2045. The emissions forecast provides an up-to-date projection of how GHG emissions are expected to change within the region in the future based on changes in population and employment, as well as existing State and federal legislation aimed at reducing GHG emissions through 2045. This document also presents provisional GHG targets and a gap analysis, which identifies the level of GHG emissions reduction

[1] AB 1279 defines net zero GHG emissions as reducing GHG emissions at least 85 percent below 1990 levels. California also set a goal to reach 1990 levels by 2020, as established by AB 32, The 2020 goal set by AB 32 was achieved by the State in 2016. CARB. Frequently Asked Questions – California's 2022 Climate Scoping Plan. Accessed November 14, 2022 at: https://ww2.arb.ca.gov/sites/default/files/2022-06/2022_Scoping_Plan_FAQ_6.21.22.pdf

[2] CARB. California's 2017 Climate Change Scoping Plan. Accessed November 14, 2022 at: https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf

that will need to be achieved through local action to meet the GHG emissions reduction targets. The analysis in this document relies on the best available data and calculation methodologies currently available.

2 Background

2.1 Legislative Context

The State has developed statewide legislative goals and programs to reduce GHG emissions. CARB has issued guidance concerning the establishment of GHG emissions reduction targets for local CAPs so communities can contribute their fair share towards the State's achievement of the GHG emissions reduction goals. In the first Climate Change Scoping Plan (referred to as the 2008 Scoping Plan), CARB encouraged local governments to adopt a reduction target for their own community emissions that parallels the State commitment to reduce GHG emissions.[3] In 2017, CARB published the 2017 Climate Change Scoping Plan (referred to as the 2017 Scoping Plan Update) outlining the strategies the State will employ to reach the additional State targets set by SB 32.[4]

On December 15, 2022, the 2022 Scoping Plan for Achieving Carbon Neutrality (2022 Scoping Plan Update) was published and includes recommendations for achieving the goal of carbon neutrality by 2045, which was codified by AB 1279.[5]

The most relevant climate-related legislation is summarized below.

- **Executive Order S-3-05**, signed in 2005, establishes statewide GHG emissions reduction goals to achieve long-term climate stabilization as follows: by 2020, reduce GHG emissions to 1990 levels and by 2050, reduce GHG emissions to 80 percent below 1990 levels. The 2050 goal was accelerated by the 2045 carbon neutral goal established by EO B-55-18 and AB 1279, as discussed below.
- **Assembly Bill 32**, known as the Global Warming Solutions Act of 2006, requires California's GHG emissions be reduced to 1990 levels by the year 2020 (approximately a 15 percent reduction from 2005 to 2008 levels). The 2008 Scoping Plan identifies mandatory and voluntary measures to achieve the statewide 2020 GHG emissions limit.
- **Senate Bill 32**, signed in 2016, establishes a statewide mid-term GHG emissions reduction goal of 40 percent below 1990 levels by 2030. CARB formally adopted the 2017 Scoping Plan Update in December 2017, laying the roadmap to achieve 2030 goals and giving guidance to achieve substantial progress toward the 2050 State goals. The 2022 Scoping Plan Update provides further guidance for reaching the State's SB 32 goal.
- **Executive Order B-55-18**, signed in 2018, expanded upon EO S-3-05 by creating a statewide GHG emissions goal of carbon neutrality by 2045. EO S-55-18 identifies CARB as the lead agency to develop a framework for implementation and progress tracking toward this goal in the 2022 Scoping Plan Update.
- **Assembly Bill 1279**, known as the California Climate Crisis Act, signed by the governor in 2022, codifies the GHG emissions reduction goals of achieving carbon neutrality by 2045 and expands upon this goal to define carbon neutrality as reducing direct emissions 85 percent below 1990

[3] CARB. 2008. Climate Change Scoping Plan: A Framework for Change. Available at: ww2.arb.ca.gov/sites/default/files/classic//cc/scopingplan/document/adopted_scoping_plan.pdf

[4] CARB. 2017. California's 2017 Climate Change Scoping Plan. Available at: https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf

[5] CARB. 2022. 2022 Scoping Plan Documents. Available at: https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents

levels and removing the remaining 15 percent of emissions via other technologies and practices, like carbon sequestration. The 2022 Scoping Plan Update adopted in December 2022 provides the pathway for reaching the State's AB 1279 goal.

2.2 Climate Science Context

Greenhouse Gases

GHGs are chemical compounds found in the earth's atmosphere which affect climate conditions by trapping infrared radiation from sunlight which can serve to raise global temperatures. Emissions can occur from natural processes as well as human activities which release excess GHGs into the atmosphere. Table 1 presents the six internationally recognized GHGs commonly quantified in GHG inventories. The 2022 Humboldt County Regional GHG Inventory focuses on the three GHGs most relevant to Humboldt's community: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The other gases (hydrofluorocarbons, perfluorocarbons, and sulfur hexafluorides) are emitted primarily in private sector manufacturing and electricity transmission and are therefore omitted from the inventory. This approach is consistent with typical community inventory approaches, as industrial emissions are typically outside of the communities' control and influence. Table 1 also includes the global warming potentials (GWP) for each gas. The 2022 Humboldt County Regional GHG Inventory used 100-year GWPs for each gas that are consistent with the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report,[6] which were also used by the State in the latest State-wide GHG emissions inventory. The GWP refers to the ability of each gas to trap heat in the atmosphere. For example, one pound of methane gas has 25 times more heat capturing potential than one pound of carbon dioxide gas. GHG emissions are reported in metric tons of CO_2 equivalent (MT CO_2e).

Table 1 2022 Inventory GHGs and GWPs

Greenhouse Gas	Primary Source	100-year GWP
Carbon dioxide (CO_2)	Combustion	1
Methane (CH_4)	Combustion, anaerobic decomposition of organic waste (e.g., in landfills, wastewater treatment plants)	25
Nitrous Oxide (N_2O)	Leaking refrigerants and fire suppressants	298
Hydrofluorocarbons	Leaking refrigerants and fire suppressants	4 - 12,400
Perfluorocarbons	Aluminum production, semiconductor manufacturing, HVAC equipment manufacturing	6,630 - 11,100
Sulfur Hexafluoride (SH6)	Transmission and distribution of power	23,500

Source: Intergovernmental Panel on Climate Change (IPCC). 2007. AR4 Synthesis Report: Climate Change 2007. Available at: https://www.ipcc.ch/assessment-report/ar4/

[6] Intergovernmental Panel on Climate Change (IPCC). 2014. AR5 Synthesis Report: Climate Change 2014. Accessed January 5, 2023, at: https://www.ipcc.ch/report/ar5/syr/

2.3 Regional Context

Humboldt's landscape is predominantly rural, contributing to a unique demographic distribution. A significant portion of the population (53 percent) resides in unincorporated areas, emphasizing the county's expansive and varied geography. Incorporated city areas within Humboldt include Arcata, Blue Lake, Eureka, Ferndale, Fortuna, Rio Dell, and Trinidad. At roughly 26,500 residents, Eureka is the largest urban area in Humboldt County followed by Arcata and Fortuna. Due to their smaller population size, the incorporated cities of Ferndale, Blue Lake, Rio Dell, and Trinidad are considered rural and share more characteristics with the unincorporated county.

Incorporated Humboldt cities occupy approximately 1 percent of the total land area of the county. The primary land uses in the Humboldt region include public ownership (e.g. national parks), tribal land, timberland, and agriculture, with timberland and agriculture accounting for the majority of rural land use.[7] The region has witnessed a significant downturn in industries like logging resulting in a shrinking job market, population sizes, and reduced economic capacity. With the decline of the once-dominant industrial sector, the major sources of employment shifted to commercial urban centers such as Eureka, Arcata, and Fortuna. However, the region is anticipated to experience an economic shift on the horizon with the shift in focus to building out green job industries, and other major developments such as the California Polytechnic State University student housing expansion in Arcata,[8] the Nordic Aquafarms project,[9] and the Humboldt Bay Offshore Wind Heavy Lift Multipurpose Marine Terminal project[10], the Humboldt Offshore Wind Farm projects[11], and the associated electrical transmission projects are all scheduled to occur in the foreseeable future.

The 2022 Humboldt County Regional GHG inventory serves as a reflection of emissions from land uses and activities which occur across the incorporated and unincorporated regions of the county. The region is characterized by a population that is largely dispersed with a few city centers, which is reflected in the emission trends observed in the transportation, waste, and energy sectors. Due to the dispersed nature of the communities, there are limited options for public and active transportation to accommodate the travel needs of the community, resulting in a high rate of single occupancy vehicle miles traveled regionally. With no open landfills in Humboldt County, all solid waste generated by the community must be transported far outside the region, further contributing to transportation related emissions. Additionally, Humboldt County is at the end of the utilities energy distribution line resulting in limited electricity capacity and resulting in many areas having no access to natural gas lines. Communities without access to natural gas rely on other non-utility fuels such as propane or wood to supply energy to their homes and businesses. Such characteristics of the region are reflected in the trends observed in the GHG inventory.

Sectors such as natural and working land uses pose significant opportunities for Humboldt County communities. The region boasts significant forests with great sequestration potential, contributing to the county's ability to offset carbon emissions. The dairy industry is also prominent, presenting

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[7] https://humboldtgov.org/DocumentCenter/View/1351/Chapter-4-Building-Communities-PDF

[8] https://facilitymgmt.humboldt.edu/sites/default/files/web_cal_poly_humboldt_feir_student_housing_project_0.pdf

[9] https://humboldtgov.org/3218/Nordic-Aquafarms-Project

[10] Humboldt Bay Harbor, Recreation & Conservation District. 2024. Humboldt Bay Offshore Wind Heavy Lift Marine Terminal Project. Available at: https://humboldtbay.org/humboldt-bay-offshore-wind-heavy-lift-marine-terminal-project-3

[11] Bureau of Ocean Energy Management (BOEM). 2025. Humboldt Wind Energy Area. Available at: https://www.boem.gov/renewable-energy/state-activities/humboldt-wind-energy-area

both economic opportunities and environmental considerations. However, because the County and local jurisdictional governments have limited control of agricultural emissions and the state has not yet issued guidance on methodology for quantifying mitigation of emissions from natural working lands or agricultural lands, agricultural emissions and carbon sequestration of natural working lands are not included in the 2022 Humboldt County Regional GHG inventory.

The 2022 Humboldt County Regional GHG inventory framework aligns with the broader CAP and supporting measures being developed by the County, emphasizing the importance of regional collaboration for collective action to achieve GHG emissions reductions. Addressing the identified challenges in transportation, energy distribution, and waste management as well as leveraging the regions natural lands potential to mitigate carbon emissions will likely play a crucial role in achieving the community's sustainability goals.

3 Regional GHG Emissions Inventory

Conducting a GHG emissions inventory provides a comprehensive understanding of a communities' GHG emissions, and may be developed to serve the following purposes:

- Establishes perspective of GHG emissions conditions in the applicable inventory year.
- Provide an understanding of where the highest sources of GHG emissions in the community originate and where the greatest opportunities for emissions reduction exist.
- Create a GHG emissions baseline from which the community can establish a forecast, reduction targets, and track progress over time.

GHG inventories are developed by identifying the sources and sinks (sectors) for GHGs within the geographic or system boundary of interest (e.g., county), collecting activity data for each sector, and applying an emissions factor to determine the carbon dioxide equivalence (CO_2e). There are often many potential sectors contributing to the communities' GHG emissions. However, only a select few sectors are typically considered the major contributors to a community GHG inventory. The GHG emissions sectors used for the 2022 Humboldt County Regional GHG Inventory are identified in Section 3.1 below.

3.1 Methodology

Protocol

The 2022 Humboldt County Regional GHG Inventory was developed in alignment with accounting protocols provided by the Local Governments for Sustainability International Council for Local Environmental Initiatives (ICLEI) as recommended by the Association of Environmental Professionals (AEP) and the California Office of Planning and Research (OPR).[12] ICLEI protocols are designed for local-scale accounting of GHG emissions that contribute to climate change and provide authoritative guidance to account for GHG emissions accurately and consistently. The ICLEI U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions Version 1.2 (Community Protocol) serves to guide the measurement and reporting of GHG emissions in a standardized way and is used by other jurisdictions to support their own inventory, forecast, and climate action planning efforts. The Community Protocol also includes steps to evaluate the relevance, completeness, consistency, transparency, and accuracy of data used in the GHG inventory.

GHG emissions were calculated by multiplying the activity data in each GHG emissions sector (e.g., transportation, energy, waste, water, and wastewater) by an associated emission factor. Activity data refer to the relevant measured or estimated level of GHG-generating activity (e.g., energy consumption, miles traveled). Emission factors are observation-based conversion factors used to equate activity data to generated GHG emissions. The 2022 Humboldt County Regional GHG Inventory leverages the latest available models and best available data in accordance with the Community Protocol. The inventory serves to provide a comprehensive understanding of the

[12] Association of Environmental Professionals (AEP). 2013. AEP Climate Change Committee's "The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Emissions Protocol". Available at: https://califaep.org/docs/California_Supplement_to_the_National_Protocol.pdf

community's current GHG emissions. The following sections contain further information on the inventory approach, calculation methodologies, data used, and results.

Emissions Boundary

The 2022 Humboldt County Regional GHG Inventory covers the relevant emissions sources within the boundary of Humboldt County, including all incorporated and unincorporated areas. The inventory thereby reflects emissions sectors resulting from Humboldt community activities over which the local governments (i.e., County and partnering jurisdictions) have jurisdictional control and influence. Sectors where the local government has limited influence are generally excluded from the 2022 GHG Community Inventory as the local government does not have the power to develop measures to impact associated emissions. The emissions boundary set forth in the analysis herein aligns with general GHG inventory accounting principles as well as methods set forth by the Community Protocol.

Scope

The Community Protocol recommends reporting GHG emissions from five basic reporting activities in a community inventory, which include:

- Use of electricity by the community
- Use of fuel in residential and commercial buildings
- On-road passenger and freight motor vehicle travel
- Use of energy in potable water and wastewater treatment and distribution
- Generation of solid waste by the community

The Community Protocol also provides recommendations for additional GHG emissions source reporting for activities that can be influenced by the accounting agency.[13] Based on reporting practices in California, it is recommended that GHG emissions from off-road equipment fuel combustion and wastewater treatment processes are also included in community GHG emissions inventories. GHG emissions sources can be categorized more generally into the following five activity sectors:

- Electricity
- Natural Gas
- Transportation
- Water and Wastewater
- Solid Waste

The 2022 Humboldt County Regional GHG Inventory assesses regional community generated GHG emissions in these five sectors, forming the foundation for emissions forecasts and targets. This includes electricity and natural gas consumption from industrial operations as most industrial facilities in the area are not subject to regulations under the State's Cap and Trade program which typically governs industrial emissions. While there are some industrial facilities which are subject to Cap and Trade, disaggregated data was not available to remove State regulated industrial facilities energy use from activity data. Furthermore, local jurisdictions are considered to have some influence over the energy use at industrial land uses through zoning and building codes and

[13] i.e. local governments

therefore are included in the inventory. Emissions from industrial point source discharge have been excluded due to lack of local jurisdictional control over this emissions source.

Notably, water sector emissions, arising from electricity use in water delivery and treatment, are accounted for under electricity sector emissions as the entirety of water supplied to Humboldt community members occurs within Humboldt geographic and jurisdictional boundaries.[14] Given that all community water is supplied from within the Humboldt community, these emissions are accounted under electricity sector emissions to prevent double counting (see Section 3.2.1).

There are opportunities to analyze the GHG emissions impacts of other sectors such as natural and working lands and refrigerants. However, the state has not yet issued guidance on methodology for quantifying GHG emission impacts associated with natural working lands or agricultural lands, and the available methodology for accounting of emissions activities in this sector can be difficult and resource intensive to quantify. Due to the lack of specific state guidance and methodology for inclusion of natural working lands GHG emission impact in a communitywide inventory, this sector has been excluded from the 2022 Humboldt County Regional GHG Inventory. Similarly, though the Community Protocol offers a methodology for assessing refrigerant emissions, it recognizes that obtaining accurate, reliable data for this sector on a community-wide scale poses a significant challenge. Due to lack of publicly available, reliable data regarding refrigerant use in the region, emissions from refrigerant use has also been excluded from the 2022 regional inventory. More information regarding inclusions or exclusions particular to the five mandatory sectors is provided in Section 3.2 below.

3.2 2022 Community GHG Emissions Inventory

3.2.1 Energy

Energy: Residential and Nonresidential Electricity

Emissions from residential and nonresidential electricity were calculated using Community Protocol Equation BE.2.1. Nonresidential electricity includes consumption from commercial, industrial, and agricultural sources. Commercial electricity use is expected to comprise the majority of nonresidential consumption due to the decline in regional industrial operations.

To account for only electricity consumed in the built environment, equation 3.1 subtracts electricity consumed by electric vehicles (EVs) from total purchased electricity by removing passenger car EV electricity use from residential electricity consumption and commercial and bus EV electricity consumption from nonresidential consumption. Electricity use from passenger, commercial, and bus EVs are instead accounted for under the transportation sector of the inventory to provide a more thorough differentiation between building and transportation sector emissions. More information regarding EV energy use can be found in Section 3.2.2. Equation 3.1 and Table 2 provide the equation, associated parameters, and data sources used to quantify GHG emissions associated with community electricity consumption.

[14] Water sector operation information is based on feedback provided by the County and water districts which supply water to the Humboldt community.

EQUATION 3.1

BE.2.1 RESIDENTIAL/NONRESIDENTIAL ELECTRICITY SECTOR EMISSIONS

$$CO_2e_{electricity,j} = \sum_i \left(Elec_{i,j} - EV_{i,j}\right) \times EF_{elec,i,j} \quad 3.1$$

Table 2 Emissions Parameters and Data Sources – Community Electricity Use

Definition	Parameter	Value	Unit	Data Source
Annual GHG emissions from electricity consumption per building type	$CO_2e_{electricity,j}$	See Table 5	MT CO_2e/year	Calculated
Electricity consumption per building type per energy provider	$Elec_{i,j}$	See Table 4	kWh/year	i. PG&E Community Inventory Reports[1] ii. RCEA[2] iii. CEC[3]
Attributed electric vehicle electricity consumption	$EV_{i,j}$	See Table 4	kWh/year	EMFAC2021[4]
Electricity emission factor based on energy provider	$EF_{elec,i,j}$	See Table 5	MT CO_2e/kWh	i. PG&E Community Inventory Reports ii. EPA eGRID[5] iii. RCEA Power Content Label[6]
Energy Providers	i	PG&E RCEA	Categorical	–
Building type	j	Residential Nonresidential[7]	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; kWh = kilowatt hour

1. Pacific Gas and Electricity (PG&E) Community Inventory Reports provided by each jurisdiction in Humboldt County via SharePoint on December 21, 2023. Information regarding PG&E Community Inventory Reports is available at: https://pge-energydatarequest.com/
2. Redwood Coast Energy Authority (RCEA) county-wide electricity consumption data provided by RCEA via email on March 21, 2024.
3. California Energy Commission (CEC). 2023. California Energy Consumption Database. Available at: https://ecdms.energy.ca.gov/Default.aspx
4. California Air and Resources Board (CARB). 2023. Emission FACtor (EMFAC2021 v1.0.1) Model. Available at: https://arb.ca.gov/emfac/emissions-inventory/5e0cb7d6006cc10661f4b3ffb9c120a486d46ea6
5. Environmental Protection Agency (EPA). 2024. Frequently Asked Questions about eGRID. Available at: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid-questions-and-answers
6. Redwood Coast Energy Authority (RCEA). 2024. Power Resources, 2022 Power Content Label. Available at: https://redwoodenergy.org/power-resources/
7. Nonresidential includes kWh consumption includes commercial, industrial, and agricultural sources.

Electricity consumed by residents and businesses in Humboldt County is supplied by Pacific Gas and Electric (PG&E), Redwood Coast Energy Authority (RCEA), and direct access (e.g., primarily rooftop solar panels). According to RCEA, in 2022 there was 19.4 MW of customer rooftop solar in the region, supplying an estimated 31,150 MWh of electricity generation onsite. RCEA provided county-wide electricity sales data broken out by residential and nonresidential uses. RCEA provided data excluded direct access on-site solar generation. PG&E electricity consumption data was received from each jurisdiction within Humboldt County boundaries via the PG&E Community Inventory Reports which differentiates between residential, commercial, industrial, agricultural, and direct access use categories. To determine the quantity of county-wide electricity received from PG&E, the consumption data by use category was summed across all jurisdictions within Humboldt County

boundaries. The direct access category reported by PG&E includes electricity provided by commuinty choice aggregations, such as RCEA, and does not differentiate by customer type (i.e., residential or nonresidential).

Utility data reported by PG&E is subject to 15/15 Rule[15] reporting restrictions which can result in utility data being either fail-dropped from the report (i.e. excluded) or aggregated into another sector (e.g. combining commercial and industrial consumption). Agricultural and industrial electricity use did not pass the California Public Utilities Commission (CPUC) 15/15 Rule reporting restrictions and were excluded from the PG&E Community Inventory Report. PG&E provided commercial electricity 2022 data for Rio Dell, as well as 2022 residential and commercial electricity consumption data for for Blue Lake, Ferndale, and Trinidad, all failed 15/15 Rule reporting restrictions and were also exluded. Due to 15/15 rule failures for PG&E data, the RCEA supplied electricity data appears to exceed the kWh of direct access reported by PG&E that encompasses RCEA supplied electricity. The significant number of fail-dropped sectors within the PG&E Community Inventory Report results in an under reporting of regional utility consumption data from PG&E

To establish a more accurate estimate of county-wide electricity use, PG&E provided electricity to these communites was estimated using California Energy Commission (CEC) county-wide data as the basis for total Humboldt electricity usage. CEC county-wide data is reported based on residential and nonresidential consumption, and includes all electricity end-uses which includes PG&E supplied electricity, RCEA supplied electricity, and direct access. To estimate PG&E total provided electricity, known RCEA residential and nonresidential electricity was deducted from CEC electricity data. This approach assumes that all remaining residential and nonresidential kWh consumption is sourced from PG&E. Though RCEA is expanding direct access solar options in the area, direct access was not disaggregated from the remaining residential and nonresidential data due to data limitations. This method provides a replicable, conservative estimation of GHG emissions assocaited with electricyt use county-wide as well as a more complete accounting of regional electricity consumption, though is limited in reporting sector-based emissions as it cannot establish differentiation between commercial, industrial, and agricultural utility consumption in the nonresidential sector. Table 3 provides a summary of calculation methods and results of this estimation.

Table 3 15/15 Rule Failure Electricity Use Adjustment

Sector	CEC [kWh]	RCEA [kWh]	PG&E 15/15 Adjustment[1] [kWh]
Residential	355,284,200	300,405,000	54,879,200
Nonresidential	419,005,700	297,940,000	121,065,700

Notes: kWh = kilowatt hour;

1. PG&E residential kWh is estimated by deducting RCEA residential kWh from CEC residential electricity data. PG&E nonresidential electricity use is determined by deducting RCEA nonresidential kWh from CEC nonresidential data.

Table 4 below provides resulting electricity activity data by utility provider, allocated EV electricity use data, and subsequent building activity data used to determine GHG emissions for the community's electricity consumption in the built environment.

[15] The 15/15 Rule is a policy put in place by the California Public Utilities Commission which protects the privacy of energy users. Aggregated energy information must have more than 15 customers, with no one customer representing 15 percent of the aggregated energy consumption.

Table 4 Community Residential and Nonresidential Electricity Activity Data Adjustment

Sector	Provider	Provided Activity Data [kWh]	Attributed EV[1] [kWh]	Building Activity Data [kWh]
Residential	PG&E	54,879,200	2,579,824	52,299,376
	RCEA	300,405,000	14,121,779	286,283,221
Nonresidential[2]	PG&E	121,065,700	2,649	121,063,051
	RCEA	297,940,000	6,519	297,933,481

Notes: kWh = kilowatt hour; MT CO_2e = Metric tons of carbon dioxide equivalent; EV = electric vehicles

1. Attributed EV allocates electric vehicle kWh consumption to each provider based on the vehicle type, electricity sector, and proportion of electricity provided by each provider per sector. EV kWh usage from passenger vehicles is removed from residential electricity, while commercial and bus EV kWh usage is removed from nonresidential electricity.
2. Nonresidential includes kWh consumption from commercial, industrial, and agricultural sources.

Resulting activity data, emissions factors, and GHG emissions per building type and provider is summarized in Table 5.

Table 5 Community Residential and Nonresidential Electricity GHG Emissions Calculations

Sector	Provider	Building Activity Data [kWh]	Emission Factor [MT CO2e/kWh]	GHG Emissions [MT CO2e]
Residential	PG&E[1]	52,299,376	0.0000263	1,376
	RCEA	286,283,221	0.0000220	6,293
Nonresidential	PG&E[1]	121,063,051	0.0000263	3,186
	RCEA	297,933,481	0.0000220	6,549

Notes: kWh = kilowatt hour; MT CO_2e = Metric tons of carbon dioxide equivalent

1. PG&E emissions factor only reports carbon dioxide emissions associated with production. To estimate CO_2e emissions, average CAMX grid CH_4 and N_2O emissions reported by eGRID were incorporated into the PG&E CO_2 emissions factor (See Table 2).

Energy: Electricity Transmission and Distribution Losses

Electricity Transmission and Distribution (T&D) losses arise from electricity lost during delivery to the buildings and associated end-uses in the community. Electricity T&D losses occur in the electricity transmission and distribution system and are therefore upstream of the delivery endpoints located within the communities' geographical boundary. This means this electricity is lost before it is counted. However, T&D losses are estimated and included in the 2022 Humboldt County Regional GHG Inventory as they are associated with energy usage by communities in Humboldt County and thereby directly impacted by the community's electricity consumption. Additionally, emissions from T&D losses are recommended for inclusions in community GHG inventories by the Community Protocol. Equation 3.2 and Table 6 provide the calculation method, associated parameters, and data sources used to quantify GHG emissions associated with community T&D losses from electricity consumption. T&D losses associated with EV electricity use are considered negligible and therefore are included in the quantification of residential and nonresidential building electricity T&D.

EQUATION 3.2

BE.4 ELECTRICITY T&D LOSS SECTOR EMISSIONS

$$CO_2e_{T\&D,j} = \sum_i Elec_{i,j} \times L_{T\&D} \times EF_{elec,i,j} \quad 3.2$$

Table 6 Emissions Parameters and Data Sources – Community Electricity T&D Loss

Definition	Parameter	Value	Unit	Data Source
Annual GHG emissions from transmission and distribution losses per building type	$CO_2e_{T\&D,i}$	See Table 7	MT CO_2e/year	Calculated
Electricity consumption per energy provider and building type	$Elec_{i,j}$	See Table 7	kWh/year	i. PG&E Community Inventory Reports[1] ii. RCEA[2] iii. CEC[3]
Electricity emissions factor per energy provider and building type	$EF_{elec,i,j}$	See Table 7	MT CO_2e/kWh	i. PG&E Community Inventory Reports ii. EPA eGRID[4] iii. RCEA Power Content Label[5]
Electricity loss factor	$L_{T\&D}$	5.10%	Percent	EPA eGRID
Energy Providers	i	PG&E RCEA	Categorical	–
Building type	j	Residential Nonresidential[6]	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; kWh = kilowatt hour

1. Pacific Gas and Electricity (PG&E) Community Inventory Reports provided by the County via SharePoint on December 21, 2023. Information regarding PG&E Community Inventory Reports is available at: https://PG&E-energydatarequest.com/
2. Redwood Coast Energy Authority (RCEA) county-wide electricity consumption data provided by the County via SharePoint on January 3, 2024.
3. California Energy Commission (CEC). 2023. California Energy Consumption Database. Available at: https://ecdms.energy.ca.gov/Default.aspx
4. Environmental Protection Agency (EPA). 2022. Emissions & Generation Resource Integrated Database (eGRID) Data Explorer. Available at: https://www.epa.gov/egrid/data-explorer
5. Redwood Coast Energy Authority (RCEA). 2024. Power Resources, 2022 Power Content Label. Available at: https://redwoodenergy.org/power-resources/
6. Nonresidential includes kWh consumption from commercial, industrial, and agricultural sources.

The activity data, emissions factors, and GHG emissions associated with electricity T&D losses is summarized in Table 5 per building type and provider.

Table 7 Community Electricity T&D Loss GHG Emissions Calculations

Sector	Provider	Activity Data [kWh]	T&D Losses [kWh][1]	Emission Factor [MT CO_2e/kWh]	GHG Emissions [MT CO_2e]
Residential	PG&E	54,879,200	2,798,839	0.0000263	74
	RCEA	300,405,000	15,320,655	0.0000220	337
Nonresidential	PG&E	121,065,700	6,174,351	0.0000263	162

Sector	Provider	Activity Data [kWh]	T&D Losses [kWh][1]	Emission Factor [MT CO_2e/kWh]	GHG Emissions [MT CO_2e]
	RCEA	297,940,000	15,194,940	0.0000220	334

Notes: kWh = kilowatt hour; MT CO_2e = Metric tons of carbon dioxide equivalent

1. T&D losses include the kWh consumption associated with EV charging.

Energy: Residential and Nonresidential Natural Gas

GHG emissions from natural gas result from the stationary combustion of natural gas in both the residential and nonresidential building sectors. In alignment with building electricity emissions, nonresidential natural gas includes commercial, industrial, and agricultural sources of consumption, though the majority of consumption is attributable to commercial operations due to limited industrial presence in the Humboldt community. PG&E reported natural gas consumption for the community's industrial and agricultural sources were excluded due to 15/15 rule reporting restrictions. Therefore, CEC reported county-wide natural gas data was utilized to adequately account for regional natural gas emissions from the Humboldt community. This methodology does not allow for differentiation between commercial, agricultural, and industrial utility consumption as CEC regional utility data only reports aggregated residential and nonresidential sources.

Emissions from residential and nonresidential natural gas use were calculated using Community Protocol Equation BE.1.1. Though the majority of GHG emissions result from the combustion of natural gas, not all the natural gas purchased is combusted. Natural gas that leaks from pipes and processing plants has a larger GHG impact compared to combusted natural gas due to the higher global warming potential of methane. Some natural gas also leaks from fittings and appliances within a building, after the natural gas meter which is used to quantify total gas usage. Therefore, Community Protocol has been adjusted to remove this small percentage of metered natural gas from the combustion calculation, and instead count it as leakage. More information regarding emissions associated with natural gas leaks can be found under "Energy: Natural Gas Methane Leaks" subsection below. Equation 3.3 and Table 8 provide the equation used, associated parameters, and data sources used to quantify GHG emissions associated with community natural gas consumption in residential and nonresidential buildings.

EQUATION 3.3

BE.1.1 RESIDENTIAL/NONRESIDENTIAL NATURAL GAS SECTOR EMISSIONS

$$CO_2e_{NatGas,i} = \left(Fuel_{NG,i} - [1 - L_{enduse}]\right) \times \left[\left(EF_{NG,CO_2} \times GWP_{CO_2}\right) + \left(EF_{NG,CH_4} \times GWP_{CH_4}\right) + \left(EF_{NG,N_2O} \times GWP_{N_2O}\right)\right] \times 10^{-1} \times 10^{-3} \quad (3.3)$$

Table 8 Emissions Parameters and Data Sources – Community Natural Gas Use

Definition	Parameter	Value	Unit	Data Source
Annual GHG emissions from stationary combustion of natural gas per building type	$CO_2e_{NatGas,i}$	See Table 9	MT CO_2e/year	Calculated
Natural gas consumed per building type	$Fuel_{NG,i}$	See Table 9	therms/year	CEC[1]

Definition	Parameter	Value	Unit	Data Source
Percent natural gas lost during consumer end-use	L_{enduse}	0.50%	Percent	Environmental Defense Fund[2]
Carbon dioxide emission factor for natural gas combustion	EF_{NG,CO_2}	53.06	kg CO_2/mmBTU natural gas	EPA Emission Factors Hub[3]
Methane emission factor for natural gas combustion	EF_{NG,CH_4}	0.001	kg CH_4/mmBTU natural gas	EPA Emission Factors Hub
Nitrous oxide emission factor for natural gas combustion	EF_{NG,N_2O}	0.0001	kg N_2O/mmBTU natural gas	EPA Emission Factors Hub
Global warming potential of carbon dioxide	GWP_{CO_2}	See Table 1	–	IPCC Fourth Assessment Report[4]
Global warming potential of methane	GWP_{CH_4}	See Table 1	–	IPCC Fourth Assessment Report
Global warming potential of nitrous oxide	GWP_{N_2O}	See Table 1	–	IPCC Fourth Assessment Report
Conversion factor	10^{-1}	0.1	mmBTU/therm	–
Conversion factor	10^{-3}	0.001	MT/kg	–
Building type (i.e. residential or nonresidential)	i	Residential Nonresidential[5]	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; therms = thermal unit; mmBTU = metric million British thermal unit; kg = kilograms

1. California Energy Commission (CEC). 2023. California Energy Consumption Database. Available at: https://ecdms.energy.ca.gov/Default.aspx
2. Environmental Defense Fund USER GUIDE FOR NATURAL GAS LEAKAGE RATE MODELING TOOL. Available at: https://www.edf.org/sites/default/files/US-Natural-Gas-Leakage-Model-User-Guide.pdf
3. Environmental Protection Agency (EPA). 2022. GHG Emission Factors Hub (April, 2022). Available at: https://www.epa.gov/climateleadership/ghg-emission-factors-hub
4. Intergovernmental Panel on Climate Change (IPCC). 2007. AR4 Synthesis Report: Climate Change 2007. Available at: https://www.ipcc.ch/assessment-report/ar4/
5. Nonresidential includes natural gas use from commercial, industrial, and agricultural sources.

The total natural gas consumption, combusted natural gas activity data, emissions factors, and GHG emissions associated with community natural gas use is summarized in Table 9 per building type and provider.

Table 9 Community Residential and Nonresidential Natural Gas GHG Emissions Calculations

Sector	Provided Activity Data [therms]	End-use Leakage [therms]	Combustion Activity Data [therms]	Emissions Factor [MT CO_2e/therm]	GHG Emissions [MT CO_2e]
Residential	19,402,770	97,014	19,305,756	0.005311	102,542
Nonresidential	11,017,950	55,090	10,962,860	0.005311	58,229

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent

Energy: Natural Gas Methane Leaks

Natural gas methane leaks occur during delivery to the buildings and during associated end-uses in the community. Gas methane leaks from delivery occur in the pipeline distribution system and are therefore upstream of the delivery endpoints located in Humboldt and not reflected in the reported total natural gas purchased. While natural gas pipeline distribution leakage is technically outside of a local government's jurisdictional boundaries, the leakage is directly impacted by natural gas consumption in the community. As such, it is more holistic to include leakage as an emissions sector and is therefore included in the 2022 Humboldt County Regional GHG Inventory.

The Community Protocol does not provide a specific calculation methodology for determining GHG emissions from natural gas leakage. Therefore, emissions from natural gas leaks were calculated using Equation 3.4 which estimates emissions in alignment with energy calculation principles set forth by the Community Protocol and the guidance provided under Community Protocol Section BE.5 Upstream Emissions from Energy Use. Table 10 shows the parameters and data sources associated with Equation 3.4 which were used to quantify GHG emissions from natural gas distribution and end-use leakage.

EQUATION 3.4

NATURAL GAS LEAKAGE SECTOR EMISSIONS

$$CO_2e_{leak,i} = Fuel_{NG,i} \times EF_{NG\ leak} \times (L_{enduse} + L_{dist}) \quad 3.4$$

Table 10 Emissions Parameters and Data Sources – Community Natural Gas Leaks

Definition	Parameter	Value	Unit	Data Source
Annual GHG emissions from natural gas distribution leakage per building type	$CO_2e_{leak,i}$	See Table 11	MT CO_2e/year	Calculated
Natural gas consumed per building type	$Fuel_{NG,i}$	See Table 11	therms/year	CEC[1]
Emission factor for natural gas leakage	$EF_{NG\ leak}$	0.047381	MT CO_2e/therm	Calculated[2]
Percent natural gas lost during distribution	L_{dist}	2.3%	Percent	Alvarez, Ramón et al. (2018)[3]
Percent natural gas lost during consumer end-use	L_{enduse}	0.5%	Percent	Environmental Defense Fund[4]
Building type (i.e. residential or nonresidential)	i	Residential Nonresidential[5]	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; therms = thermal unit

1. California Energy Commission (CEC). 2023. California Energy Consumption Database. Available at: https://ecdms.energy.ca.gov/Default.aspx
2. Emission factor is calculated using the following equation:
$$2.85\ \frac{cubic\ meters}{therm} * 95\%\ methane\ content * 0.7 \frac{kg}{cubic\ meter} * 25\ \frac{CO_2e}{CH_4} * 0.001 \frac{MT}{kg}$$
3. Alvarez, Ramón et al. (2018). Assessment of methane emissions from the U.S. oil and gas supply chain. Science. 361. Accessed January 12, 2023 at: https://www.science.org/doi/abs/10.1126/science.aar7204
4. Environmental Defense Fund USER GUIDE FOR NATURAL GAS LEAKAGE RATE MODELING TOOL. Accessed January 12,2023 at: https://www.edf.org/sites/default/files/US-Natural-Gas-Leakage-Model-User-Guide.pdf
5. Nonresidential includes natural gas use from commercial, industrial, and agricultural sources.

The total natural gas use and resulting leakage activity data, emissions factors, and GHG emissions per building type is summarized in Table 11.

Table 11 Community Natural Gas Methane Leaks GHG Emissions Calculations

Natural Gas Sector	Provided Activity Data [therms]	Leakage Source	Methane Leakage [therms]	Emissions Factor [MT CO_2e/therm]	GHG Emissions [MT CO_2e]
Residential	19,402,770	Distribution	446,264	0.047381	25,741
		End-use	97,014	0.047381	
Nonresidential	11,017,950	Distribution	253,413	0.047381	14,617
		End-use	55,090	0.047381	

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent

Energy: Building Fuel Use

Though PG&E provides natural gas utility to the majority of Humboldt, capacity and infrastructure limitations prevent PG&E from supplying natural gas to the entirety of the community. Due to this limitation, many communities in Humboldt County, particularly the rural regions at the edge of PG&E service territory, rely on stationary fuel sources (e.g. propane, diesel, kerosene, wood, heating oil) instead of a central utility distribution system to supply or supplement building energy consumption. GHG emissions from these fuels result primarily from the stationary combustion in the residential building sector in Humboldt. Based on census data, a majority of homes relying on an alternative fuel source rather than natural gas, relied on propane and wood. Therefore, GHG emission calculations are based on propane and wood used in residential buildings. Emissions from residential fuel use were calculated using Community Protocol Equation BE.1.2. which uses estimated annual state-level fuel consumption and counts of household fuel use obtained from the U.S. Census to determine an average rate of fuel consumption per household in the given inventory year. The established rate is then applied to the number of households in the community which utilize a given fuel type (i.e. propane or wood) to determine regional consumption activity data. Equation 3.3 and Table 8 provide the equation used, associated parameters, and data sources used to quantify GHG emissions associated with residential building fuel consumption.

EQUATION 3.5

BE.1.1 RESIDENTIAL BUILDING FUEL USE EMISSIONS

$$CO_2e_{fuel,i} = \frac{Fuel_{state,i}}{Res_{state,i}} \times EF_i \times Res_{jurisdiction,i} \quad 3.5$$

Table 12 Emissions Parameters and Data Sources – Community Fuel Use

Definition	Parameter	Value	Unit	Data Source
Annual GHG emissions from stationary combustion of building fuel	$CO_2e_{fuel,i}$	See Table 13	MT CO_2e/year	Calculated
Fuel consumed per fuel type in the State	$Fuel_{state,i}$	See Table 13	mmBtu/year	EIA SEDS[1]

Definition	Parameter	Value	Unit	Data Source
Number of residences in the State which use a given fuel type	$Res_{state,i}$	See Table 13	households	EIA RECS Survey[2]
Emissions factor per fuel type	EF_i	See Table 13	MT CO_2e/mmBtu	EPA Emission Factors Hub[3]
Number of residences in the jurisdiction which use a given fuel type	$Res_{jurisdiction,i}$	See Table 13	households	U.S. Census Bureau[4]
Fuel type	i	Propane Wood	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; mmBTU = metric million British thermal unit;

1. U.S. Energy Information Administration (EIA). 2023. State Energy Data System (SEDS), State Energy Consumption Estimates Table C5 Residential Sector Energy Consumption Estimates, 2021. Available at: https://www.eia.gov/state/seds/archive/seds2021.pdf
2. U.S. Energy Information Administration (EIA). 2023. 2020 RECS Survey Data, Highlights for fuels used in U.S. homes by state, 2020. Available at: https://www.eia.gov/consumption/residential/data/2020/index.php?view=state
3. Environmental Protection Agency (EPA). 2022. GHG Emission Factors Hub (April, 2022). Available at: https://www.epa.gov/climateleadership/ghg-emission-factors-hub
4. U.S. Census Bureau. 2022. American Community Survey, ACS 5-Year Estimates Data Profiles, Table DP04 Selected Housing Characteristics. Available at: https://data.census.gov/table/ACSDP5Y2022.DP04?q=DP04: SELECTED HOUSING CHARACTERISTICS&g=050XX00US06023_160XX00US0602476,0607162,0623042,0623910,0625296,0660900,0680448

The data used to quantify residential building stationary fuel emissions from non-utility sources primarily utilized in Humboldt are summarized in Table 13 below.

Table 13 Community Building Fuel Use GHG Emissions Calculations

Fuel Type	State Consumption [mmBtu]	State Households [households]	Fuel Rate [mmBtu/household]	Emissions Factor [MT CO_2e/mmBtu]	Jurisdiction Households [households]	GHG Emissions [MT CO_2e]
Propane	24,200,000	630,000	38	0.0951	4,370	15,956
Wood	22,800,000	1,030,000	22	0.0631	9,104	12,721
Total						**28,677**

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; mmBTU = metric million British thermal unit

3.2.2 Transportation

Transportation: On-road

On-road vehicles in the community produce GHG emissions from the mobile combustion of fossil fuels (i.e., internal combustion engines) and up-stream from the production of electricity (i.e., electric vehicles). The Community Protocol recommends estimating GHG emissions from the on-road transportation sector using a regional travel demand model to acquire vehicle miles travelled (VMT) activity data for the community based on an origin-destination methodology, differentiated between passenger, commercial, and bus vehicle classes. However, the growth of big data[16] sources related to VMT activities presents an opportunity for more precise and reliable data collection on

[16] Big data refers to large and/or complex data sets which grow at increasing rates, and which cannot be handled by traditional data-processing software. These data sets typically provide greater statistical power in data processing.

VMT behaviors in the region. This inventory relies on county-wide 2022 VMT data provided by the traffic consultants Fehr & Peers. During Fehr & Peers review of the existing Humboldt County Travel Demand Model, it was deemed that the regional travel demand model was outdated and was not appropriate for establishing baseline VMT data for the region. Instead, Fehr & Peers developed 2022 baseline VMT data county-wide by leveraging data from StreetLight Data[17]. The VMT estimates were validated by Fehr & Peers using California Statewide Travel Demand Model data, and California Household Travel Survey data. StreetLight Data is a notable big data provider specializing in transportation information. StreetLight Data's Insight cloud-based software utilizes navigation-GPS and other location-based data derived from vehicles and location apps to provide a variety of traffic metrics such as annual average daily traffic (AADT) counts, average travel distances, and top origin-destination locations.[18] Therefore, the 2022 Humboldt County Regional GHG Inventory uses 2022 VMT baseline data sourced from Streetlight Data processed by Fehr & Peers to estimate transportation emissions. Equation 3.6 and Table 14 define the equations, parameters, and data sources used to estimate GHG emissions based on StreetLight Data passenger VMT activity data analyzed and validated by traffic consultant Fehr & Peers.[19]

EQUATION 3.6

PASSENGER ON-ROAD TRANSPORTATION COMBUSTION EMISSIONS

$$CO_2e_{onroad,pass} = \sum_i \left(R_{H,i} + V_{OH,i} + V_{HO,i} + V_{OW,i} + V_{WO,i}\right) \times N_{pass,i} \times 301 \times EF_{auto} \quad 3.6$$

Table 14 Emissions Parameters and Data Sources – Passenger On-road Transportation

Definition	Parameter	Value	Unit	Data Source
Total annual community passenger on-road GHG emissions per jurisdiction	$CO_2e_{Onroad,pass}$	See Table 20	MT CO_2e/year	Calculated
Resident-based average daily trip VMT	$T_{H,i}$	See Table 15	miles/person/weekday	StreetLight Data[1]
Visitor average daily trip VMT from other location within regional boundaries to home	$V_{OH,i}$	See Table 15	miles/person/weekday	StreetLight Data
Visitor average daily trip VMT from home to other location within regional boundaries	$V_{HO,i}$	See Table 15	miles/person/weekday	StreetLight Data
Visitor average daily trip VMT from other location to work, either of which	$V_{OW,i}$	See Table 15	miles/person/weekday	StreetLight Data

[17] https://www.streetlightdata.com/how-it-works/

[18] https://www.streetlightdata.com/streetlight-data-privacy-principles/

[19] https://www.fehrandpeers.com/

Definition	Parameter	Value	Unit	Data Source
may occur within regional boundaries				
Visitor average daily trip VMT from work to other location, either of which may occur within regional boundaries	$V_{WO,i}$	See Table 15	miles/person/weekday	StreetLight Data
Number of passenger vehicles registered to each jurisdiction	N_{pass}	See Table 15	vehicles	CEC[2,3]
Annualization factor	301	301	Annual VMT/weekday VMT	Caltrans PeMS[4]
Emissions factor for on-road vehicles per vehicle class	$EF_{auto,i}$	See Table 20	MT CO_2e/mile	EMFAC2021 v1.0.1[5]
Jurisdiction	i	Arcata Blue Lake Eureka Ferndale Fortuna Rio Dell Trinidad Uninc. Humboldt	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; VMT = vehicle miles travelled

1. StreetLight Data VMT activity data provided by Fehr & Peers via email on December 11, 2023.
2. California Energy Commission (CEC). 2024. Light-Duty Vehicle Population in California, 2022, Humboldt County. Available at: https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics/light-duty-vehicle
3. Number of vehicles rather than the number of residents in each jurisdiction was used to scale average daily VMT per person as a more realistic and conservative estimate of GHG emissions.
4. Caltrans PeMS provides online traffic volume measurements by which average weekday daily volume and total annual volume can be measured to determine annualization factors for scaling average weekday VMT. Fehr & Peers provided a range of Caltrans PeMS annualization factors ranging from 242-344 from which StreetLight Data could be scaled. The designated value (301) was chosen as a moderately conservative estimation of annual VMT in each jurisdiction.
5. California Air Resources Board (CARB). 2023. EMission FACtor (EMFAC2021 v1.0.1) Model. Available at: https://arb.ca.gov/emfac/emissions-inventory/5e0cb7d6006cc10661f4b3ffb9c120a486d46ea6

A summary of total average daily VMT per person per day and the methodology to scale StreetLight Data passenger VMT provided by Fehr & Peers is provided in Table 15.

Table 15 Passenger VMT Annualization Calculations

Jurisdiction	AADT [miles/person/weekday]	Population PCT[1]	Vehicles[2]	Annual Passenger VMT[3] [miles]
Arcata	52	13.62%	14,843	232,279,893
Blue Lake	75	0.62%	673	15,255,444
Eureka	41	19.48%	21,235	261,431,302
Ferndale	80	1.15%	1,256	30,317,925
Fortuna	51	9.20%	10,031	154,212,684
Rio Dell	70	2.49%	2,711	57,491,252

Jurisdiction	AADT [miles/person/weekday]	Population PCT[1]	Vehicles[2]	Annual Passenger VMT[3] [miles]
Trinidad	98	0.33%	360	10,556,945
Uninc Humboldt Co	82	53.11%	57,898	1,427,445,820
County Total			**109,008**	**2,188,991,265**

Notes: AADT = annual average daily traffic; VMT = vehicle miles travelled

1. United States Census Bureau. 2022. ACS Demographic and Housing Estimates, American Community Survey, ACS 5-year Estimates Data Profiles, Table DP05. Available at: https://data.census.gov/table/ACSDP5Y2022.DP05?q=population&g=050XX00US06023_160XX00US0602476,0607162,0623042,0623910,0625296,0660900,0680448
2. CEC reports light-duty vehicles registered on a county-wide basis and does not distinguish between jurisdictions. Total county-wide registered vehicles (109,008) are apportioned to each jurisdiction based on jurisdictional percent of total County population as determined based on U.S. Census Bureau data. For example, 109,008 county vehicles multiplied by 53.11 population percent results in 57,898 vehicles attributable to unincorporated Humboldt County.
3. Annual passenger VMT is quantified based on AADT, population proportion, number of registered vehicles in each jurisdiction, and an annualization factor of 301 as provided by Fehr & Peers. The annualization factor was derived from California's Caltrans PeMS online traffic volume database.

The Humboldt VMT assessment provided by Fehr & Peers did not include commercial or bus related activity data, therefore commerical and bus related data was estimated from Caltrans and National Transit Database data, respectively. Equation 3.7 and Table 16 define the equation, parameters, and data sources used to estimate GHG emissions in alignment with the Community Protocol and best available data which will allow the County to track regional progress over time.

EQUATION 3.7

OTHER ON-ROAD TRANSPORTATION COMBUSTION EMISSIONS

$$CO_2e_{onroad,i} = T_{annual,i} \times EF_{auto,i} \quad 3.7$$

Table 16 Emissions Parameters and Data Sources – Other On-road Transportation

Definition	Parameter	Value	Unit	Data Source
Total annual community on-road GHG emissions per jurisdiction and vehicle class	$CO_2e_{Onroad,i}$	See Table 20	MT CO_2e/year	Calculated
Annual VMT per jurisdiction and vehicle class	$T_{annual,i}$	See Table 15	miles	i. Caltrans[1] ii. NTD[2]
Emissions factor for on-road vehicles per vehicle class	$EF_{auto,i}$	See Table 20	MT CO_2e/mile	EMFAC2021 v1.0.1[5]
Vehicle Class	i	Commercial Bus	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; VMT = vehicle miles travelled

1. California Department of Transportation (Caltrans). 2024. Traffic Census Program, Truck Traffic: Annual Average Daily Truck Traffic, 2021 AADT Truck. Available at: https://dot.ca.gov/programs/traffic-operations/census
2. National Transit Database (NTD). 2022. 2022 Annual Agency Profile – Humboldt Transit Authority (NTD ID 91036). Available at: https://www.transit.dot.gov/ntd/transit-agency-profiles
3. California Air Resources Board (CARB). 2023. EMission FACtor (EMFAC2021 v1.0.1) Model. Available at: https://arb.ca.gov/emfac/emissions-inventory/5e0cb7d6006cc10661f4b3ffb9c120a486d46ea6

Bus VMT was determined based on data provided by the National Transit Database which reports activity data on a county-wide basis, while commercial VMT was estimated based on StreetLight Data passenger annual VMT results and the percent of commercial VMT activity as reported by the Caltrans Traffic Census Program. The quantification methodology and resulting annual VMT for commercial and bus activity data is summarized in Table 17 below.

Table 17 Commercial and Bus Activity Data Calculations

Jurisdiction	Annual Passenger VMT [miles]	Commercial PCT[1]	Annual Commercial VMT[2] [miles]	Annual Bus VMT[3,4] [miles]
Arcata	232,279,893	11.42%	29,946,222	–
Blue Lake	15,255,444	11.42%	1,966,778	–
Eureka	261,431,302	11.42%	33,704,510	–
Ferndale	30,317,925	11.42%	3,908,678	–
Fortuna	154,212,684	11.42%	19,881,563	–
Rio Dell	57,491,252	11.42%	7,411,945	–
Trinidad	10,556,945	11.42%	1,361,033	–
Uninc. Humboldt Co	1,427,445,820	11.42%	184,030,608	–
County Total	**2,188,991,265**	**11.42%**	**282,211,337**	**1,028,481**

Notes: AADT = annual average daily traffic; VMT = vehicle miles travelled; PCT = percentage

1. California Department of Transportation (Caltrans). 2024. Traffic Census Program, Truck Traffic: Annual Average Daily Truck Traffic, 2021 AADT Truck. Available at: https://dot.ca.gov/programs/traffic-operations/census
2. Annual commercial VMT is derived through a backward calculation process, utilizing the annual passenger VMT and the percentage of commercial VMT represented on Humboldt County roads as reported by Caltrans.
3. National Transit Database (NTD). 2022. 2022 Annual Agency Profile – Humboldt Transit Authority (NTD ID 91036). Available at: https://www.transit.dot.gov/ntd/transit-agency-profiles
4. Includes vehicle revenue miles data from public transit entities over which local governments within Humboldt County have control, including Humboldt Transit Authority, City of Eureka, and City of Arcata

In addition to mobile combustion emissions accounted under Community Protocol Equations TR.1.A and TR.2.B, GHG emissions from electric vehicles were included in the 2022 Humboldt County Regional GHG Inventory for more accurate accounting of on-road transportation trends. This was achieved through modifying Equation 3.6 to account for EV modeshare estimates obtained from EMFAC2021 based on total VMT. The equation, parameters, and data sources used to estimate GHG emissions attributable to on-road EV activity is provided in Equation 3.8 and Table 18 below.

EQUATION 3.8

ON-ROAD TRANSPORTATION ELECTRIC VEHICLE EMISSIONS

$$CO_2e_{onroad,EV,i} = T_{annual,i} \times EV_{share,i} \times EPM_i \times EF_{elec,j} \quad 3.8$$

Table 18 Emissions Parameters and Data Sources – Community On-road Transportation EV

Definition	Parameter	Value	Unit	Data Source
Total annual community on-road EV GHG emissions per vehicle class	$CO_2e_{Onroad,EV,i}$	See Table 20	MT CO_2e/year	Calculated

Definition	Parameter	Value	Unit	Data Source
Annual VMT per jurisdiction and vehicle class	$T_{annual,i}$	See Table 15 See Table 17	miles	i. StreetLight Data[1] ii. Caltrans[2] iii. NTD[3]
Percent share of VMT attributable to EVs	$EV_{share,i}$	See Table 19	%	EMFAC2021 v1.0.1[4]
Average rate of electricity consumption per EV-mile per vehicle class	EPM_i	See Table 19	kWh/mile	EMFAC2021 v1.0.1
Weighted average electricity emissions factor per building type	$EF_{elec,j}$	See Table 19	MT CO_2e/kWh	i. PG&E Community Inventory Reports[5] ii. EPA eGRID[6] iii. RCEA Power Content Label[7]
Vehicle class	i	Passenger Commercial Bus	Categorical	
Building type	j	Residential Nonresidential	Categorical	

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; EV = electric vehicles; VMT = vehicle miles travelled; kWh = kilowatt hour

1. StreetLight Data VMT activity data provided by Fehr & Peers via email on December 11, 2023.
2. California Department of Transportation (Caltrans). 2024. Traffic Census Program, Truck Traffic: Annual Average Daily Truck Traffic, 2021 AADT Truck. Available at: https://dot.ca.gov/programs/traffic-operations/census
3. National Transit Database (NTD). 2022. 2022 Annual Agency Profile. Available at: https://www.transit.dot.gov/ntd/transit-agency-profiles
4. California Air Resources Board (CARB). 2023. EMission FACtor (EMFAC2021 v1.0.1) Model. Available at: https://arb.ca.gov/emfac/emissions-inventory/5e0cb7d6006cc10661f4b3ffb9c120a486d46ea6. Percent of EV share validated with CEC data for County.
5. Pacific Gas and Electricity (PG&E) Community Inventory Reports provided by the County via SharePoint on December 21, 2023. Information regarding PG&E Community Inventory Reports is available at: https://pge-energydatarequest.com/
6. Environmental Protection Agency (EPA). 2024. Frequently Asked Questions about eGRID. Available at: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid-questions-and-answers
7. Redwood Coast Energy Authority (RCEA). 2024. Power Resources, 2022 Power Content Label. Available at: https://redwoodenergy.org/power-resources/

Table 19 shows the VMT activity data for community vehicles per vehicle class as well as the EV share of VMT and EVMT used to determine EV activity data expressed as electricity consumption.

Table 19 Community On-road EV Activity Data Calculations

Vehicle Class	VMT Activity Data [miles]	EV Share [%]	EVMT [miles]	EPM [kWh/mile]	EV Activity Data [kWh]
Passenger	2,188,991,265	2.09%	45,749,917	0.37	16,701,602
Commercial	282,211,337	0.00%	0	0.00	0
Bus	1,028,481	0.51%	5,245	1.75	9,168

Notes: VMT = vehicle miles travelled; EV = electric vehicle; EPM = electricity per mile; EVMT = electric vehicle miles traveled; kWh = kilowatt hour

The activity data, emissions factors, and resulting GHG emissions from on-road transportation quantified in accordance with Equation 3.6 and Equation 3.8 is summarized in Table 20 below. It is important to highlight that the VMT emissions factors provided by EMFAC2021 encompass all

vehicle types, including EV VMT. However, the GHG emissions for EV activity are considered zero in this emissions factor and does not take into account regional electricity grid emissions. Consequently, applying the emission factor to total VMT data does not result in duplication of emissions associated with EVs.

Table 20 Community On-road Transportation GHG Emissions Calculations

Sector	Activity Data[1]		Emission Factor		GHG Emissions [MT CO_2e]
Passenger VMT	2,188,991,265	VMT	0.0003610	MT CO2e/mile	790,226
Commercial VMT	282,211,337	VMT	0.0011290	MT CO2e/mile	318,617
Bus VMT	1,028,481	VMT	0.0014930	MT CO2e/mile	1,536
Passenger EVMT[2]	16,701,602	kWh	0.0000226	MT CO2e/kWh	378
Commercial EVMT[3]	0	kWh	0.0000226	MT CO2e/kWh	0
Bus EVMT[3]	9,168	kWh	0.0000237	MT CO2e/kWh	<1
Total					**1,110,756**

Notes: VMT = vehicle miles traveled; EVMT = electric vehicle miles traveled; kWh = kilowatt hour; MT CO_2e = Metric tons of carbon dioxide equivalent

1. EV activity data does not include kWh associated with T&D losses as these emissions are considered negligible and are included under energy sector emissions.
2. Emissions factor for on-road passenger EV electricity use is weighted according to the portion of electricity supplied per provider in the residential electricity sector (see Table 5)
3. Emissions factor for on-road commercial and bus EV electricity use is weighted according to the portion of electricity supplied per provider in the commercial electricity sector (see Table 5)

Transportation: Off-road

Off-road equipment and vehicles in the community generate GHG emissions from the mobile combustion of fossil fuels. Off-road fuel usage results from equipment operation for sectors such as agricultural, construction, lawn and garden, or recreational equipment. Community Protocol Equation TR.8 was used to quantify GHG emissions from off-road equipment fuel consumption and is shown under Equation 3.9 below. Table 21 lists the parameters, values, and data sources used to quantify emissions in accordance with the Community Protocol.

EQUATION 3.9

TR.8 OFF-ROAD EQUIPMENT SECTOR EMISSIONS

$$CO_2e_{offroad,j} = EF_j \times \sum_i Fuel_{offroad,i,j} \times AF_i \quad (3.9)$$

Table 21 Emissions Parameters and Data Sources – Community Off-Road Equipment

Definition	Parameter	Value	Unit	Data Source
Annual GHG emissions from offroad equipment	$CO_2e_{offroad,j}$	See Table 23	MT CO_2e/year	Calculated
Annual fuel consumption in the jurisdiction per sector per fuel type	$Fuel_{offroad,i,j}$	See Table 23	Gallons/year	OFFROAD2021[1]
Fuel attribution factor per equipment type	AF_i	See Table 22	Percent	–
Emission factor per fuel type	EF_j	See Table 23	MT CO_2e/gallon	EPA Emission Factors Hub[2]
Equipment Type	i	See Table 22	Categorical	OFFROAD2021
Fuel type	j	Gasoline Diesel Natural Gas	Categorical	OFFROAD2021

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent

1. California Air Resource Board (CARB). 2023. Mobile Source Emissions Inventory Off-road (OFFROAD2021). Available at: https://arb.ca.gov/emfac/emissions-inventory/5e0cb7d6006cc10661f4b3ffb9c120a486d46ea6
2. Environmental Protection Agency (EPA). 2022. GHG Emission Factors Hub. Available at: https://www.epa.gov/climateleadership/ghg-emission-factors-hub

The OFFROAD2021 model used to determine off-road sector activity data reports gallons of fuel consumption per off-road vehicle sector on a county-wide basis. However, fuel consumption from certain off-road vehicle sectors may be considered outside of the local governments jurisdictional control and therefore should not be included in the 2022 Humboldt County Regional GHG Inventory. Identification of off-road vehicle sectors over which Humboldt's incorporated and unincorporated jurisdictions have influence is identified in Table 22 below.

Table 22 Community Off-road Equipment Sector Attributions

Equipment Type	Attribution
Agricultural	Complete Regional Control
Airport Ground Support	Complete Regional Control
Cargo Handling Equipment	Excluded – Not Under Jurisdictional Control
Commercial Harbor Craft	Complete Regional Control
Construction and Mining	Complete Regional Control
Industrial	Complete Regional Control
Lawn and Garden	Complete Regional Control
Light Commercial	Complete Regional Control
Locomotive	Excluded – Other[1]
Ocean Going Vessel	Excluded – Not Under Regional Control
Oil Drilling	Excluded – Other[1]
Outboard Marine Tanks	Excluded – Other[1]
Pleasure Craft	Complete Regional Control
Portable Equipment	Complete Regional Control
Transport Refrigeration Unit	Complete Regional Control
Recreational	Complete Regional Control

Equipment Type	Attribution
Military Tactical Support	Excluded – Not Under Regional Control
Forestry	Complete Regional Control

Notes:

1. Outboard marine, oil drilling, and locomotive activities do not occur in Humboldt County according to OFFROAD2021 model

The attributed and aggregated activity data by fuel type, emission factors, and emissions results for the inventory's off-road equipment sector are provided in Table 23.

Table 23 Community Off-road GHG Emissions Calculations

Fuel Type	Activity Data (gallons)	Emission Factor (MT CO_2e/gallon)[1]	GHG Emissions (MT CO_2e)
Diesel	9,101,978	0.0105021	95,590
Gasoline	2,975,135	0.0091151	27,119
Natural Gas	410,588	0.0058821	2,415
TOTAL			**125,124**

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; Values may not add due to rounding

1. Emission factors per fuel type represent a weighted average based on the emissions factor and fuel consumption per offroad equipment type as determined according to EPA's Emissions Factor Hub available at: https://www.epa.gov/climateleadership/ghg-emission-factors-hub

3.2.3 Solid Waste

GHG emissions associated with the waste sector result from the decomposition of waste at a landfill as well as landfill operation processes. Emissions arising from the decomposition of solid waste can occur at both operational and closed landfills within the community as the waste material naturally degrades over time. However, the Community Protocol indicates to exclude closed landfill emissions as the methodology accounts for current and future decomposition emissions resulting from community generated solid waste. Therefore, the closed Cummings Road Landfill[20] within the community's boundaries is excluded from the 2022 Humboldt County Regional GHG Inventory to avoid double counting of emissions in alignment with the Community Protocol.

GHG emissions from community generated waste decomposition were calculated using Community Protocol Method SW.4. Equation 3.10 and Table 24 provide the calculation method, associated parameters, and data sources used to quantify GHG emissions in accordance with Community Protocol SW.4.

EQUATION 3.10

SW.4.1 SOLID WASTE FUGITIVE EMISSIONS

$$CO_2e_{Waste,fugitive} = GWP_{CH_4} \times (1 - CE) \times (1 - OX) \times M \times \sum_i P_i \times EF_i \quad 3.10$$

[20] https://www.hwma.net/cummings-road-landfill

Table 24 Emissions Parameters and Data Sources – Community Solid Waste Fugitive Emissions

Definition	Parameter	Value	Unit	Data Source
Annual community generated waste GHG emissions	$CO_2e_{Waste,fugitive}$	36,353	MT CO_2e/year	Calculated
Methane global warming potential	GWP_{CH_4}	See Table 1		IPCC Fourth Assessment Report[1]
Default LFG collection efficiency	CE	0.75	Fraction	ICLEI Community Protocol
Oxidation rate	OX	0.10	Fraction	ICLEI Community Protocol
Total mass of waste entering landfill	M	107,713	Wet short tons	CalRecycle[2,3]
Proportion of total waste material per material type	P_i	1	Fraction	–
Emission factor per material type[4]	EF_i	0.060	MT CH_4/wet short ton	ICLEI Community Protocol
Material type	i	Multiple	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent

1. Intergovernmental Panel on Climate Change (IPCC). 2007. AR4 Synthesis Report: Climate Change 2007. Available at: https://www.ipcc.ch/assessment-report/ar4/
2. California Department of Resources Recycling and Recovery (CalRecycle). 2022. RDRS Report 1: Overall Jurisdiction Tons for Disposal and Disposal Related Uses. Available at: https://www2.calrecycle.ca.gov/RecyclingDisposalReporting/Reports/OverallJurisdictionTonsForDisposal
3. Data pulled from CalRecycle includes waste ton information for the incorporated cities and unincorporated areas of Humboldt County.
4. For mixed municipal waste streams where the proportion of material type is unknown, ICLEI specifies a default value of 0.060 MT CH_4 per wet short ton may be used.

Landfill process emissions were quantified according to Equation SW.5 of the Community Protocol. Equation 3.11 and Table 25 provide the calculation method, associated parameters, and data sources used to quantify GHG emissions from landfill operations.

EQUATION 3.11

SW.5 SOLID WASTE PROCESS EMISSIONS

$$CO_2e_{Waste,process} = M \times EF_p \qquad 3.11$$

Table 25 Emissions Parameters and Data Sources – Community Solid Waste Process Emissions

Definition	Parameter	Value	Unit	Data Source
Annual landfill process GHG emissions	$CO_2e_{Waste,process}$	1,185	MT CO_2e/year	Calculated
Total mass of solid waste that enters the landfill in the inventory year	M	107,713	Wet short tons/year	CalRecycle[1,2]
Emissions factor for landfill process emissions	EF_p	0.011	MT CO_2e/wet short ton	ICLEI Community Protocol

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent

Definition	Parameter	Value	Unit	Data Source

1. California Department of Resources Recycling and Recovery (CalRecycle). 2022. RDRS Report 1: Overall Jurisdiction Tons for Disposal and Disposal Related Uses. Available at: https://www2.calrecycle.ca.gov/RecyclingDisposalReporting/Reports/OverallJurisdictionTonsForDisposal
2. Data pulled from CalRecycle includes waste ton information for the incorporated cities and unincorporated areas of Humboldt County.

3.2.4 Wastewater

Management of wastewater produces emissions through every stage of the process from collection to final use or discharge. Humboldt is serviced by several wastewater facilities which utilize a variety of processing methods to manage the community's wastewater. Additionally, a large portion of the unincorporated County's wastewater is processed using residential on-site septic tanks. Information regarding the population served by each wastewater facility was used to estimate GHG emissions in alignment with Community Protocol methodologies. Table 26 provides a summary of the wastewater facilities within Humboldt, the populations served by each wastewater facility, and the Community Protocol equations applied to estimate GHG emissions.

Table 26 Wastewater Facility Processes and Population Served

Jurisdiction	Wastewater Treatment Plant (WWTP)	Population Served[1]	Community Protocol EQ's[2]
Arcata	Arcata WWTP	18,555	WW.1.(alt) - stationary combust WW.2.(alt) - stationary combust WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, river)
Blue Lake	City of Blue Lake Public Works Department	1,100	WW.6.(alt) - Lagoon WW.12.(alt) - Effluent (anaerobic, river)
Eureka	Elk River WWTP	44,000	WW.1.(alt) - stationary combust WW.2.(alt) - stationary combust WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, ocean)
Ferndale	City of Ferndale Public Works Department	638	WW.1.(alt) - stationary combust WW.2.(alt) - stationary combust WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, river)
Fortuna	City of Fortuna WWTP	12,500	WW.1.(alt) - stationary combust WW.2.(alt) - stationary combust WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, river)
Rio Dell	City of Rio Dell WWTP	3,300	WW.7 - Process N2O (w/ nit/denit) WW.12.(alt) - Effluent (aerobic, river)
Trinidad	Residential	449	WW.11.(alt) - septic system
Uninc. Humboldt County	Fieldbrook Glendale CSD	1,204	WW.1.(alt) - stationary combust WW.2.(alt) - stationary combust WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, river)

Jurisdiction	Wastewater Treatment Plant (WWTP)	Population Served[1]	Community Protocol EQ's[2]
Uninc. Humboldt County	Humboldt CSD	19,500	WW.1.(alt) - stationary combust WW.2.(alt) - stationary combust WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, river)
Uninc. Humboldt County	Loleta CSD	828	WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, river)
Uninc. Humboldt County	Manila CSD	750	WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, river)
Uninc. Humboldt County	Miranda CSD	360	WW.11.(alt) - septic system
Uninc. Humboldt County	Redway CSD	1,400	WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, river)
Uninc. Humboldt County	RID	800	WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, ocean)
Uninc. Humboldt County	Palmer Creek CSD	320	WW.1.(alt) - stationary combust WW.2.(alt) - stationary combust WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, river)
Uninc. Humboldt County	Scotia CSD	875	WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, river)
Uninc. Humboldt County	McKinleyville CSD	14,000	WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, river)
Uninc. Humboldt County	Garberville CSD	1,400	WW.8 - Process N2O (w/o nit/denit) WW.12.(alt) - Effluent (aerobic, river)
Uninc. Humboldt County	Weott CSD	364	WW.11.(alt) - septic system
Uninc. Humboldt County	Residential[3]	14,238	WW.11.(alt) - septic system

Notes: EQ = equations; Uninc. = unincorporated

1. Population Served = the combined total number of employees and residents in Humboldt County
2. Population served and community protocol equations determined based on WWTP system descriptions provided to the County by each WWTP. The County provided the information via SharePoint between December 21, 2023 and January 29, 2024.
3. The population served by residential on-site septic tanks in the unincorporated county is estimated based on the differential of total population in Humboldt County and the total population served by an identified wastewater treatment process, including septic (e.g. Trinidad). This estimate assumes that the remaining population not included under a verified wastewater treatment process lies within the unincorporated County and is serviced by a septic system.

The set of methods used to quantify stationary combustion emissions is outlined in Equation 3.12 and Table 27 as well as Equation 3.13 and Table 28 below.

EQUATION 3.12

WW.1.(ALT) WASTEWATER DIGESTER GAS STATIONARY COMBUSTION EMISSIONS (CH_4)

$$CO_2e_{WW,Stat,CH4,i} = (P_i \times Digester\ Gas \times f_{CH4} \times BTU_{CH4} \times 10^{-6} \times EF_{CH4} \times 365.25 \times 10^{-3}) \times GWP_{CH4} \quad 3.12$$

Table 27 Emissions Parameters and Data Sources – Community Wastewater Stationary Combustion (CH_4)

Definition	Parameter	Value	Unit	Data Source
Total annual GHG emitted by devices designed to combust digester gas	$CO_2e_{WW,Stat,CH4}$	See Table 35	MT CO_2e/year	Calculated
Population served by WWTP with stationary combustion	P_i	78,598	People	See Table 26
Rate of digester gas volume production	$Digester\ Gas$	1.00	std ft³/person/day	ICLEI Community Protocol
Fraction of methane in digester gas	f_{CH4}	0.65	Fraction	ICLEI Community Protocol
Default higher heating value of methane	BTU_{CH4}	1,028	BTU/ft³	ICLEI Community Protocol
Conversion factor	10^{-6}	0.000001	mmBTU/BTU	ICLEI Community Protocol
Methane emissions factor	EF_{CH4}	0.0032	kg CH_4/mmBTU	ICLEI Community Protocol
Conversion factor	365.25	365.25	Days/year	ICLEI Community Protocol
Conversion factor	10^{-3}	0.001	MT/kg	ICLEI Community Protocol
Global warming potential of methane	GWP_{CH4}	See Table 1	–	IPCC Fourth Assessment Report
Wastewater treatment plant (WWTP)	i	See Table 26	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; std ft³ = standard cubic feet; BTU = British thermal unit; mmBTU = one million British thermal units; kg = kilograms

EQUATION 3.13

WW.2.(ALT) WASTEWATER DIGESTER GAS STATIONARY COMBUSTION EMISSIONS (N_2O)

$$CO_2e_{WW,Stat,N2O,i} = (P_i \times Digester\ Gas \times f_{CH4} \times BTU_{CH4} \times 10^{-6} \times EF_{N2O} \times 365.25 \times 10^{-3}) \times GWP_{N2O} \quad 3.13$$

Table 28 Emissions Parameters and Data Sources – Community Wastewater Stationary Combustion (N_2O)

Definition	Parameter	Value	Unit	Data Source
Total annual GHG emitted by devices designed to combust digester gas	$CO_2e_{WW,Stat,N2O}$	See Table 35	MT CO_2e/year	Calculated
Population served by WWTP with stationary combustion	P_i	78,598	People	See Table 26
Rate of digester gas volume production	$Digester\ Gas$	1.00	std ft³/person/day	ICLEI Community Protocol
Fraction of methane in digester gas	f_{CH4}	0.65	Fraction	ICLEI Community Protocol
Default higher heating value of methane	BTU_{CH4}	1,028	BTU/ft³	ICLEI Community Protocol

Definition	Parameter	Value	Unit	Data Source
Conversion factor	10^{-6}	0.000001	mmBTU/BTU	
Nitrous Oxide emissions factor	EF_{N2O}	0.0006	kg N_2O/mmBTU	ICLEI Community Protocol
Conversion factor	365.25	365.25	Days/year	ICLEI Community Protocol
Conversion factor	10^{-3}	0.001	MT/kg	ICLEI Community Protocol
Global warming potential of nitrous oxide	GWP_{N2O}	See Table 1	–	IPCC Fourth Assessment Report
Wastewater treatment plant (WWTP)	i	See Table 26	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; std ft^3 = standard cubic feet; BTU = British thermal unit; MMBtu = one million British thermal units; kg = kilograms;

Equation 3.14 shows the calculation method use to quantify emissions from wastewater treatment plants which utilize lagoon processing systems in accordance with Community Protocol WW.6.(alt). Table 29 show the parameter definitions, default factors, and data sources used.

EQUATION 3.14

WW.6.(ALT) METHANE EMISSIONS FROM LAGOONS

$$CO_2e_{WW,lagoon,i} = P_i \times F_{ind-com} \times BOD_5\ load \times \left(1 - F_p\right) \times B_0 \times MCF_a \times 365.25 \times 10^{-3} \times GWP_{CH4} \quad (3.14)$$

Table 29 Emissions Parameters and Data Sources – Community Wastewater Lagoons

Definition	Parameter	Value	Unit	Data Source
Total annual GHG emitted by lagoon system	$CO_2e_{WW,lagoon,i}$	See Table 35	MT CO_2e/year	Calculated
Population served by lagoon system	P_i	1,100	People	See Table 26
Factor for insignificant industrial or commercial discharge	$F_{ind-com}$	1.00	–	ICLEI Community Protocol
Amount of BOD_5 treated per day	$BOD_5\ load$	0.09	kg BOD_5/person/day	ICLEI Community Protocol
Fraction of BOD_5 removed in primary treatment	F_p	0.325	–	ICLEI Community Protocol
Maximum CH_4 producing capacity for domestic wastewater	B_0	0.60	kg CH_4/kg BOD_5	ICLEI Community Protocol
CH_4 correction factor for anaerobic systems	MCF_a	0.80	–	ICLEI Community Protocol
Conversion factor	365.25	365.25	Days/year	ICLEI Community Protocol
Conversion factor	10^{-3}	0.001	MT/kg	ICLEI Community Protocol
Global warming potential of CH_4	GWP_{CH4}	See Table 1	–	IPCC Fourth Assessment Report

Definition	Parameter	Value	Unit	Data Source
Wastewater treatment plant (WWTP)	i	See Table 26	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; BOD_5 = five-day biochemical oxygen demand; kg = kilograms;

Equation 3.15 shows the calculation method use to quantify process emissions with nitrification/denitrification in accordance with Community Protocol WW.7. Table 30 show the parameter definitions, default factors, and data sources used.

EQUATION 3.15

WW.7 CENTRALIZED WWTP W/ NITRIFICATION/DENITRIFICATION

$$CO_2e_{WW,nit/denit,i} = P_i \times F_{ind-com} \times EF_{nit/denit} \times 10^{-6} \times GWP_{N2O} \quad 3.15$$

Table 30 Emissions Parameters and Data Sources – Community Wastewater With Nit/Denit

Definition	Parameter	Value	Unit	Data Source
Total annual GHG emitted by WWTP processes	$CO_2e_{WW,nit/denit,i}$	See Table 35	MT CO_2e/year	Calculated
Population served by the wastewater treatment process	P_i	3,300	People	See Table 26
Factor for insignificant industrial or commercial discharge	$F_{ind-com}$	1.00	–	ICLEI Community Protocol
Emissions factor for a WWTP without nitrification or denitrification	$EF_{nit/denit}$	7.00	g N_2O/person/year	ICLEI Community Protocol
Conversion factor	10^{-6}	0.000001	mmBTU/BTU	ICLEI Community Protocol
Global warming potential of nitrous oxide	GWP_{N2O}	See Table 1	–	IPCC Fourth Assessment Report
Wastewater treatment plant (WWTP)	i	See Table 26	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; std ft^3 = standard cubic feet; BTU = British thermal unit; mmBTU = one million British thermal units; kg = kilograms

Equation 3.16 shows the calculation method use to quantify process emissions without nitrification/denitrification in accordance with Community Protocol WW.8. Table 31 show the parameter definitions, default factors, and data sources used.

EQUATION 3.16

WW.8 CENTRALIZED WWTP W/O NITRIFICATION/DENITRIFICATION

$$CO_2e_{WW,w/o\ nit/denit,i} = P_i \times F_{ind-com} \times EF_{w/o\ nit/denit} \times 10^{-6} \times GWP_{N2O} \quad 3.16$$

Table 31 Emissions Parameters and Data Sources – Community Wastewater Without Nit/Denit

Definition	Parameter	Value	Unit	Data Source
Total annual GHG emitted by WWTP processes	$CO_2e_{WW,w/o\ nit/denit,i}$	See Table 35	MT CO_2e/year	Calculated
Population served by the wastewater treatment process	P_i	100,163	People	See Table 26
Factor for insignificant industrial or commercial discharge	$F_{ind-com}$	1.00	–	ICLEI Community Protocol
Emissions factor for a WWTP without nitrification or denitrification	$EF_{w/o\ nit/denit}$	3.20	g N_2O/person/year	ICLEI Community Protocol
Conversion factor	10^{-6}	0.000001	MMBtu/BTU	ICLEI Community Protocol
Global warming potential of nitrous oxide	GWP_{N2O}	See Table 1	–	IPCC Fourth Assessment Report
Wastewater treatment plant (WWTP)	i	See Table 26	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; std ft^3 = standard cubic feet; BTU = British thermal unit; MMBtu = one million British thermal units; kg = kilograms;

Equation 3.17 shows the calculation method use to quantify emissions from septic tanks wastewater processing in accordance with Community Protocol WW.7. Table 32 show the parameter definitions, default factors, and data sources used.

EQUATION 3.17

WW.11.(ALT) FUGITIVE METHANE EMISSIONS FROM SEPTIC SYSTEMS

$$CO_2e_{WW,septic,i} = P_i \times BOD_5\ load \times B_0 \times MCF_s \times 365.25 \times 10^{-3} \times GWP_{CH4} \quad 3.17$$

Table 32 Emissions Parameters and Data Sources – Community Wastewater Septic

Definition	Parameter	Value	Unit	Data Source
Total annual GHG emitted by septic systems	$CO_2e_{WW,septic,i}$	See Table 35	MT CO_2e/year	Calculated
Population served by the septic system	P_i	15,411	People	See Table 26
Amount of BOD_5 treated per day	$BOD_5\ load$	0.09	kg BOD_5/person/day	ICLEI Community Protocol
Maximum CH_4 producing capacity for domestic wastewater	B_0	0.60	kg CH_4/kg BOD_5	ICLEI Community Protocol
CH_4 correction factor for septic tanks	MCF_s	0.22	–	ICLEI Community Protocol
Conversion factor	365.25	365.25	Days/year	ICLEI Community Protocol
Conversion factor	10^{-3}	0.001	MT/kg	ICLEI Community Protocol

Definition	Parameter	Value	Unit	Data Source
Global warming potential of nitrous oxide	GWP_{CH4}	See Table 1	–	IPCC Fourth Assessment Report
Septic type	i	WWTP Residential	Categorical	See Table 26

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; BOD_5 = five-day biochemical oxygen demand ; kg = kilograms; MT = metric ton

Community Protocol Equation WW.12.(alt) was used to quantify GHG emissions associated with treated wastewater effluent discharge into natural water bodies. Equation 3.18 shows the calculation method used to quantify effluent emissions in accordance with the Community Protocol while Table 33 shows the parameter definitions, default factors, and data sources used.

EQUATION 3.18

WW.12.(ALT) NITROUS OXIDE EMISSIONS FROM EFFLUENT DISCHARGE

$$CO_2e_{WW,effluent,i} = P_i \times F_{ind-com} \times (Total\ N\ Load - N\ Uptake_i \times BOD_5\ load) \times EF_{effluent,i} \times \frac{44}{28} \times \left(1 - F_{plant,i}\right) \times 365.25 \times 10^{-3} \times GWP_{N2O} \quad 3.18$$

Table 33 Emissions Parameters and Data Sources – Community Wastewater Effluent

Definition	Parameter	Value	Unit	Data Source
Total annual GHG emitted by WWTP processes	$CO_2e_{WW,effluent,i}$	See Table 34	MT CO_2e/year	Calculated
Population	P_i	See Table 34	People	See Table 26
Factor for industrial or commercial discharge	$F_{ind-com}$	1.00	–	ICLEI Community Protocol
Average total nitrogen per day	$Total\ N\ Load$	0.026	kg N/person/day	ICLEI Community Protocol
Nitrogen uptake for cell growth per system type (aerobic vs anaerobic)	$N\ Uptake_i$	See Table 34	kg N/kg BOD_5	ICLEI Community Protocol
Rate of BOD_5 produced	$BOD5\ load$	0.09	kg BOD_5/person/day	ICLEI Community Protocol
Emissions factor of discharge to water body type (river or ocean)	$EF_{effluent,i}$	See Table 34	kg N_2O-N/kg sewage-N discharged	ICLEI Community Protocol
Molecular weight ratio of N_2O to N_2	$\frac{44}{28}$	1.57	Fraction	ICLEI Community Protocol
Fraction of nitrogen removed from the WWTP per system type (w/ or w/o nit/denit)	$F_{plant,i}$	See Table 34	Fraction	ICLEI Community Protocol
Conversion factor	365.25	365.25	Days/year	ICLEI Community Protocol

Definition	Parameter	Value	Unit	Data Source
Conversion factor	10^{-3}	0.001	MT/kg	ICLEI Community Protocol
Global warming potential of nitrous oxide	GWP_{N2O}	See Table 1	–	IPCC Fourth Assessment Report
Wastewater treatment plant (WWTP)	i	See Table 26	Categorical	–

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; std ft^3 = standard cubic feet; kg = kilograms; BOD_5 = five-day biochemical oxygen demand

The different effluent discharge conditions exhibited within Humboldt and associated Community default factors are listed in Table 34 along with resulting GHG emissions.

Table 34 Wastewater Effluent GHG Emissions

Effluent Conditions	WWTP N_2O Processing	Population Served	Nitrogen Uptake	Discharge	Nitrogen Removal	MT N_2O	MT CO_2e
Aerobic/river	WW.8	72,844	0.0500	0.0050	0.0000	4.4946	1,339
Aerobic/ocean	WW.8	27,319	0.0500	0.0025	0.0000	0.8428	251
Aerobic/river	WW.7	3,300	0.0500	0.0050	0.7000	0.0611	18
Anaerobic/river	WW.6	1,100	0.0050	0.0050	0.0000	0.0807	24
Total							**1,631**

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; values may not sum due to rounding
1. Population served (or service population) is the sum of population and employment

The resulting GHG emissions from the various wastewater treatment processes present within Humboldt is summarized in Table 35 below.

Table 35 Humboldt Wastewater Management GHG Emissions by Process

Process	Equation	Population Served	MT CO_2e
Stationary Combustion	WW.1.(alt)	78,598	1.53
Stationary Combustion	WW.2.(alt)	78,598	3.60
Process N2O Emissions	WW.7	3,300	6.88
Process N2O Emissions	WW.8	100,163	95.52
Effluent Discharge Fugitive N2O	WW.12.(alt)	104,563	1,631.29
Lagoon System	WW.11.(alt)	1,100	292.89
Septic System	WW.6.(alt)	15,411	7,598.97
Total			**9,630.69**

Notes: MT CO_2e = Metric tons of carbon dioxide equivalent; values may not sum due to rounding
1. Population served (or service population) is the sum of population and employment

3.3 2022 Community GHG Emissions Inventory Results

The inventory provides Humboldt with current GHG emissions estimates that follow the Community Protocol and current best practices for GHG accounting. The results of the 2022 Humboldt County

Regional GHG inventory encompassed incorporated and unincorporated regional emissions resulting from community activities in the energy, transportation, solid waste, and wastewater sectors, including residential, commercial, agricultural, and industrial subsectors. Of the total **1,531,167 MT CO_2e** emitted county-wide, on-road transportation contributed the vast majority of emissions (73 percent) followed by building natural gas consumption (13 percent). Off-road equipment contributed 8 percent of total regional emissions, while solid waste, building electricity, and building fuel use contributed a relatively equal 2 percent. At less than 1 percent, wastewater process emissions resulted in the least contribution to the 2022 Humboldt County Regional GHG inventory total emissions. A summary of the 2022 Humboldt County Regional GHG inventory results are shown in Figure 2 and Figure 2 summarized in detail in Table 36.

Figure 1 Updated 2022 Humboldt County Regional GHG Inventory by Sector

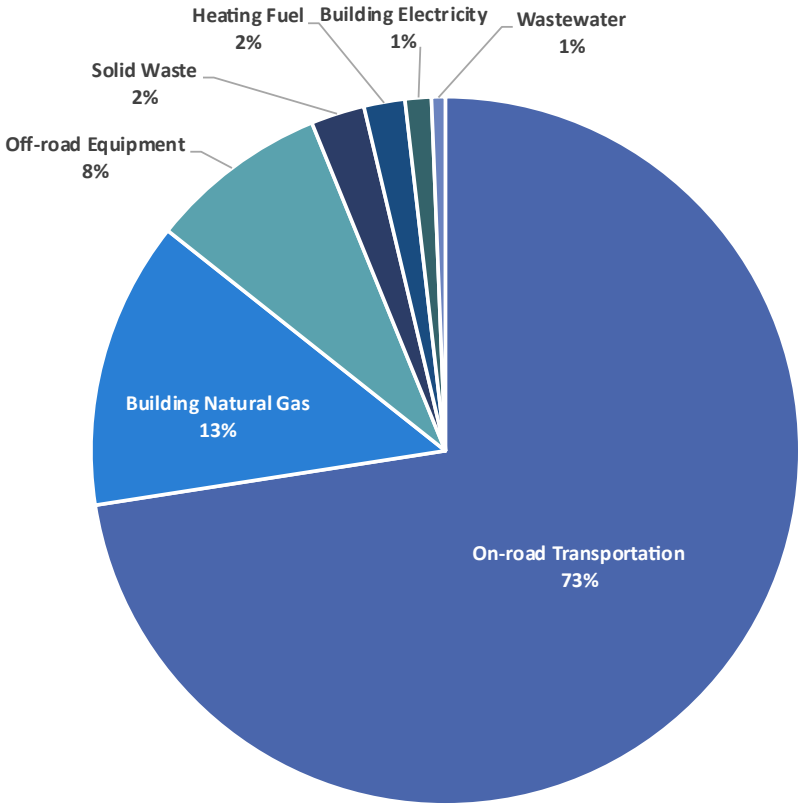

Figure 2 Updated 2022 Humboldt County Regional GHG Inventory by Sub-Sector

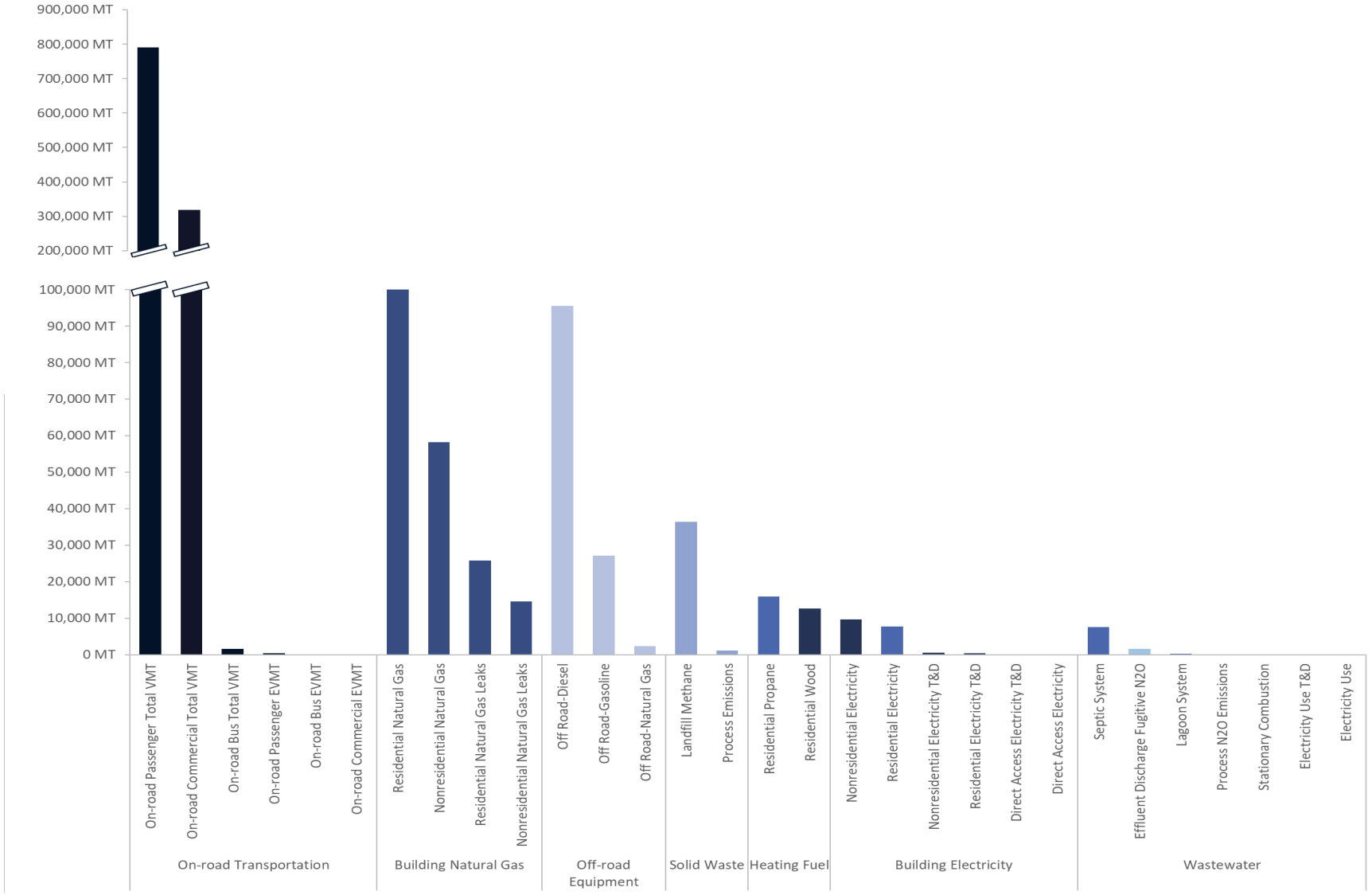

Table 36 2022 Humboldt Community GHG Emissions Inventory

GHG Emissions Sector	GHG Emissions Subsector	Activity Data		Emission Factor		GHG Emissions [MT CO_2e]
Energy	Residential Electricity	338,582,598	kWh	0.0000227	MT CO_2e/kWh	7,669
	Residential Electricity T&D	18,119,494	kWh	0.0000227	MT CO_2e/kWh	410
	Nonresidential Electricity	418,996,532	kWh	0.0000232	MT CO_2e/kWh	9,735
	Nonresidential Electricity T&D	21,369,291	kWh	0.0000232	MT CO_2e/kWh	496
	Residential Natural Gas	19,305,756	therms	0.0053115	MT CO_2e/therm	102,542
	Residential Natural Gas Leaks	543,278	therms	0.0473813	MT CO_2e/therm	25,741
	Nonresidential Natural Gas	10,962,860	therms	0.0053115	MT CO_2e/therm	58,229
	Nonresidential Natural Gas Leaks	308,503	therms	0.0473813	MT CO_2e/therm	14,617
Fuel Use	Residential Propane	4,370	households	3.6512345	MT CO_2e/ household	15,956
	Residential Wood	9,104	households	1.3973035	MT CO_2e/ household	12,721
Transportation	Passenger VMT	2,188,991,265	VMT	0.0003610	MT CO_2e/mile	790,226
	Commercial VMT	282,211,337	VMT	0.0011290	MT CO_2e/mile	318,617
	Bus VMT	1,028,481	VMT	0.0014930	MT CO_2e/mile	1,536
	Passenger EVMT	16,701,602	kWh	0.0000224	MT CO_2e/kWh	378
	Commercial EVMT	0	kWh	0.0000224	MT CO_2e/kWh	0
	Bus EVMT	9,168	kWh	0.0000222	MT CO_2e/kWh	<1
	Off-road Diesel	9,101,978	Gallons	0.0105021	MT CO_2e/gal	95,590
	Off-road Gasoline	2,975,135	Gallons	0.0091151	MT CO_2e/gal	27,119
	Off-road Natural Gas	410,588	Gallons	0.0058821	MT CO_2e/gal	2,415
Solid Waste	Landfill Methane	107,713	Wet short tons	0.3375000	MT CO_2e/ton	36,353
	Process Emissions	107,713	Wet short tons	0.0110000	MT CO_2e/ton	1,185
Water[1]	Local	-	kWh	-	MT CO_2e/kWh	-

GHG Emissions Sector	GHG Emissions Subsector	Activity Data		Emission Factor		GHG Emissions [MT CO_2e]
	Imported	-	kWh	-	MT CO_2e/kWh	-
Wastewater	Stationary Combustion	78,598	people	0.0000653	MT CO_2e/person	5
	Process N_2O Emissions	103,463	people	0.0009897	MT CO_2e/person	102
	Effluent Discharge Fugitive N_2O	104,563	people	0.0156010	MT CO_2e/person	1,631
	Lagoon System	1,100	people	0.2662673	MT CO_2e/kWh	293
	Septic System	15,411	people	0.4930875	MT CO_2e/kWh	7,599
Total						**1,531,167**

Notes: VMT = vehicle miles traveled; EVMT = electric vehicle miles traveled; kWh = kilowatt hour; MT CO_2e = Metric tons of carbon dioxide equivalent; gal = gallons

1. Because all water provided to the community in Humboldt County comes from water providers within county-limits, water sector emission from electricity consumption to extract, treat, convey, and distribute water is included under building electricity sector emissions and therefore not accounted separately to avoid double counting.

4 GHG Emissions Forecast

A GHG emissions inventory sets a reference point for a single year; however, annual GHG emissions change over time due to factors such as population and job growth as well as new technologies and policies. A GHG emissions forecast estimates future GHG emission changes by accounting for projected community growth and changes. Calculating the difference between the GHG emissions forecast and GHG emissions reduction targets determines the gap in GHG emissions that needs to be closed through the implementation of local GHG reduction policies. This section includes an estimate of the future emissions for Humboldt County in the years 2030, 2035, 2040 and 2045 in a *business-as-usual scenario* (BAU) forecast and a *legislative adjusted scenario* (adjusted) forecast, which are defined as follows:

- B*usiness-as-usual scenario*- Provides a forecast of how future GHG emissions would change if consumption trends continued as they did in 2022 and projected changes in population, housing, employment, and transportation activity over time consistent with planned projects within the Humboldt County boundaries. The BAU does not include any GHG reductions associated with local and state regulations.
- *Legislative adjusted scenario*- Provides a forecast of how currently adopted state legislation would reduce GHG emissions from the *business-as-usual scenario*. The *legislative adjusted scenario* represents the State's contribution to reducing local GHG emissions to meet state goals.

Because the adjusted forecast incorporates the impact of State regulations that provide GHG emission reduction potential, the legislative adjusted scenario offers a more accurate picture of future GHG emission growth and the responsibility of Humboldt for GHG reductions through regional actions.

4.1 Business-as-usual Scenario GHG Emissions Forecast

For the BAU forecast, future GHG emissions were calculated by multiplying projected activity data with the baseline emission factors utilized in the 2022 community GHG emissions inventory. Several indicator growth rates were developed from 2022 activity data and applied to demographic projections to project future activity data.

Over the past two decades, U.S. Census data and the Department of Finance has indicated a consistent decline in population, likely attributed to the departure of industrial operations. However, evidence garnered from interviews with local jurisdictions and agencies present a contrasting narrative. Through the implementation of significant development projects such as the Cal Poly student housing expansion[21], Nordic Aquafarms,[22] the Humboldt Offshore Wind Heavy Lift

[21] California State Polytechnic University (Cal Poly). 2023. Final Environmental Impact Report, Student Housing Project. Available at: https://facilitymgmt.humboldt.edu/sites/default/files/web_cal_poly_humboldt_feir_student_housing_project_0.pdf

[22] County of Humboldt, Planning and Building Department. 2022. Final Environmental Impact Report, Samoa Peninsula Land-Based Aquaculture Project. Available at: https://humboldtgov.org/DocumentCenter/View/108020/Nordic-Aquafarms-Final-EIR

Multipurpose Marine Terminal project[23], the Humboldt Offshore Wind Farm projects[24], and the associated electrical transmission projects, it is anticipated that there will be new job opportunities and increased housing that will serve as catalysts for population movement and regional growth. This anticipation of growth is reflected in the Humboldt County Association of Governments (HCAOG) Regional Transportation Plan (RTP) which projects a 1 percent population growth rate in the region in consideration of local project developments, climate trends, and State-wide population movement trends.[25] Additionally, the State has consistently provided mandates for increases in local housing availability, as specified by the State Regional Housing Needs Allocation (RHNA).[26]

Based on the housing increases required by the 5th and 6th RHNA cycles, the most recent available cycles for the region, it becomes apparent that Humboldt needs to elevate housing development efforts to meet the specified State housing needs. To provide a comprehensive, forward-looking projection of demographic trends in the Humboldt community, this report utilized 6th cycle RHNA data to establish a household baseline growth rate in the percent increase of additional households per year. The household growth rate was then applied to U.S. Census 2022 household data to estimate anticipated growth. Projected household estimates were then used to project population and employment growth according to the methodology described in Table 37. This demographic forecast approach aligns with HCAOG estimates of regional growth, serves as a reasonable reflection of current and future conditions within Humboldt's community based on best available data, and recognizes the transformative forces shaping the region in the foreseeable future. A summary of the resulting demographics and projection metrics for each forecast year in the BAU forecast are provided in Table 37.

Table 37 BAU Forecast Demographic and Projection Metrics by Forecast Year

Metric	Data Source	2022	2030	2035	2040	2045
Population	Multiple[1]	136,132	143,556	148,196	152,836	157,476
Employment	Multiple[2]	66,837	70,482	72,760	75,038	77,316
Service Population	Calculated[3]	202,969	214,038	220,956	227,874	234,792
Households	Multiple[4]	54,495	57,467	59,324	61,182	63,039
Off-road gasoline usage (gallons)	CARB OFFROAD2021	2,975,135	3,202,801	3,338,686	3,475,420	3,625,989
Off-road diesel usage (gallons)	CARB OFFROAD2021	9,101,978	9,348,454	9,517,249	9,702,621	9,908,708
Off-road natural gas usage (gallons)	CARB OFFROAD2021	410,588	418,808	425,309	430,298	430,298

[23] Humboldt Bay Harbor, Recreation & Conservation District. 2024. Humboldt Bay Offshore Wind Heavy Lift Marine Terminal Project. Available at: https://humboldtbay.org/humboldt-bay-offshore-wind-heavy-lift-marine-terminal-project-3

[24] Bureau of Ocean Energy Management (BOEM). 2025. Humboldt Wind Energy Area. Available at: https://www.boem.gov/renewable-energy/state-activities/humboldt-wind-energy-area

[25] Humboldt County Association of Governments (HCAOG). 2022. Regional Transportation Plan, VROOM 2022-2042. Available at: https://www.hcaog.net/sites/default/files/vroom_2022-2042_full_report.pdf

[26] California Department of Housing Needs Allocation (RHNA). 2024. Regional Housing Needs Allocation (RHNA). Available at: https://www.hcd.ca.gov/planning-and-community-development/regional-housing-needs-allocation

Notes:

1. Population forecast estimated based on the 2022 proportion of people per household and the forecasted number of households from 2030-2045.
2. Employment forecast estimated based on the 2022 proportion of jobs per person and the forecasted population from 2030-2045.
3. Service population reflects the sum of population and employment in the region.
4. Household forecast estimated based on a 0.68% household growth rate compared to baseline year as determined by Humboldt's 6th cycle RHNA and using U.S. Census 2022 household data as the baseline year. More information regarding Humboldt's 6th cycle RHNA is available at: https://www.hcd.ca.gov/community-development/housing-element/docs/Humboldt_County_Regional_Housing_Need_Determination_and_Plan_for_the_Sixth_Housing_Element_Update_1.pdf

A description of the demographic metrics used to project activity data and associated growth factors for each forecasted GHG emission source in the 2022 community GHG emissions inventory are provided in Table 38.

Table 38 GHG Emission Sources and Growth Factors for BAU Scenario Forecast

GHG Emissions Source	Demographic Projection Metric	Growth Factor	Value	Units
Energy[1]				
Residential Electricity Consumption	Households	Electricity consumption per household	6,213.09	kWh
Non-residential Electricity Consumption	Employment	Electricity consumption per job	6,268.93	kWh
Residential Natural Gas Consumption	Households	Natural gas consumption per household	354.27	therms
Residential Natural Gas Leaks	Households	Natural gas leakage per household	9.97	therms
Non-residential Natural Gas Consumption	Employment	Natural gas consumption per job	164.02	therms
Non-residential Natural Gas Leaks	Employment	Natural gas leakage per job	4.62	therms
Building Fuel Use[2]	–	–	–	–
Transportation				
On-Road Passenger Vehicles	Households	Annual VMT per household	40,168.66	VMT
On-Road Commercial Vehicles	Employment	Annual VMT per job	4,222.38	VMT
On-Road Buses	Service Population	Annual bus service per service population	5.07	VMT
Off-Road Equipment[3]	–	–	–	–
Water & Wastewater[4]				
Wastewater Process and Fugitive Emissions	Service Population	Wastewater process and fugitive emissions per service population	0.05	MT CO2e
Solid Waste				
Solid Waste Disposal	Service Population	Solid waste disposed per service population	0.18	tons

Notes: MT CO2e = Metric tons of carbon dioxide equivalent; kWh = kilowatt-hour; VMT = vehicle miles traveled; N/A = Not Applicable; SP = Service Population – the combined total number of employees and residents in Humboldt County

1. Electricity T&D growth factor is not included as GHG emissions from electricity T&D is calculated based on each forecasted year's total electricity amount.
2. Building fuel use is held constant at 2022 rates of household consumption as a conservative estimation of projected emissions.
3. Fuel consumption for each forecasted year are obtained from the CARB OFFROAD2021 Model, available at: https://arb.ca.gov/emfac/emissions-inventory/5e0cb7d6006cc10661f4b3ffb9c120a486d46ea6%206
4. Electricity emissions associated with water consumption and wastewater processing are captured within the energy sector, as previously described in the Community Inventory section of this technical report and therefore are projected under energy sector forecasted activity data.

Using the above demographic and projection metrics in Table 37, multiplied by the growth factors in Table 38 and the 2022 Humboldt County Regional GHG inventory emission factors, the BAU forecast can be calculated. In the BAU forecast, GHG emissions are expected to increase through 2045 due to anticipated regional growth from regional projects and industry expansion. A summary of the BAU forecast results by GHG emission sector is provided in Table 39.

Table 39 BAU Forecast Results Summary by Emission Sector

GHG Emissions Source	2022	2030	2035	2040	2045
Energy	**248,118**	**260,085**	**267,564**	**275,044**	**282,524**
Residential Electricity + T&D	8,080	8,520	8,796	9,071	9,347
Nonresidential Electricity + T&D	10,231	10,789	11,138	11,487	11,836
Residential Natural Gas	102,542	108,134	111,629	115,125	118,620
Residential Natural Gas Leaks	25,741	27,145	28,022	28,900	29,777
Nonresidential Natural Gas	58,229	61,405	63,389	65,374	67,359
Nonresidential Natural Gas Leaks	14,617	15,414	15,913	16,411	16,909
Building Fuel	28,677	28,677	28,677	28,677	28,677
Transportation	**1,235,880**	**1,301,168**	**1,342,077**	**1,383,159**	**1,424,556**
On-road Passenger Vehicles	790,604	833,720	860,667	887,615	914,562
On-road Commercial Vehicles	318,617	335,992	346,852	357,712	368,572
On-road Buses	1,536	1,619	1,672	1,724	1,777
Off-road Equipment	125,124	129,836	132,885	136,108	139,645
Water and Wastewater	**9,631**	**10,156**	**10,484**	**10,812**	**11,141**
Wastewater Process and Fugitive Emissions	9,631	10,156	10,484	10,812	11,141
Solid Waste	**37,538**	**39,585**	**40,865**	**42,144**	**43,424**
Solid Waste Disposal	37,538	39,585	40,865	42,144	43,424
Total GHG Emissions	**1,531,167**	**1,610,994**	**1,660,990**	**1,711,160**	**1,761,644**

Notes: All values are presented in metric tons of carbon dioxide equivalent (MT CO2e)

4.2 Legislative Adjusted Scenario GHG Emissions Forecast

Several federal and state regulations have been enacted that would reduce Humboldt's GHG emissions below the BAU forecasted levels in 2030, 2035, 2040 and 2045. The impact of these regulations was quantified and incorporated into the adjusted forecast to provide a more realistic depiction of future emissions growth and the GHG emission reduction responsibility of the local governments. The state legislation included in the adjusted forecast reduce GHG emissions associated with transportation, building energy efficiency, and renewable electricity. A brief description of each regulation and the methodology used to calculate associated reductions is provided in the following, as well as a description of why specific legislation was excluded from the analysis.

4.2.1 Legislative Reduction Programs

Additional legislative programs are expected to reduce GHG emissions in specific sectors throughout California, as identified in the 2017 and 2022 Scoping Plan Updates. Many of these programs were incorporated into the forecast analysis and are summarized in the subsections below.

Transportation Legislation

Advanced Clean Cars Programs

Prior to 2012, mobile emissions regulations were implemented on a case-by-case basis for GHG and criteria pollutant emissions separately. In January 2012, CARB approved a new emissions-control program (the Advanced Clean Cars program) combining the control of smog, soot causing pollutants, and GHG emissions into a single coordinated package of requirements for passenger cars and light trucks model years 2017 through 2025. The Advanced Clean Cars program coordinates the goals of the Low Emissions Vehicles, Zero Emissions Vehicles, and Clean Fuels Outlet programs, and is more stringent than the federal Corporate Average Fuel Economy (CAFE) standards. The new standards will reduce California's GHG emissions by 34 percent in 2025 which is modeled under the CARB EMission FACtor (EMFAC) Model and included in the GHG forecast.[27]

Advanced Clean Cars II was approved by CARB in August 2022 and expands the program's roadmap so that by 2035 all new cars and passenger trucks will be ZEV. This regulation effectively binds the State to EO N-79-20. The executive order was passed by the governor in 2020 and requires all new cars and passenger trucks sold in California be ZEV by 2035. While these legislations will lead to an expedited timeline for ZEV adoption in California, modeling data is not yet available in CARB's EMFAC Model, and emissions reductions attributable to the Advanced Clean Cars II program were therefore, excluded from the GHG forecast.

Advanced Clean Trucks was approved by CARB in June 2020 and sets a zero-emission vehicle (ZEV) percent-of-sales requirement on medium- and heavy- duty vehicle manufacturers to promote increased truck ZEV sales from 2024 to 2035. The standard is intended to reduce NO_x pollution and GHG emissions, which are disproportionately high in medium- and heavy-duty vehicle classes compared to passenger vehicles, as well as promote first-wave ZEV truck technology penetration in

[27] California Air and Resource Board (CARB). 2019. Advanced Clean Cars Summary. Available at: https://ww2.arb.ca.gov/sites/default/files/2019-12/acc%20summary-final_ac.pdf

the market.[28] EMFAC models the effect of the Advanced Clean Trucks regulation on ZEV truck penetration and associated GHG emissions and is included in the forecast.

Assembly Bill 1493

Signed into law in 2002, AB 1493 (Pavley Standards) required vehicle manufacturers to reduce GHG emissions from new passenger vehicles and light trucks from 2009 through 2016. Regulations were adopted by CARB in 2004 and took effect in 2009 when the United States Environmental Protection Agency (USEPA) issued a waiver confirming California's right to implement the bill. CARB anticipates that the Pavley I standard will reduce GHG emissions from new California passenger vehicles by about 30 percent in 2016, while simultaneously improving fuel efficiency and reducing motorists' costs.[29]The impacts of the Pavley Standards on ZEV market penetration was incorporated into the EMFAC model starting in 2014 and is included in the forecast assessment.

Innovative Clean Transit

Public transit GHG emissions will be reduced in the future through the Innovative Clean Transit (ICT) regulation, which was adopted in December 2018. It requires all public transit agencies to gradually transition to a 100-percent zero-emission bus fleet by 2040. Under ICT, large transit agencies are expected to adopt Zero-Emission Bus Rollout Plans to establish a roadmap towards zero emission public transit buses.[30] The effects of the ICT regulation on GHG emissions are modeled in EMFAC2021 and is therefore included in the forecast.

Energy Legislation

Title 24

Although it was not originally intended to reduce GHG emissions, California Code of Regulations Title 24, Part 6: California's Energy Efficiency Standards for Residential and Nonresidential Buildings, was adopted in 1978 in response to a legislative mandate to reduce California's energy consumption, which in turn reduces fossil fuel consumption and associated GHG emissions. The standards are updated triennially to allow consideration and possible incorporation of new energy-efficient technologies and methods. Starting in 2020, new residential developments had to include on-site solar generation and near-zero net energy use. For projects implemented after January 1, 2020, the California Energy Commission (CEC) estimates that the 2019 standards will reduce electricity consumption by 53 percent for residential buildings and 30 percent for non-residential buildings, relative to the 2016 standards. The CEC further estimates residential natural gas efficiency increases of 7 percent for residential end uses.[31] No efficiency increases were estimated for commercial natural gas end uses, based on lack of requirements in this sector in the 2019 standards. These percentage savings relate to heating, cooling, lighting, and water heating only and do not

[28] California Air and Resource Board (CARB). 2023. Advanced Clean Trucks. Available at: https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks/about

[29] CARB. Clean Car Standards – Pavley, Assembly Bill 1493. May 2013. Accessed November 14, 2022, at: http://www.arb.ca.gov/cc/ccms/ccms.htm

[30] Innovative Clean Transit. Approved August 13, 2019. Accessed November 14, 2022 at: https://ww2.arb.ca.gov/sites/default/files/2019-10/ictfro-Clean-Final_0.pdf?utm_medium=email&utm_source=govdelivery

[31] California Energy Commission. 2019 Building Energy Efficiency Standards Frequently Asked Questions. January 1, 2020. Accessed November 8, 2022 at: https://www.energy.ca.gov/sites/default/files/2020-03/Title_24_2019_Building_Standards_FAQ_ada.pdf

include other appliances, outdoor lighting not attached to buildings, plug loads, or other energy uses. In December 2022 the CEC published the new Title 24 2022 Building Efficiency Standards.[32]

Due to the complexity of the new code, there is currently no available model establishing projected efficiency increase as a result of the standard. Therefore, the updated 2022 code was not included in the forecast. This provides a conservative estimate of forecasted GHG emission reductions resulting from efficiency increases.

Renewables Portfolio Standard, Senate Bill 100, & Senate Bill 1020

Established in 2002 under SB 1078, enhanced in 2015 by SB 350, and accelerated for the first time in 2018 under SB 100, California's Renewable Portfolio Standard (RPS) is one of the most ambitious renewable energy standards in the country. The RPS program requires investor-owned utilities, publicly owned utilities, electric service providers, and community choice aggregators to increase procurement from eligible renewable energy resources to 50 percent of total procurement by 2026 and 60 percent of total procurement by 2030. The RPS program further requires that by 2045 that 100 percent of total energy procured be a combination of eligible renewable energy resources and zero-carbon resources.

California's RPS was further accelerated in 2022 by SB 1020 which established additional requirements that procurement from eligible renewable energy resources and zero-carbon resources increase to 90 percent of total procurement by 2035 and 95 percent of total procurement by 2040. The requirements of SB 1020 do not affect those previously set forth and are to be considered additional to the existing RPS requirements. The RPS program and SB 1020 were incorporated into the GHG forecast by adjusting the electricity emissions factors for future years, as discussed in Section 4.4.

PG&E as well as RCEA currently provide electricity to Humboldt and are subject to the RPS requirements. Weighted emission factors adjusted for RPS requirements were used to project emissions through 2045. Table 40 provides the estimated electricity emission factors that would result from SB 100.

Table 40 Forecasted RPS and Weighted Electricity Emission Factor

Metric	2022	2030	2035	2040	2045
Renewables Portfolio Standard Percentage (PG&E)	50%	60%	90%	95%	100%
Renewables Portfolio Standard Percentage (RCEA)	51%	60%	90%	95%	100%
Residential Weighted EF (MT CO_2e/kWh)	0.0000227	0.0000183	0.0000046	0.0000023	0.0000000
Nonresidential Weighted EF (MT CO_2e/kWh)	0.0000232	0.0000187	0.0000047	0.0000023	0.0000000

Notes: MT CO2e = Metric tons of carbon dioxide equivalent; kWh = kilowatt-hour; EF = emissions factor

[32] California Energy Commission (CEC). 2023. 2022 Building Energy Efficiency Standards. Available at: https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency

Waste Legislation

Assembly Bill 939 & Assembly Bill 341

In 2011, AB 341 set the target of 75 percent recycling, composting, or source reduction of solid waste by 2020 calling for the California Department of Resources Recycling and Recovery (also known as CalRecycle) to take a statewide approach to decreasing California's reliance on landfills. This target was an update to the former target of 50 percent waste diversion set by AB 939.

As actions under AB 341 are not assigned to specific local jurisdictions, potential future reductions from the bill were conservatively not included in the GHG forecast analysis.

Assembly Bill 1826

In 2014, AB 1826 set regulations in place requiring California businesses to recycle all of their organic waste starting in April 2016. The bill also required jurisdictions across the State to provide organic waste recycling programs to accommodate diverted waste from local businesses. As Humboldt has already implemented an organics collection program, implementation of AB 1826 compliance is reflected in the community's inventory solid waste activity data and is thereby included in the BAU and adjusted forecast.

Senate Bill 1383

SB 1383 established a methane emission reduction target for short-lived climate pollutants in various sectors of the economy, including waste. Specifically, SB 1383 establishes targets to achieve a 50 percent reduction in the level of the statewide disposal of organic waste from the 2014 level by 2020 and a 75 percent reduction by 2025.[33] Additionally, SB 1383 requires a 20 percent reduction in "current"[34] edible food disposal by 2025. Although SB 1383 has been signed into law, compliance with this Senate Bill must occur at the jurisdiction-level rather than the state-level. Due to current limitations in local jurisdiction's ability to comply with organic waste targets set by SB 1383, as well as regional exemptions for some local governments within Humboldt County, anticipated emissions reductions attributable to the bill are conservatively excluded from the forecast. However, estimated impacts associated with SB 1383 will be included in the GHG reduction measures in the CAP.

4.2.2 Legislative Adjusted Scenario Forecast Results

In the adjusted emissions forecast, energy and transportation show a steady decline in GHG emissions, while wastewater, solid waste, are projected to slightly increase. Electricity shows a downward trend approaching zero in 2045 due to stringent RPS requirements from SB 100/1020. This effect is counteracted by natural gas consumption growth which experiences minimal benefits from Title 24 code efficiency cycles. Transportation emissions are expected to decrease in the next 10 to 15 years due to existing fuel efficiency requirements, fleet turnover rates, and increased electric vehicle penetration. As most current regulations expire in 2025 or 2030, emissions

[33] CalRecycle. California's Short-Lived Climate Pollutant Reduction Strategy. https://calrecycle.ca.gov/organics/slcp/

[34] SB 1383 does not specify a baseline year for the 20 percent food recovery target; however, CalRecycle's 2018 statewide waste characterization studies will be used to help measure the baseline for the State to meet its SB 1383 goals. See CalRecycle FAQ accessed November 14, 2022 for more information:https://calrecycle.ca.gov/organics/slcp/faq/foodrecovery/#:~:text=SB%201383%20requires%20the%20state,for%20individual%20jurisdictions%20to%20achieve.

standards will experience diminishing returns while VMT continues to increase, leading to lower rates of emissions reduction in the transportation sector as 2045 is approached. A detailed summary of Humboldt's projected GHG emissions under the adjusted forecast by sector and year through 2045 can be found in Table 41.

Table 41 Legislative Adjusted Scenario Forecast Results

GHG Emissions Source	2022	2030	2035	2040	2045
Energy	**248,118**	**255,592**	**250,748**	**255,384**	**259,934**
Residential Electricity + T&D	8,080	6,726	1,712	870	0
Nonresidential Electricity + T&D	10,231	8,580	2,202	1,129	0
Residential Natural Gas	102,542	107,743	110,993	114,244	117,494
Residential Natural Gas Leaks	25,741	27,047	27,863	28,679	29,495
Nonresidential Natural Gas	58,229	61,405	63,389	65,374	67,359
Nonresidential Natural Gas Leaks	14,617	15,414	15,913	16,411	16,909
Building Fuel	28,677	28,677	28,677	28,677	28,677
Transportation	**1,235,880**	**1,154,265**	**1,106,063**	**1,078,584**	**1,073,445**
On-road Passenger Vehicles	790,604	698,109	665,176	651,449	653,308
On-road Commercial Vehicles	318,617	324,984	306,827	290,094	279,775
On-road Buses	1,536	1,336	1,175	932	717
Off-road Equipment	125,124	129,836	132,885	136,108	139,645
Water and Wastewater	**9,631**	**10,156**	**10,484**	**10,812**	**11,141**
Wastewater Process and Fugitive Emissions	9,631	10,156	10,484	10,812	11,141
Solid Waste	**37,538**	**39,585**	**40,865**	**42,144**	**43,424**
Solid Waste Disposal	37,538	39,585	40,865	42,144	43,424
Total GHG Emissions	**1,531,167**	**1,459,598**	**1,408,160**	**1,386,924**	**1,387,943**

Notes: All values are presented in metric tons of carbon dioxide equivalent (MT CO2e)

4.2.3 Legislative GHG Emission Reduction Contribution

A summary of the reductions from the BAU forecast that can be expected under the adjusted forecast are provided in Table 42.

Table 42 Summary of Legislative GHG Emission Reductions

Metric	2030	2035	2040	2045
California Renewable Portfolio Standards	3,955	17,540	20,999	24,483
Title 24	845	1,440	2,005	2,581
Transportation (Pavley, Innovative Clean Transit, etc.)	146,596	233,850	301,232	346,636
Total	**151,396**	**252,830**	**324,236**	**373,700**

Notes: All values are presented in metric tons of carbon dioxide equivalent (MT CO2e); negative values indicate

5 GHG Emissions Targets

GHG reduction targets are used in climate action planning to establish metrics that guide the community's commitment to achieve GHG emissions reductions and help gauge progress reducing emissions over time. California has established statewide GHG reduction goals for 2030 and 2045, relative to a baseline emissions level. CARB's 2022 Scoping Plan encourages local agencies to take ambitious, coordinated climate action that is consistent with and supportive of the state's climate goals[35]. Thus, local agencies are recommended to establish equivalent reduction targets at the local level by establishing community wide GHG reduction goals for climate action that will help California achieve its 2030 and 2045 goals. CARB has issued several guidance documents concerning the establishment of GHG emission reduction targets for CAPs to comply with California Environmental Quality Act (CEQA) Guidelines § 15183.5(b). Even if a plan is not CEQA-qualified, CARB has long recommended that local targets be a part of the process of developing, monitoring, and updating a CAP.

5.1 1990 Level GHG Emissions Back-cast

Humboldt County does not have a 1990 GHG emissions inventory from which to develop GHG reduction targets consistent with SB 32, however, 1990 GHG emissions can be estimated for the community relative to Humboldt's updated 2022 inventory using a state-level emissions change metric.

As the State 2022 GHG emissions inventory has not yet been published, Humboldt's 1990 GHG emissions have been calculated using the State's 2021 GHG emissions inventory[36] as compared to the State's GHG emissions inventory in 1990 to calculate approximate percent reduction in the Humboldt community between 2022 and 1990. The calculation is developed using the published Statewide emissions results from CARB[37], after removing emissions from sectors not included in Humboldt's inventory (e.g., non-specified, industrial point sources, agricultural land management practices). This approach assumes that Humboldt's community activities and associated GHG emissions have generally tracked with the State's activity trends and associated GHG emissions. However, since 1990, electricity and natural gas consumption and associated GHG emissions in Humboldt have declined at a much more rapid rate than the Statewide trend reflected in the Statewide inventory. This is because Humboldt has experienced a significant decline in industrial operations leading to a significant decrease in electricity and natural gas consumption. Further, RCEA has emerged as the main alternative electricity provider in the region opposed to PG&E, the sole utility provider to the Humboldt region in 1990. Because RCEA has a more renewable and carbon-free energy profile than PG&E, GHG emissions associated with building electricity use in the region have declined to a greater extent than Statewide trends reflect.

[35] California Air Resources Board. 2022. California's Climate Change Scoping Plan, p.268. https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf

[36] The State's 2020 GHG emissions inventory was used as this is the most recently available statewide inventory from CARB. It is assumed that the 1990-2020 Statewide GHG emissions change is similar to the 1990-2021 Statewide GHG emissions change, therefore it can be used to estimate 1990 level GHG emissions for Humboldt based on the 2022 Humboldt County Regional GHG Inventory.

[37] California Air Resources Board. 2023. California GHG Emission Inventory Program. https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf

Since these trends are specific to the Humboldt region and do not track with Statewide trends reflected in the Statewide inventory, electricity and natural gas emissions were also removed from the Statewide emissions to back-cast Humboldt's 1990 emissions associated with the following included inventory sectors: transportation (on and off-road), solid waste, wastewater, and heating fuel. GHG emissions from electricity and natural gas consumption in Humboldt in 1990 was quantified using 1990 county-wide activity data obtained from CEC and PG&E 1990 electricity emissions factor provided in the PG&E Community Report. This approach for developing a 1990 back-cast for Humboldt assumes that Humboldt's community GHG emissions associated with transportation, solid waste, wastewater, and heating fuel consumption have generally tracked with Statewide trends, while taking into consideration the more regionally applicable changes in electricity and natural gas consumption in the county. The 1990 back-cast for Humboldt is shown in Table 43.

Table 43 1990 Back-cast Calculations

GHG Emissions Inventory/Emissions Category	Emissions
2021 Statewide GHG Emissions w/o Building Energy (MMT CO2e)[1]	170.32
1990 Statewide GHG Emissions w/o Building Energy (MMT CO2e)[1]	188.98
2021 to 1990 Statewide GHG Emissions Change (%)	10.96%
2022 Humboldt GHG Emissions w/o Building Energy (MT CO2e)[2]	1,311,726
1990 Humboldt GHG Emissions w/o Building Energy (MT CO2e)[3]	1,455,496
1990 Humboldt Electricity Emissions (MT CO2e)[4]	259,675
1990 Humboldt Natural Gas Emissions (MT CO2e)[4]	354,144
1990 Total Humboldt GHG Emissions (MT CO2e)[5]	2,069,316

Notes:

1. Includes transportation, solid waste, wastewater, and heating fuel emissions.

2. Excludes 2022 building energy emissions associated with electricity and natural gas consumption. As shown in Table 36, in 2022 electricity consumption accounted for X MT CO2e and natural gas consumption accounted for X MT CO2e.

3. Humboldt 1990 GHG emission associated with transportation, solid waste, wastewater, and heating fuel was back-cast from the Statewide GHG emissions inventory by multiplying the percent change that occurred at the Statewide level to the 2022 Humboldt GHG inventory less electricity and natural gas associated emissions. based on the percent change.

4. In 1990, Humboldt consumed a total of 1,007,867,146 kWh of electricity and 53,349,803 therms of natural gas. According to PG&E, the emissions factor in 1990 was 0.000258 MT CO2e/kWh. Emissions were calculated in accordance with methods outlined in Section 3.2.1. More information regarding CEC activity data is available at: https://ecdms.energy.ca.gov/Default.aspx

5. Calculated 1990 electricity and natural gas emissions were added to the "1990 Humboldt GHG Emissions w/o Building Energy" back-cast to determine the total Humboldt 1990 GHG Emissions.

5.2 GHG Emissions Reduction Target Setting

The purpose of target setting is to develop the trajectory toward achieving the State's 2030 goal (SB 32) and prepare for the deep decarbonization needed by 2045 in a cost-effective manner by setting an incremental path toward achieving AB 1279 targets. CARB guidance is for jurisdictions to first strive to exceed the SB 32 targets of reducing GHG emissions 40% below 1990 levels, while establishing a policy framework to achieve the long-term target of carbon neutrality by 2045.

Target setting is an iterative process which must be informed by the reductions that can realistically be achieved through the development of feasible GHG reduction measures. As such, the targets identified herein should remain provisional until the quantification and analysis of potential GHG reduction measures has been completed.

Achieving the established target will require major shifts in how communities within California obtain and use energy, transport themselves and goods, and how the population lives and builds. The CEQA Guidelines section 15183.5(b) requires qualified GHG reduction plans (which allow for CEQA streamlining) to "Establish a level, based on substantial evidence, below which the contribution to greenhouse gas emissions from activities covered by the plan would not be cumulatively considerable".[38] A defensible way (shown through litigation) to identify such levels is to demonstrate consistency with State targets.

To maintain consistency with State targets, Humboldt's provisional GHG emissions reduction targets are:

- Reduce GHG emissions to 40% below 1990 levels by 2030 (SB 32 target year)
- Make substantial progress towards carbon neutrality by 2045 (AB 1279 target year)

With GHG emission reduction targets in place, the reduction gap that Humboldt will be responsible for through local action can be calculated. Humboldt's GHG emissions reduction gap is based on the difference between the adjusted forecast, discussed previously, and the established GHG emission reduction targets. Table 44 provides a summary of the GHG emission reduction targets in mass emissions.

Table 44 GHG Emissions Reduction Targets and Gap Analysis

Emissions Forecast or Pathway	2022	2030	2035	2040	2045
Mass Emissions Target Pathway Scenario (MT CO2e)					
Adjusted Forecast	1,531,167	1,459,598	1,408,160	1,386,924	1,387,943
SB 32 Mass Emissions Target Pathway[1]	1,531,167	1,241,589	827,726	413,863	-
Remaining Emissions Gap	-	218,008	580,434	973,061	1,387,943

Notes: MT CO2e = Metric tons of carbon dioxide equivalent

Emissions have been rounded to the nearest whole number and therefore sums may not match.

1. The target pathway is calculated by reducing 1990 mass emissions by 40% in 2030 and to 0 in 2045. This provisional target pathway is consistent with both SB 32 and a trajectory set forth to achieve AB 1279.

Figure 3 provides a visual representation of future GHG emissions, with the impacts of State legislation and the remaining gap the community will be responsible for to meet the GHG emission reduction targets set by the State.

[38] https://casetext.com/regulation/california-code-of-regulations/title-14-natural-resources/division-6-resources-agency/chapter-3-guidelines-for-implementation-of-the-california-environmental-quality-act/article-12-special-situations/section-151835-tiering-and-streamlining-the-analysis-of-greenhouse-gas-emissions

Figure 3 GHG Emissions Forecast and Provisional Target Pathways (Mass Emissions)