Alameda County

Greenhouse Gas Emissions Analysis

2003 Unincorporated Areas Community Emissions Inventory
&
2003 County Government Operations Emissions Inventory

November 2008

Credits and Acknowledgements

This report was prepared by Alameda County in partnership with ICLEI – Local Governments for Sustainability. The greenhouse gas inventory was a project of the Alameda County Climate Action Team, which is made up of key staff from the General Services Agency, the Community Development Agency, and the Public Works Agency. Extensive information was provided by all agencies in order to complete this analysis.

In addition, other organizations provided data, information, and assistance to make this report possible. These entities have been credited through out the report, but special thanks go to:

- Alameda County Waste Management Authority (Stopwaste.Org)
- Pacific Gas & Electric Company
- Bay Area Air Quality Management District
- Metropolitan Transportation Commission

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Executive Summary

Background

Alameda County has long been a leader in taking action to promote environmental protection and sustainability at the local level. As part of this commitment, the County has implemented many innovative climate protection programs within its own operations and throughout the unincorporated community. In 2006, the County adopted a resolution committing to reduce its greenhouse gas emissions, prepare for the eventual impacts of climate change, and adopt a cross-agency approach for integrating climate change into its decision making process. In 2007 the County adopted the Cool Counties Climate Stabilization Declaration, which included a specific target of reducing emissions 80% by 2050.

This inventory provides policymakers with valuable information for developing a strategic plan to reduce greenhouse gas emissions. It provides an overview of the County's emissions levels and sources, which can be used to prioritize future emissions reduction policies and programs. It also and establishes a baseline against which future trends and the impact of current initiatives can be measured. The inventory is the first of a five-step process for addressing the challenge of climate change. Those steps include:

1) Conduct an **inventory** of local greenhouse gas emissions;
2) Establish greenhouse gas emissions **reduction target(s)**;
3) Develop a **climate action plan** for achieving the emissions reduction target(s);
4) **Implement** the climate action plan; and,
5) **Re-inventory** emissions to monitor and report on progress.

Methodology

The County's goal is to create a policy-relevant inventory of greenhouse gas emissions following internationally accepted standards.[1] The inventory focuses on both greenhouse gas emissions from the government's internal operations and from the communities in the unincorporated areas of the County.[2] Input data (i.e. energy usage, vehicle miles traveled, waste generation, fleet energy use, etc.) were provided by PG&E, StopWaste.org, and various State and County agencies. These data sets were converted to greenhouse gas emissions by applying regionally appropriate emission factors. It is an end-user/tail-pipe inventory of emissions and as such does not account for the additional upstream and downstream emissions associated with the production and transportation of the goods and services consumed within the County.

A baseline year of 2003 was chosen for Alameda County's inventory because accurate data are available and because it is prior to the implementation of a number of large emission reduction projects (e.g. large solar installations, completion of the new LEED gold certified Juvenile Justice Center). Choosing an historic base-year was desirable because it allowed the County to quantify and demonstrate the impact of previously implemented emission reduction activities and to better understand the scope of effort that will be required to achieve the needed emissions reductions.

Within this inventory, the three main greenhouse gas emissions (carbon dioxide, methane, and nitrous oxide) are quantified, aggregated, and reported in terms of metric tons of carbon dioxide equivalents (CO_2e). Carbon dioxide equivalents is a convention used to aggregate and report different greenhouse gases in terms of their impact on the climate (e.g., methane is 21 times more potent than carbon dioxide; therefore 1 ton CH_4 = 21 tons CO_2e).

[1] This inventory was completed before the State of California adopted the Local Government Operations Protocol, but followed the internationally recognized emission inventory framework developed by ICLEI – Local Governments for Sustainability.
[2] As the County government has limited influence on activities with the 14 incorporated cities that fall within the County's boarder, this inventory focused on the unincorporated areas over which County has a direct influence.

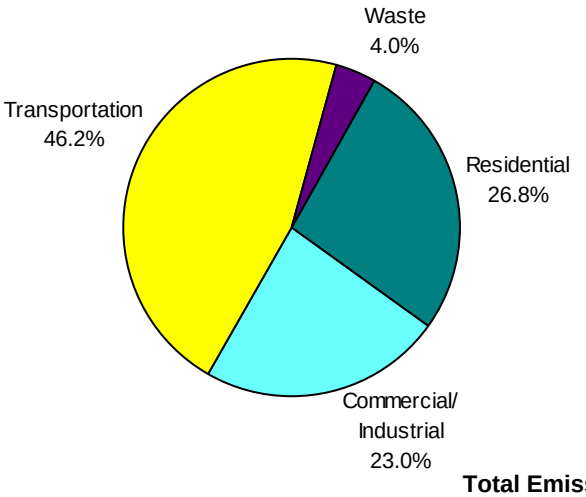
Unincorporated Community - Emissions Results

The unincorporated areas of Alameda County emitted approximately ***736,579 metric tons of CO_2e in the base year 2003*.** On-road transportation accounted for 46% of the emissions from the unincorporated community, with the majority of these emissions from the gasoline burned by passenger vehicles. [3]

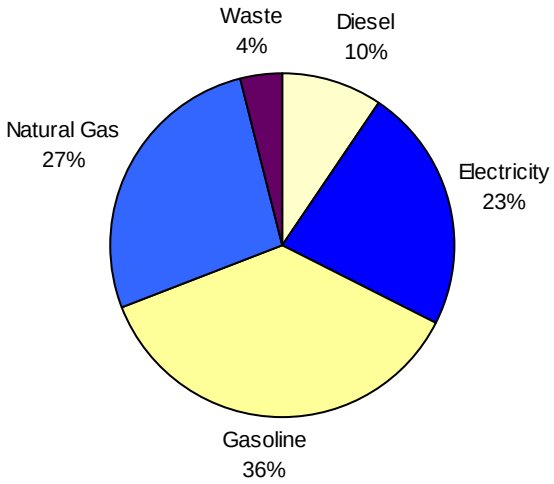
Electricity and natural gas use in the built environment (homes, businesses, factories, etc.) accounted for much of the rest of the unincorporated communities' greenhouse gas emissions. Those emissions were split between residential sources (27%) and commercial/industrial sources (23%).[4] The inventory also showed that natural gas accounted for a larger percentage of the emissions from the built environment than electricity – especially in the residential sector. This suggests that the heating needs of the existing buildings are a potentially significant source of emissions.

Waste materials sent from the unincorporated communities to area landfills generated the remaining emissions (4%). The largest share of the waste sector's emissions occurred as a result of sending paper products to area landfills.

Community Greenhouse Gas (GHG) Emissions by Sector (2003)



Community Greenhouse Gas Emissions by Source (2003)



Total Emissions: 736,579 metric tons CO_2e

Future changes in emissions were estimated based on the anticipated growth in population, employment, and the California Energy Commission's analysis of transportation trends. Without action being taken to reduce emissions levels, greenhouse gas emissions from unincorporated Alameda County are predicted to grow by approximately 21.5% between 2003 and 2050. This would be an increase from 736,579 to 895,285 metric tons CO_2e. The transportation sector was forecast to have the largest annual emissions growth, followed by the commercial/industrial sector. This trend of increasing emissions under a business as usual scenario will need to be accounted for when creating a plan to meet the County's emissions reduction targets

[3] The transportation sector only includes local roads; data on state highways were not included in the analysis.
[4] Due to privacy rules, industrial consumption is not reported independently and has been included with the commercial sector.

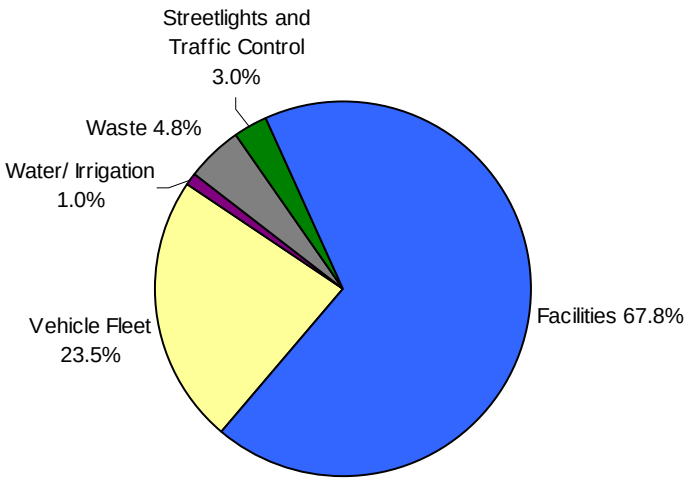
Government Operations - Emissions Results

Alameda County's government operations resulted in the emission of 32,295 *metric tons of CO_2e in 2003*. Of these greenhouse gases, the majority (68%) were released by energy use within the County's facilities (buildings, bridges, etc). Emissions from the County vehicle fleet were the next largest source of emissions (24%). Specifically, passenger vehicles emitted the most greenhouse gasses, followed by light-trucks/SUVs. Landfilled waste from County facilities, County operated street-lights and traffic signals, and County flood control/irrigation controllers each released a small portion of the remaining emissions.[5]

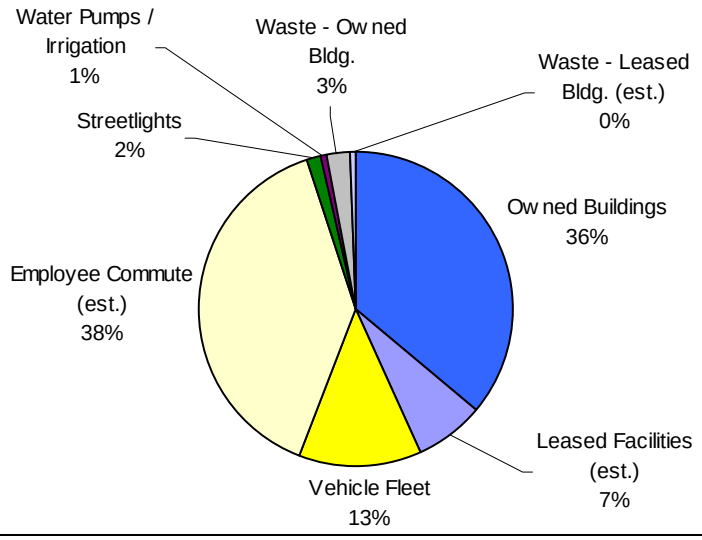
An estimate was also made of other sources of emissions associated with, but not directly released from, government operations. This additional analysis included vehicle emissions from County employee commutes, as well as the energy use and waste generated at facilities the County leases. When included in the inventory, these sectors increase the government operations emissions by a remarkable 87% to 60,546 metric tons CO_2e. It also increases the relative importance of vehicle-related emissions from government activities. In this expanded analysis, vehicle-related emissions (employee commute and fleet vehicles) account for 51.7% of the government's emissions profile, and County facilities remain a significant source (36%). Data were not readily available to estimate emissions from the use of personal vehicles for County business.

Within the government operations, emissions are expected to fluctuate from year to year, but no changes are expected that would result in significant emissions growth. Therefore, a forecast for emissions from government operations was not conducted.

Government Operations GHG Emissions by Sector (2003)



Government Operations Emissions by Sector Including Select Associated Emissions (2003)



Conclusion

Meeting the County's greenhouse gas reduction targets will require a tremendous effort. The County has begun developing a comprehensive Climate Action Plan to take on that challenge. There are two major components to the effort, one related to the unincorporated communities and one related to the County's emissions associated with its operations and service delivery. The County's strategy is to engage both the

[5] As water and sewage treatment and delivery is the responsibility of the East Bay Municipal Utility District, the energy used in pumps and treatment facilities is not included in this inventory.

unincorporated communities as well as its employees in developing the Plan to ensure that a broad set of solutions are brought to the table. This report presents a baseline greenhouse gas emissions inventory that will be used by the County to help focus the effort in identifying specific emission reduction actions and strategies. The inventory will also serve as a baseline that the County will use to measure the effectiveness of those emission activities.

As local government greenhouse gas inventory analysis is a developing field, continuing to develop and refine quantitative tools will be an important component of meeting the County's goals. Though this is an evolving field, the information presented in this report is sufficiently robust to guide policy, identify mitigation strategies, and implement emissions reduction actions. Bold action is required today to meet the significant challenge that we have in front of us. The County will use this information as a tool to meet those challenges.

1. Introduction

1.1. Alameda County and Climate Protection

Alameda County is the region comprising much of the eastern shore of the San Francisco Bay. Its jurisdiction extends eastward from the bay over a range of coastal hills and across the Livermore Valley. The 2005 census estimates the County's population at 1.45 million, making Alameda County the 7th most populous county in the State of California. Its population is clustered in urban centers, but the County also contains tracks of rural and agricultural land. The climate of the region varies from Mediterranean near the bay to hotter and more arid in the inland regions.

As is true everywhere, the inhabitants of Alameda County contribute to the problem of global warming (through energy consumption, waste generation and related activities). However, they also have an immense potential to contribute to the solution through taking concerted action to reduce emissions of greenhouse gases from the County government's operations and from throughout their community as a whole.

California's county governments fill a unique role as both greenhouse gas emitters and practitioners of the solutions to climate change. A majority of the emissions in Alameda County arise from population centers in the unincorporated areas and the 14 incorporated cities throughout the County. While the County government has little direct influence over activities within the incorporated cites in its borders, it does provide a vast array of traditional municipal services to the unincorporated areas (i.e., roads, parks, law enforcement, emergency services, libraries, etc.). In addition, the County serves in the broader capacity of acting as the delivery entity for many State services to the entire County – both the City and unincorporated populations (i.e. foster care, public health, jails, elections, property assessment / tax collection, record keeping / vital statistics, district attorney / public defender, etc.). This dual role of local and regional government greatly influences the size of the County government's operations.

Alameda County has embraced its unique position within the region and has taken a leadership role in promoting environmental sustainability and adopting actions that help to reduce greenhouse gas emissions. Within its own operations, the County government has operated an extensive waste reduction, reuse, and recycling program, is the largest solar power producer of any county government in the United States, and has undertaken a number of initiatives to reduce the use of water, energy, and toxic chemicals. On the community side, the County has worked to enact similar policies in the unincorporated areas under their jurisdictional influence and has worked closely with the cities and various special districts within the County's boundaries to promote a shared vision for a sustainable future.

In early 2006, the Alameda County Board of Supervisors voted unanimously to adopt a resolution establishing the County's climate change leadership strategy. This resolution commits the County to taking steps to reduce its greenhouse gas emissions and prepare for the eventual impacts of climate change. This will be accomplished through a cross-agency approach for meeting the County's targets and for integrating mitigation and adaptation strategies into the County's planning, budgetary, and other processes.

At the same time, the County, together with all the city governments within Alameda County, joined the Alameda County Climate Protection Project. The project was launched by StopWaste.Org in partnership with the Alameda County Conference of Mayors. Through this process, all of the participants agreed to embark on an ongoing, coordinated effort to reduce the emissions that cause global warming, improve air quality, reduce waste, cut energy use and save money.

In 2007, the Alameda County Board of Supervisors voted unanimously to adopt the Cool Counties Climate Stabilization Declaration, which commits the County to an aggressive 80% reduction in greenhouse gas emissions by 2050. This resolution also encouraged the other 57 counties within California to join the Cool Counties campaign and adopt similar emission reduction targets.

Through these actions, the County of Alameda has recognized that:

- Climate change is one of the most critical issues threatening the long-term human and environmental health, social well-being, and economic vitality of the County,
- Rapid and significant reductions of greenhouse gas emissions are needed to prevent higher temperatures and the severe local effects they will bring, and
- Local leadership is critical to addressing this urgent issue.[6]

"Counties have a unique role to play in reducing greenhouse gas emissions and preparing for the impacts of climate change through their regional jurisdiction over policy areas such as air quality, land use planning, transportation, zoning, forest preservation, water conservation, and wastewater and solid waste management."[7] Through promoting energy efficiency in its facilities and vehicle fleet, clean alternative energy sources, sustainable purchasing, waste reduction efforts, and forward thinking land use and transportation planning, Alameda County can achieve multiple benefits, including lower energy bills, improved air quality, and economic development – which lead to a better quality of life throughout the community.

The greenhouse gas emissions analyses presented in this report represent completion of an important initial step in Alameda County's climate protection planning process. That is to quantify recent-year emissions and establish: 1) a baseline, against which to measure future progress, and 2) an understanding of where emissions are coming from to identify the greatest opportunities for emissions reductions. Presented here are estimates of greenhouse gas emissions in 2003 resulting from the unincorporated communities as a whole, and from the County government's operations.

1.2. Climate Change Background

A balance of naturally occurring gases in the atmosphere determines the Earth's climate and temperatures. This is accomplished by a subset of these gases, known as greenhouse gases, which allows solar radiation to reach the planet's surface but trap heat energy from escaping. This phenomenon is known as the greenhouse effect. Modern human activity, most notably the burning of fossil fuels, introduces large amounts of carbon dioxide and other gases into the atmosphere. Collectively, these gases intensify the natural greenhouse effect, causing global average surface temperature to rise, which is in turn expected to affect global climate patterns.

Alameda County communities will likely confront a number of the effects of a changing climate. Rising sea levels and changes in local and regional weather patterns (specifically more frequent and damaging storms) will increase risks of flooding and land slides. Reduced snow packs and increasing temperatures would lead to more frequent summer droughts and an increased fire risk. Warmer temperatures also negatively affect air quality and lead to an expansion in the range of disease causing organisms. All of these potential effects will directly impact the health and quality of life of vulnerable communities served by the County and could disrupt local ecosystems and agricultural activities.

In response to the threat of climate change, communities worldwide are voluntarily reducing greenhouse gas emissions. The United National Framework Convention on Climate Change was drafted in 1992

[6] R-2006-204 Resolution of the Board of Supervisors of the County of Alameda Establishing County Climate Change Leadership Strategy
[7] Cool Counties Climate Stabilization Declaration

committing the 192 signatory countries to reducing atmospheric concentrations of greenhouse gas emissions. The Kyoto Protocol arose from the Convention as an international effort to coordinate mandatory reductions in greenhouse emissions to achieve atmospheric levels of 7% lower than in 1990 by 2012. This Protocol went into effect in February 2005. The United States was one of only three industrialized countries that chose not to sign.

In the face of federal inaction, many communities in the United States have chosen to take responsibility for addressing climate change at the local level. Although one jurisdiction cannot independently resolve the issue of climate change, local governments can make a significant impact through cumulative local action. This is the impetus of the Alameda County Climate Protection Project.

1.3. ICLEI's Five Milestone Process

By adopting a resolution committing the County to locally advancing climate protection, Alameda County has joined an international movement of local governments. More than 1,000 local governments, including over 470 in the United States, have joined ICLEI. In addition to Alameda County, all 14 Alameda municipalities are ICLEI members, part of the more than 120 member California network (approximately 80 members are located in the Bay Area).

The Five Milestone Process developed by ICLEI provides a framework for local communities to identify and reduce greenhouse gas emissions, organized along five milestones:

1) Conduct an **inventory** of local greenhouse gas emissions;
2) Establish a greenhouse gas emissions **reduction target**;
3) Develop a **climate action plan** for achieving the emissions reduction target;
4) **Implement** the climate action plan; and,
5) **Re-inventory** emissions to monitor and report on progress.

This inventory report represents the completion of the first milestone, and provides a foundation for future work to reduce greenhouse gas emissions in Alameda County through providing a basis for future policy development, quantification of emissions reductions, the creation of an emissions forecast, and the establishment of an informed emissions reduction target.

2. Inventory Methodology

2.1. Framework

The County of Alameda systematically tracks its energy, water, and waste related activities within their jurisdiction. ICLEI assisted the County by calculating the relative quantities of greenhouse gases produced by each activity and sector. The greenhouse gas inventory involved performing two assessments:

1) A community-wide assessment of the emissions from the unincorporated areas in the County, and
2) A separate inventory of the emissions arising from the County government's own internal operations and services.

This inventory focuses on the emissions from the unincorporated County as these are the areas in which the County government has the greatest level of influence (i.e. through the planning process, code development, and policy adoption). Although Alameda County is a regional government, its does not have direct influence over the incorporated cities that exist within the County's boundaries. Therefore, this inventory (and subsequent climate action plans) focuses on the unincorporated areas in which the County has a direct influence. Each of the cities within Alameda County has completed their own emissions inventories for their communities and for their government operations.

It should also be noted that the government operations and unincorporated community inventories each represent stand-alone inventories. The results from each inventory should not be added together. This is due to the fact that the County operates facilities throughout the region (both within the unincorporated and incorporated areas). Therefore, the geographic scope of the government operations inventory is not the same as the unincorporated community inventory and combining the results from these two inventories could lead to double counting (or exclusion) of some emission sources.

Additionally, it should be noted that counties provide many regional services in addition to those traditionally provided by city governments. Therefore, the scope of services included in the County government inventory is not directly comparable to other (non-county) local government inventories in the region. In most cases, the higher level of services offered by county governments lead directly to a larger greenhouse gas footprint than the cities within their borders.

This inventory represents an assessment of the major sources of emissions at both the community and County government operations scale conducted in line with internationally accepted practices for greenhouse gas emissions inventories. Given that this inventory was performed before the State adopted the Local Government Operations Protocol (LGOP), the County government operations section of the inventory does not fully conform to with the State of California's LGOP. However, it is assumed that adhering to the standards adopted in the LGOP would not significantly change the results presented in this inventory report and that this inventory represents an appropriate policy-relevant estimate of emissions from the County. A discussion of the LGOP in comparison to the methodology used here is included in Appendix B.

2.2. Calculations

To facilitate community efforts to reduce greenhouse gas emissions, ICLEI developed the Clean Air and Climate Protection (CACP) software package.[8] This software calculates emissions resulting from energy consumption and waste generation. It takes an end-user approach to emissions analysis, which is standard

[8] The CACP software was developed by ICLEI in partnership with the State and Territorial Air Pollution Program Administrators (STAPPA), the Association of Local Air Pollution Control Officials (ALAPCO), and Torrie Smith Associates

in local government greenhouse inventories. This approach incorporates the greenhouse gas emissions generated by the *use and disposal* of products or services by the government or within its borders.[9]

The CACP software aggregates and reports the three main greenhouse gas emissions carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) in terms of equivalent carbon dioxide units, or CO_2e. Converting all emissions to equivalent carbon dioxide units allows for the consideration of different greenhouse gases in comparable terms. For example, methane is twenty-one times more powerful than carbon dioxide on a per weight basis in its capacity to trap heat; so the CACP software converts one metric ton of methane emissions to 21 metric tons of carbon dioxide equivalents.[10]

The CACP software determines the level of CO_2e emissions by applying factors (or coefficients) to various pieces of input data entered into the software. The input data includes the amount of electricity and fuel used, vehicle miles traveled, and tons of waste generated, etc. The coefficients, in turn, vary according to type of fuel used, and source. (For example, a coal fired power plant releases 1.3 tons of CO_2e per megawatt-hour of electricity generated versus 0.7 tons for natural gas turbines and 0 tons for renewable sources such as solar, wind, or hydroelectric power.)

The emissions coefficients and quantification method employed by the CACP software are consistent with national and international inventory standards established by the Intergovernmental Panel on Climate Change (1996 Revised IPCC Guidelines for the Preparation of National Inventories) and the U.S. Voluntary Greenhouse Gas Reporting Guidelines (EIA form1605).

The CACP software is used by over 470 U.S. cities, towns, and counties to quantify their greenhouse gas emissions and develop emission reduction strategies. However, it is worth noting that, although the software provides Alameda County with a sophisticated and useful tool for creating a policy-relevant emissions inventory, calculating emissions from energy use with precision is difficult. The model depends upon numerous assumptions embodied in its emissions coefficients. However, these assumptions are inherent within any emissions analysis and the methodologies employed are generated from internationally recognized computer models and national or State data sources. In addition, the quality of any emissions calculations is limited by the quantity and quality of available input data. As research progresses on the greenhouse gas emissions from various sectors, and as data collection methods and models improve, emissions calculations will continue to become more accurate with time. These methodologies and assumptions are fully described in appendices to this report.

It is important to think of any specific number generated by the model as an approximation, rather than an exact value. It should also be understood by policy makers, staff, and the public that the final emissions levels may change as new data, emissions coefficient sets, and better estimation methods become available. ***Despite these limitations, the results of this analysis are sufficiently robust to accurately inform policy decisions such as directing emission reduction activities or setting emission reduction targets.***

Emissions coefficients for community and government waste, as well as for the government vehicle fleet, were based upon the national standards mentioned above. ICLEI was able to use verified emissions coefficients specific to California for natural gas usage and Pacific Gas and Electric Company (PG&E)

[9] For example, an end-user emissions analysis would include the emissions from burning gasoline in vehicles, generating and delivering the electricity used in buildings, or landfilling paper and other goods. This is in contrast with a lifecycle analysis, which would also include the emissions associated with producing those goods and services. For example, the emissions associated with extracting and refining the oil into gasoline, mining the coal used in the electricity plant, or manufacturing and delivering the products used.

[10] The potency of a given gas in heating the atmosphere is defined as its Global Warming Potential, or GWP. For more information on GWP see: IPCC Fourth Assessment Report, Working Group I, Chapter 2, Section 2.10.

specific coefficients for electricity consumption. ICLEI was also able to use emissions coefficients specific to Alameda County to calculate emissions from the community transportation sector, based upon the nationally-accepted EMissions FACactor (EMFAC) model.

Alameda County receives its electricity and natural gas from PG&E, which provided aggregate electricity and natural gas consumption data by sector to inform the emissions inventory. The 2003 emissions coefficient for electricity and the 2005 natural gas coefficient (used as a proxy for 2003)[11] provided by PG&E are included in the notes in Appendix C. The types of power sources that make up a utility's electricity generation mix have a significant impact on a jurisdiction's greenhouse gas emissions. In general, PG&E obtains more electricity from "carbon free" sources such as hydroelectric plants, nuclear power, and renewable resources than the average U.S. utility company. Therefore, electricity usage within PG&E's service area (including in Alameda County) results in fewer greenhouse gas emissions than in other parts of the country.

2.3. Creating the Inventory

The greenhouse gas emissions inventory consists of two distinct components: one for the unincorporated Alameda County community as a whole – defined as the areas within the geographic borders of the County that do not fall within the boundaries of an incorporated city, and the second for emissions resulting from Alameda County's government operations.

When calculating the unincorporated area's community-scale emissions inventory, all energy consumed within the County's jurisdiction (unincorporated areas) was included, with the exception of fuel used on regional transportation systems (freeways, BART, CalTrain, etc.), by some special district, and at UC Berkeley and Lawrence Berkeley National Laboratory facilities.[12]

When calculating the County government operations emissions inventory, all aspects of the County's operations were included regardless of location. Therefore all stationary emissions sources operated by the County (i.e. facilities, flood control pump stations, etc.) located in incorporated cities were included in the inventory, as was any activity by the County vehicle fleet located outside of the unincorporated areas. Only cases (such as with the courts) where control of an entire operational unit has been transferred from the County's authority since 2003, were not included in this inventory.[13]

The government operations inventory allows the County, which has formally committed to reducing emissions, to track its individual facilities and vehicles and to evaluate the effectiveness of its emissions reduction efforts at a more detailed level. At the same time, the community-scale analysis provides a performance baseline against which we can build policies and demonstrate progress for Alameda County's unincorporated communities.

Creating this emissions inventory required the collection of information from a variety of sources, including the Pacific Gas and Electric Company (PG&E), Stopwaste.org, the Bay Area Air Quality Management District, the Metropolitan Transportation Commission, CalTrans, the California Integrated Waste Management Board, the California Energy Commission, and the Association of Bay Area Governments. A complete account of data sources is available in the description of each sector and in Appendix E.

[11] A 2003 specific natural gas coefficient was not available, but as the emissions associated with this fuel type do not change significantly from year to year, this was not seen as a significant issue.
[12] An explanation for these exclusions is included in the results section of this report and Appendix E
[13] When an operational functions are either in- or out-sourced, it is best practice to adjust previous inventories to reflect this change. This ensures that accurate comparisons are made over time and that entities cannot meet their emission reduction goals by simply outsourcing activities.

Please note: All greenhouse gas emissions numbers reported in this document are in terms of metric tons of CO2e. Metric tons are the international standard for reporting these emissions that is used by the International Panel on Climate Change (IPCC), the U.S. Environmental Protection Agency (EPA), and the State of California. However, these units have not always been used by local governments in the United State (or even in all emissions inventories completed for local governments within Alameda County). Therefore, special note should be made of the units whenever comparing emissions levels between jurisdictions or using the numbers reported here in other contexts[14].

[14] 1U.S. short ton = 0.90718474 metric tons

3. Unincorporated Community Emissions Inventory

This inventory includes sources from the following sectors in the unincorporated areas:

- Residential
- Commercial / Industrial
- Transportation
- Waste

3.1. Emissions by Sector

The unincorporated areas of Alameda County emitted approximately ***736,579 metric tons of CO_2e in the year 2003.***[15] As shown in Figure 1 and Table 1, the transportation sector is the largest emitter (46.2%).[16] Emissions from the residential sector account for approximately one-quarter of all community emissions (26.8%), and the commercial and industrial sectors contributed 23.0% to the unincorporated County's total emissions.[17] The remaining emissions (4.0%) are from waste from residents and businesses of the unincorporated County that was sent to landfills.

By source, consumption of gasoline and natural gas each contributed approximately one-third of the County's emissions in 2005 (figure 2), while consumption of electricity contributed slightly less than one-quarter of total County emissions. Diesel fuel and landfilled waste contributed smaller percentages.

Figure 1 – *Community GHG Emissions by Sector*

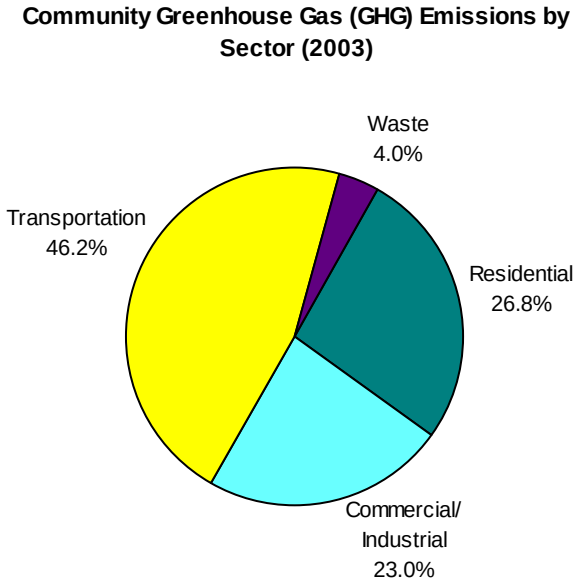
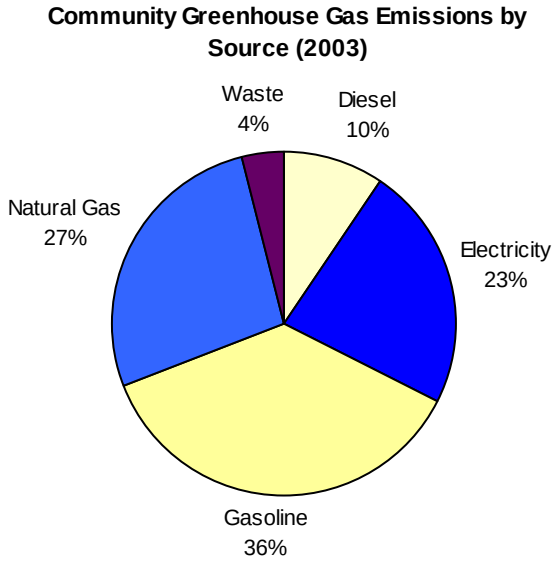


Figure 2 – *Community GHG Emissions by Source*



Total Emissions: 736,579 metric tons CO_2e

[15] There are slight variations in emitted CO_2e totals throughout the report due to different rounding techniques between the CACP software and Microsoft Excel.
[16] State highway data not included. See Transportation Sector for details.
[17] Due to privacy rules, industrial consumption is not able to be reported independently and has been included in the commercial sector.

Table 1 – Community GHG Emissions by Sector

2003 Community Emissions by Sector	Residential	Commercial/ Industrial	Transportation	Waste	TOTAL
CO_2e (metric tons)	197,216	169,578	340,574	29,211	**736,579**
Percent of Total Community CO_2e	26.8%	23.0%	46.2%	4.0%	**100.0%**
Energy Equivalent (MMBtu)	3,173,069	2,570,639	4,596,640	0	**10,340,348**

Note: The individual percentages reported may or may not add to exactly 100% due to rounding.

Transportation

As with other San Francisco Bay area cities, travel by motorized vehicle constitutes the greatest percentage (46.2%) of greenhouse gas emissions in the unincorporated areas of Alameda County. As Table 2 shows, in 2003 vehicles traveling along County roads released approximately 340,574 metric tons CO_2e. This number can be reduced dramatically by making it easier for residents to use alternative modes of transportation, including walking, bicycling, and riding public transportation.

It should be noted that, although unincorporated Alameda County includes nearly 500 miles of State highways, emissions from vehicles on State highways has not been included in this analysis. This is due to the fact that much of the vehicle travel along State highways is "pass-through" traffic, which is the result of land use decisions made outside the jurisdiction of the County government. Additionally, operational decisions about these roadways (i.e. building or expanding) are not made at the county level. Therefore the County is limited in its ability to affect emissions resulting from most State highways in its borders.[18]

Vehicle Miles Traveled (VMT) for both local roads and state highways was obtained from CalTrans, which compiles and publishes statewide VMT data annually through the Highway Performance Monitoring System.[19] County level VMT data was then translated to jurisdiction level data through an analysis of a CalTrans dataset provided by the Metropolitan Transportation Commission (MTC).[20] More detail on emissions factors used in calculating emissions from the transportation sector is contained in Appendix C.

Table 2 – Transportation GHG Emissions by Road Type

Transportation Road Type Emissions Sources	Local Roads	State Highways
CO_2e (metric tons)	340,574	Not Calculated
Total Vehicle Miles Traveled	614,915,500	647,962,600

[18] Due to the limitations of the state highways data analysis, vehicle travel on East 14th St/International Blvd (a state highway that serves significant amounts of local traffic) could not be separated from the rest of the highway data and therefore was not included in the inventory model.

[19] The 2005 report is available at: http://www.dot.ca.gov/hq/tsip/hpms/hpmslibrary/hpmspdf/2005PRD.pdf.

[20] This geographic information system analysis was completed by ICLEI to separate the local roadway miles travel within the unincorporated areas of Alameda County from the larger regional dataset.

The Built Environment (Residential, Commercial, Industrial Sectors)

As figure 1 shows, about half (49.8 %) of total 2003 community wide emissions came from the built environment, which is comprised of the residential, commercial and industrial sectors. Together, these sectors consumed about 603.9 million kilowatt hours (kWh) of electricity and 36.8 million therms of natural gas.[21]

Residential

In 2003, the estimated 140,648[22] residents living in the unincorporated regions of Alameda County's consumed 278.7 million kWh of electricity, or about 5,595 kWh per household[23], and 22.2 million therms of natural gas, or about 446 therms per household. This consumption resulted in a release of 197,216 metric tons of CO_2e. Major residential energy uses include heating/cooling, refrigeration, lighting and water heating.

Commercial/Industrial [24]

In 2003, the unincorporated County's commercial and industrial sector buildings consumed 325.2 million kWh of electricity (7,632 kWh per employee) and 14.6 million therms of natural gas (343 therms per employee).[25] This consumption resulted in a release of 169,578 metric tons of CO_2e into the atmosphere. This figure considers only electricity and natural gas consumption purchased from the utilities. It does not consider the fugitive emissions (emissions that result as a byproduct of industrial processes) or electricity / natural gas / other fuels purchased directly from suppliers instead for through the utility company.[26] These sources were excluded due to lack of available information.

Waste

In 2003, the unincorporated regions of Alameda County sent approximately 95,708 U.S. tons of solid waste and 20,198 U.S. tons of alternative daily cover (ADC) to area landfills.[27] This waste disposal leads to the release of a total of 29,211 metric tons of CO_2e.[28] Table 3 shows the estimated composition of this waste stream, as well as the distribution of greenhouse gases via the types of waste the County disposed.

Emissions from the waste sector are an estimate of methane (CH_4) generation that will result from the anaerobic decomposition of all waste sent to landfill in the base year (2003). It is important to note that although these emissions are attributed to the inventory year in which the waste is generated the emissions themselves will occur over the 100+ year timeframe that the waste will decompose. This frontloading of emissions is the approach taken by the U.S. EPA's Waste Reduction Model (WARM). Attributing all future emissions to the year in which the waste was generated incorporates all emissions from waste disposed during the inventory year into that year's greenhouse gas release. This facilitates comparisons of the impacts of waste disposal between inventory years.

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[21] Energy and fuel usage data from the built environment was provided by PG&E.
[22] Population estimates are from ABAG's *Projections 2005*. See Appendix D.
[23] The estimates of number of household are from ABAG's *Projections 2005*. See Appendix D.
[24] Due to the PUC's 15/15 privacy rules some industrial facilities were aggregated into the commercial sector instead of remaining in the industrial sector. Therefore data from both commercial and industrial facilities are reported together. Data in the industrial sector datasheets (in appendix F) only contain industrial facilities that pass the 15/15 rule test.
[25] The estimates of the number of employees are from ABAG's *Projections 2005*. See Appendix D.
[26] Countywide (incorporated and unincorporated areas) direct access energy consumption comprises approximately 7% of the emissions included in the inventory, this is likely a smaller percent in the unincorporated community (due to the lack of a large industrial base). More specific information is not available on fugitive emissions.
[27] The amount of waste disposed of in landfills is reported by the California Integrated Waste Management Board in terms of short (U.S.) tons, not metric tons.
[28] Alternative Daily Cover is material placed on the landfill at the end of each day to control pest, odors, litter, etc. This can include materials such as green waste and construction and demolition debris that may be reported by a jurisdiction as being diverted from the waste stream (i.e. through a green waste collection program) – but as ADC, it ends up in the landfill to decay anyway. Therefore, it is important to include it in the emissions analysis.

As some types of waste (e.g., paper, plant debris, food scraps, etc.) generate methane within the anaerobic environment of a landfill and others do not (e.g., metal, glass, etc.), it is important to characterize the various components of the waste stream. Alameda County is unique among California counties in that it conducted its own waste characterization study in the year 2000. ICLEI utilized this study to determine the average composition of the waste stream for all Alameda jurisdictions. Communitywide disposal tonnage figures were provided by the California Integrated Waste Management Board (CIWMB) via the "Jurisdiction Disposal and Alternative Daily Cover Tons by Facility" portion of the Disposal Reporting System (DRS).[29] Tons of alternative daily cover by material type provided by the CIWMB via the "Alternative Daily Cover by Jurisdiction of Origin and Material Type" portion of the DRS website.[30]

Most landfills in the Bay Area capture methane emissions either for energy generation or for flaring. The US EPA estimates that nationally 60%-80%[31] of total methane emissions are recovered at the landfills. Following the recommendation of the Alameda County Waste Management Authority, and keeping with general IPCC guidelines to err towards conservative estimations, ICLEI used the 60% methane recovery factor to calculate the waste related emissions from area landfills.

Similarly, ICLEI's calculations excluded any potential carbon sequestration (capturing of greenhouse gases) within the landfill itself.[32] Again, this was on the advice of the local Waste Management Authority in order to develop a conservative estimation of landfill emissions. This decision reflects scientific uncertainty about the relative permanence of landfill sequestration and the amount of methane that is generated while a specific cell within the landfill is still active (i.e. before a methane capture system is installed).

Finally, it should be noted that the effect that recycling and composting programs have on greenhouse gas emissions are incorporated into the inventory as a reduction in the total tonnage of waste sent to area landfills. Although recycling and composting have additional emissions impacts (i.e. the reduction in energy needed for the extraction, transport, and processing of virgin materials), these processes are outside of the scope of this end-user emissions inventory

Table 3 – Community Waste Composition and Emissions by Waste Type[33]

Waste Type	Municipal Solid Waste					Alternative Daily Cover		TOTAL
	Paper Products	Food Waste	Plant Debris	Wood/ Textiles	All Other Waste	Organic Waste	Non organic waste	
CO_2e (metric tons)	14,852	3,363	2,573	6,578	0	1,845	0	**29,211**
Percent of Total Waste Sector CO_2e	50.8%	11.5%	8.8%	22.5%	0.0%	6.3%	0.0%	**100%**
Total Waste Disposal (U.S. tons)	19,142	7,657	10,336	29,957	28,617	7,404	12,794	**115,907**

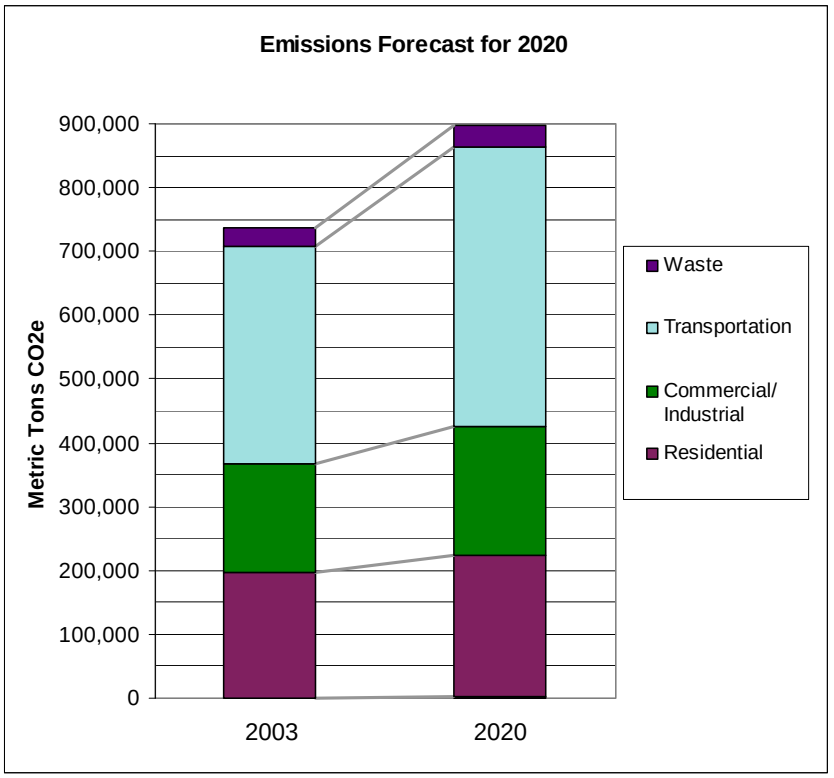
Note: The individual percentages reported may or may not add to exactly 100% due to rounding.

[29] http://www.ciwmb.ca.gov/LGCentral/drs/reports/JurDspFa.asp
[30] http://www.ciwmb.ca.gov/LGCentral/drs/reports/ADC/ADCMatlType.asp
[31] AP 42, section 2.4 Municipal Solid Waste, 2.4-6, http://www.epa.gov/ttn/chief/ap42/index.html
[32] The sequestration coefficients in the WARM model were set to zero for the purposes of this analysis
[33] Waste characterization study conducted by Stopwaste.org for the year 2000.

3.2. Community Emissions Forecast

Under a business-as-usual scenario, emissions from unincorporated Alameda County will grow over the next decade and a half by approximately 21.5%, from 736,579 to 895,285 metric tons CO_2e. To illustrate the potential emissions growth based on projected trends in energy use, driving habits, job growth, and population growth from the baseline year going forward, ICLEI conducted an emissions forecast for the year 2020. Figure 3 and Table 4 show the results of the forecast. A variety of different reports and projections were used to create the emissions forecast.

Figure 3 – *Community Emissions Forecast*



Residential Forecast Methodology

For the residential sector, ICLEI calculated the population growth rate between 2003 and 2020, using population projections from ABAG's *Projections 2005*.[34] This growth rate (0.660%) was used to estimate average annual compound growth in energy demand. ABAG estimates that the Alameda County unincorporated population was 140,648 in 2003, and will be 157,300 in 2020.

Commercial / Industrial Forecast Methodology

Analysis contained within "California Energy Demand 2008-2018: Staff Revised Forecast[35]," a report by the California Energy Commission, shows that commercial floor space and the number of jobs both closely tracked the growth in energy use in the commercial sector. Using job growth projections for unincorporated Alameda County from ABAG's *Projections 2005*, it was calculated that the annual growth in energy use in the commercial sector between 2003 and 2020 will be 1.057%.[36]

Transportation Forecast Methodology

The recently passed federal Corporate Average Fuel Economy standards and the state of California's pending tailpipe emission standards could significantly reduce the demand for transportation fuel in Alameda County. An analysis of potential fuel savings from these measures at a scale that would be useful for the purpose of this report has not been conducted, nor would such an analysis produce a true business-as-usual estimation.[37] Regardless of future changes in the types of vehicles on the road as a result of state or federal rulemaking, emissions from the transportation sector will continue to be largely determined by growth in vehicle-miles-traveled (VMT).[38] In their report, "Transportation Energy

[34] See Appendix D for more detail on ABAG's Projections report. The compound annual growth rate used in the CACP software was calculated by the formula: (2020 population/2003 population)$^{1/17}$-1)
[35] http://www.energy.ca.gov/2007publications/CEC-200-2007-015/CEC-200-2007-015-SF2.PDF
[36] See Appendix D for more detail on ABAG projections.
[37] The business as usual emissions forecast is designed to predict future emissions growth in the absence of any other measures that may be implemented. An analysis of the impact of these measures should be included in a climate action plan that outlines how the jurisdiction will meet its emission reduction targets.
[38] See Urban Land Institute's report: *Growing Cooler: The Evidence on Urban Development and Climate Change*

Forecasts for the 2007 Integrated Energy Policy Report," the CEC projects that on-road VMT will increase at an annual rate of 1.51% per year through 2020.[39] This is the number that was used to estimate emission growth in the unincorporated area's transportation sector for the Alameda County forecast.

Waste Forecast Methodology

As with the residential sector, the primary factor for determining the growth in emission in the waste sector is population. Therefore, the annual population growth rate of 0.660% (as calculated from ABAG population projections), was used to estimate future emissions in the waste sector. [40]

Table 4 – Community Emissions Growth Projections by Sector

2003 Community Emissions Growth Forecast by Sector	2003 CO_2e Emissions (metric tons)	2020 CO_2e Emissions (metric tons)	Annual Growth Rate	Percent Change from 2003 to 2020
Residential	197,216	220,565	0.660%	11.8%
Commercial/ Industrial	169,578	202,758	1.057%	19.6%
Transportation	340,574	439,292	1.509%	29.0%
Waste	29,211	32,669	0.660%	11.8%
TOTAL	**736,579**	**895,285**	--	**21.5%**

[39] Report available at: http://www.energy.ca.gov/2007publications/CEC-600-2007-009/CEC-600-2007-009-SF.PDF. Compounded Annual growth rate for 2005-2020 is calculated from Table 4 on page 12 of the referenced report. In light of recent fuel cost volatility, the calculation assumes high fuel cost scenario.

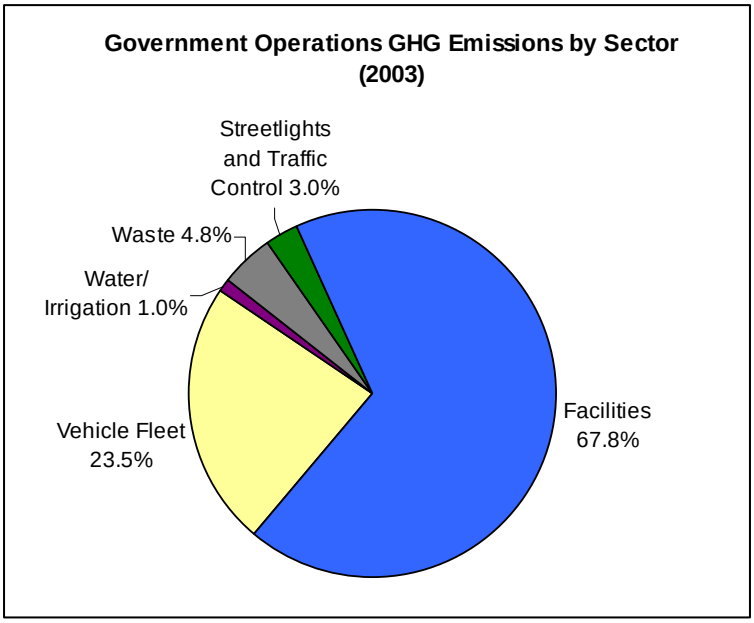
[40] See Appendix D for more detail on ABAG's projections.

4. County Government Operations Emissions Inventory

The emissions sources quantified in the Government Inventory include facilities and equipment directly owned and operated by the County government. Estimates were also made of the emissions that result from activities associated with County operations that fall outside the formal inventory boundaries (i.e. leased facilities, employee commute, etc.). These results have been included in Appendix A. The Government Operations Inventory includes sources from the following sectors:

- Facilities
- Vehicle Fleet
- Streetlights and Traffic Control
- Water Pumping and Irrigation
- Solid Waste

Figure 4 – Government GHG Emissions by Sector



4.1. Emissions by Sector

The Alameda County government's operations emitted *32,295 metric tons of CO_2e in the year 2003*.[41]

As shown in Table 5 and Figure 4, County facilities are the largest emitter (67.8%) of greenhouse gases. Emissions from the County vehicle fleet make up one-quarter of the emissions from government operations (23.5%), with waste from government facilities generating 4.8% of emissions. The remainder of the government's greenhouse gas emissions is from public lighting (3.0%) and electricity for pumping water and irrigation control (1.0%).

Table 5 – Alameda County Government GHG Emissions by Sector in 2003

Government Emissions 2003	Facilities	Vehicle Fleet	Streetlights and Traffic Control	Water/ Irrigation	Waste	TOTAL
CO2e (metric tons)	21,905	7,574	959	318	1,539	**32,295**
Percent of Total CO2e	67.8%	23.5%	3.0%	1.0%	4.8%	**100.0%**
MMBtu	325,881	97,331	11,642	5,251	-	**440,105**

Note: The individual percentages reported may or may not add to exactly 100% due to rounding.

Facilities

In 2003, Alameda County buildings, bridges, and other facilities consumed about 45.4 million kWh of electricity and 1.7 million therms of natural gas, which resulted in a release of 21,905 metric tons of CO_2e emissions into the atmosphere. Energy consumption for facilities was provided to ICLEI by PG&E and Alameda County General Services Agency's (GSA) Energy Program.

[41] When emissions from County employee commute trips and the energy use / waste generation from leased facilities are added to the operational emissions reported here, the greenhouse gas emissions from government operations increases 87% from 32,296 metric tones of CO_2e to 60,546 metric tones. These sectors were not included in the main inventory as they are a sampling of the potential indirect emissions that could be analyzed and are only generalized estimates of the emissions released. Additional information is available in Appendix A.

County Vehicle Fleet

As is shown in Figure 4, the fleet of County-owned vehicles accounted for 23.5% of government emissions, the second largest source (following County facilities) of government emissions in 2003.

The County owned approximately 1,119 vehicles in 2003. The County's vehicle fleet consumed 614,251 gallons of gas, 165,382 gallons of diesel, and 5,399 gallons of natural gas, which resulted in the emission of approximately 7,574 metric tons of CO_2e. Figure 5 and Table 7 breakdown fuel usage and greenhouse gas emissions by general vehicle type. The greatest fuel usage and fleet emissions come from the passenger vehicles (sedans), followed by light trucks (including SUVs, pick-ups, etc.). Together, these emitted more than three-quarters of the total emissions from the County fleet.

Figure 5 – *Emissions from County Fleet Vehicles*

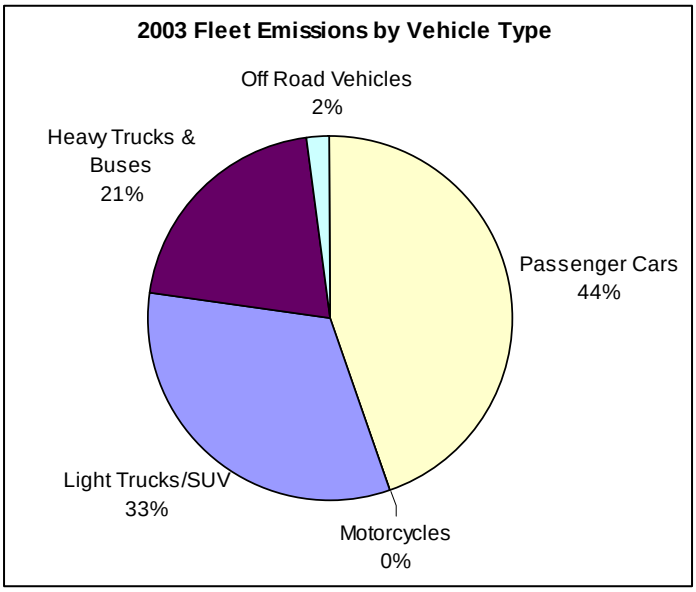


Table 7 – 2003 County Vehicle Fleet Emissions and Fuel Consumption

Department or Vehicle Type*	CO_2e (metric tons)	Percent of Total Fleet CO_2e emissions	Gasoline Consumption (gal)	Diesel Consumption (gal)	Natural Gas Consumption (gal)
Passenger Cars	3,379	45%	346,526		2,123
Light Truck / SUV	2,473	33%	243,637	10,442	2,639
Heavy Trucks and Buses	1,574	21%	23,489	140,112	
Motorcycles	2	0%	233		
Off Road	146	2%	367	14,827	637
TOTAL	**7,574**	**100%**	**614,252**	**165,381**	**5,399**

Note: The individual percentages reported may or may not add to exactly 100% due to rounding.

Streetlights and Traffic Control

The category of public lighting includes all County controlled traffic signals, sidewalk & outdoor parking lighting, and "speed control" accounts.[42] In 2003, public lighting consumed 3.4 million kWh of electricity and accounted for 960 metric tons of CO_2e emissions into the atmosphere. Energy consumption for all lighting operated by the County was provided to ICLEI by PG&E and Alameda County's GSA Energy Program. Table 8 breaks down energy use and emissions from public lighting by type. Over all categories of energy, across all sectors of County operation, public lighting generated about 3.0% of emissions (Figure 4).

[42] Two such accounts were moved to the facilities sector as they actually represented electricity usage for bridge operations.

Table 8 – 2003 Public Lighting Emissions and Energy Use

Lighting Type	CO_2e (metric tons)	Electricity Consumption (kWh)	Energy Equivalent (MMBtu)
Traffic Signals/Controllers	73	260,277	888
Streetlights	886	3,149,034	10,748
Speed Control	1	1,830	6
TOTAL	**960**	**3,411,141**	**11,642**

Water Pumps and Irrigation

Water infrastructure in Alameda County is comprised of flood control pumps and irrigation equipment.[43] In 2003, these systems consumed about 996,369 kWh of electricity, 6,990 therms of natural gas and 9,437 gallons of diesel. Energy consumption for all water delivery devices operated by the County was provided to ICLEI by PG&E and Alameda County's GSA Energy Program and Public Works Agency. This consumption resulted in a release of 317 metric tons of CO_2e emissions into the atmosphere. Table 9 breaks down energy use and emissions from water pumps and irrigation by type. These water-related facilities accounted for approximately 1.0% of total County government emissions.

Table 9 – 2003 Alameda County Operated Water Pumps and Irrigation Emissions and Energy Use

Technology Type	CO_2e (metric tons)	Energy Consumption			Energy Equivalent (MMBtu)
		Electricity (kWh)	Diesel (gal)	Nat. Gas (therms)	
Water pumps*	314	984,070	9,437	6,990	5,209
Irrigation / Sprinkler Systems	3	12,299			42
TOTAL	**317**	**996,369**	**9,437**	**6,990**	**5,251**

Solid Waste

In 2003, County-owned facilities and infrastructure sent approximately 3,424 U.S. tons of solid waste to area landfills. As this waste decomposes it will result in 1,539 metric tons of CO_2e being released from those landfills – or an estimated 4.8% (Figure 4) of the total government emissions. The amount of waste generated from the County government operations, as well as the characterization of government waste by waste type, were based upon a waste sort for County facilities performed by the General Services Agency in 2004.

As in the community analysis, the greenhouse gas emissions from the solid waste sector are an estimate of the total methane that will be eventually be released from the decomposition of waste generated in 2003 over multi-year period it takes that waste to decay in the landfill. Similarly, the final emissions numbers took into account the 60% landfill methane recovery factor that was discussed in the community waste section.

Energy-Related Costs

In addition to generating estimates on emissions per sector, ICLEI compiled the basic energy costs of various County government operations. According to data from PG&E and Alameda County's GSA Energy Program, during 2003 the government spent approximately $10.2 million on energy (electricity, natural gas, diesel, and gasoline) for its buildings, public lighting and vehicles. The large majority of County energy-related expenses ($7.5 million) were for powering and heating County facilities, with the

[43] The distribution of potable water and sewage removal/treatment is provided by the East Bay Municipal Utility District, a fully independent agency. Therefore emissions associated with these services falls outside of the scope of this inventory.

County's vehicle fleet costing $1.3 million in fuel expenses, and managing waste from County facilities costing approximately $680,000.

4.2. County Government Operations Emissions Forecast

While the community emissions growth forecast is based upon known per capita energy consumption, workforce expansion, and population growth projections, the forecast of growth within County government's operations is based upon the expansion of County services or infrastructure. As there are no current plans to significantly expand County infrastructure or the services provided, *it is assumed that there will be no major increase or decrease in annual emissions from government operations.* Although emissions will fluctuate from year to year, no significant changes are expected that can be used to model emissions growth, therefore emissions from the County governments operations are assumed to remain constant for the purposes of this modeling exercise.

5. Conclusion

Through its actions and policies, Alameda County has demonstrated a commitment to reducing its greenhouse gas emissions. This report lays the groundwork for continuing these efforts in a coordinated fashion. Developing these baseline emission levels will help to guide future emission reduction programs and provide a standard against which progress can be measured.

This analysis found that unincorporated communities in Alameda County were responsible for emitting 736,579 *metric tons of CO_2e in the base year 2003*. The transportation sector contributed the largest percent (46.2%) of these emissions – and the largest segment of the transportation emissions was generated by gasoline powered passenger vehicles. It was also interesting to note the significance of residential emissions, especially natural gas usage. This points to the need to look at the heating efficiency of the existing housing stock when considering emissions reduction programs.

Alameda County's own government operations were responsible for *32,295 metric tons of CO_2e in the year 2003*, with the greatest percentage of emissions coming from County facilities (67.8%) followed by the County vehicle fleet (23.5%). An additional analysis of other (less direct) emissions sources related to the government's operations has been included in Appendix A. Inclusion of these sectors greatly increases the government operations emissions and point to vehicle related emissions (fleets and employee commutes) as the largest emissions source (51%) from operations. These emission sources should be more fully analyzed and better incorporated into future inventories or climate plans created by the County.

Although greenhouse gas emissions from the County government's internal operations are relatively small relative to the overall community emissions, it is important for government to take steps to reduce its own emissions. County government, as an entity, is a relatively large single source of emissions; therefore, there is a significant opportunity to take meaningful action on climate protection. These actions and emissions reduction programs can also demonstrate feasibility and be a model for other entities (i.e., businesses, industry, residents). Reducing emissions also provides the government with an opportunity to reduce costs and provide services to its citizens as efficiently as possible.

Following the 5-milestone methodology (recommended by ICLEI and adopted by the Board of Supervisors), the next step for Alameda County is to use the information in this inventory to create a Climate Action Plan that outlines how the County will meet its emissions reduction target. To be successful in guiding the County's future greenhouse gas emissions reduction efforts, such a plan should:

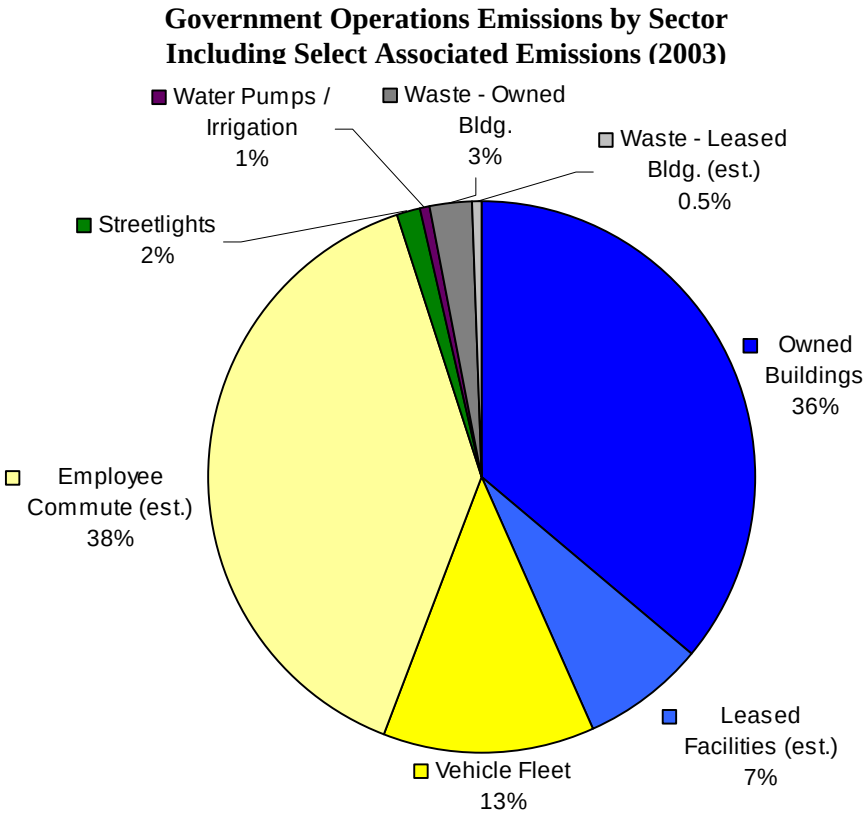
- Build on the results from this emissions inventory to target action from the largest emitters,
- Take steps to quantify the impacts of projects that have been implemented since 2003,
- Identify specific performance measures that can be tracked overtime,
- Recommend a timeline for periodic follow-up inventories of all major emissions sources.

It is only through such a performance based approach that the County can verify that the actions it undertakes will lead to the desired outcome of reducing greenhouse gases.

6. Appendices

Appendix A: Additional Analysis of Emissions Associated with Government Operations

This inventory report contains a relatively complete analysis of the major sources of emissions that Alameda County directly controls (government operations) and directly influences through its policies (unincorporated community). However, County staff felt that it was important to expand this analysis to include other emissions sources that are associated with its actions and operations. This additional analysis includes the results from the original emissions inventory along with estimates of energy and waste related emissions from leased facilities and employee commutes. Data was not readily available to estimate emissions from the use of personal vehicles for County business.



As shown in the chart to the right (and table below), the addition of these associated emissions alter the results of the greenhouse gas inventory. Their inclusion both significantly increases the emissions attributable to the government operations and changes the relative importance of the individual sectors.

The inclusion of these three additional sectors increases the total government operations emissions by 87% from 32,296 metric tonnes of CO_2e to 60,546 metric tonnes. Additionally, vehicle-related emissions greatly increase as a percentage of the total emissions from government operations. Employee commute and fleet vehicle use together account for 51.7% of the government's emissions, whereas fleet emissions alone accounted for only 23% of the County's direct emissions. If employee use of personal vehicles for County business is estimated, this number will increase this percentage further. Similarly, energy-related facility emissions (leased and owned) fell to 43.2% of the government's total emissions, from 67.8% in the original emissions analysis. The emissions from the other sectors are relatively small compared to the vehicle and facility related emissions, therefore they did not change as significantly under this expanded emissions analysis.

	Owned Buildings	*Leased Facilities (est.)*	Vehicle Fleet	*Employee Commute (est.)*	Streetlights	Water Pumps / Irrigation	Waste - Owned Bldg.	*Waste - Leased Bldg. (est.)*	Total
Equiv CO2e (metric tons)	21,905	*4,261*	7,574	*23,712*	959	318	1,539	*1,539*	60,546
% of Total CO2e	36.2%	*7.0%*	12.5%	*39.2%*	1.6%	0.5%	2.5%	*2.5%*	100%

Note: The individual percentages reported may or may not add to exactly 100% due to rounding.

It should be noted that the greenhouse gas emissions from these additional sectors are only broad estimates. They have been included here to provide a clearer picture of the scope of the emissions from the County government's operations to help inform program development and policy decisions. They should not be considered to be the exact level of greenhouse gases being released. However, the relative percentage of the total government emissions should be fairly consistent with the actual conditions, and are consistent with the results of emissions inventories from other communities within the Bay Area. Therefore, these estimates are useful in informing policy discussions. A more detailed discussion of these calculations is included in Appendix E.

Future versions of the Alameda County Inventory should attempt to better assess the emissions from these sources, and there is also an interest in expanding the inventory further to include additional emissions sources. In particular, County staff is interested in gathering more information about the lifecycle emissions of the goods and services that the County uses to better inform policy choices. Such a lifecycle analysis would not only significantly increase the County's emissions profile; it would also identify many additional up- and down-stream opportunities for emissions reductions.

Appendix B: Comparison to the Local Government Operations Protocol

In the spring/summer of 2008, a Local Government Operations Protocol (LGOP) was developed by the California Air Resources Board, in collaboration with ICLEI, the California Climate Action Registry, and The Climate Registry. The LGOP was developed as a formally recognized standard methodology for completing inventories of emissions from city/county government's internal operations.[44]

The LGOP was informed by ICLEI's standard inventory guidance, which was used in the Alameda County inventory process. Therefore, this inventory was completed utilizing similar standards as those embodied in the LGOP. ICLEI staff estimates that had this inventory been conducted according to the LGOP, the differences in reported emissions would amount to less than 5% of the total emissions. Key differences between the LGOP and methodology used in this inventory include:

- Energy use would have to be included for leased facilities in which the County is a tenant – an estimate of these emissions has been completed
- Waste generated from the County's own operations would be attributed to the landfill operator and only be included as an optional informational item not added to the government's emissions total
- Emissions from fire suppression and HVAC equipment and fleet vehicle air conditioning systems would have to be quantified.
- Emissions from other generators and other "mobile" sources (i.e. landscaping and construction equipment lifts, etc.) would need to be included either as individually tracked records or in aggregate.

A similar Community Protocol will be developed in 2009.

[44] More information is available on the LGOP and the upcoming Community Operations protocol is available at http://www.arb.ca.gov/cc/protocols/localgov/localgov.htm

Appendix C: Emissions Factors Used in the Alameda County Climate Protection Partnership

PG&E Emission Factors:

Emission Source	GHG	Emission Factor	Emission Factor Source
PG&E Electricity	CO_2e	• 0.492859 lbs/kwh for 2005, and • 0.6246947 lbs/kWh for 2003	PG&E-this factor includes release of CO_2, CH_4 and N_2O
Natural Gas	CO_2	53.05 kg/MMBtu	PG&E/CCAR. Emission factors are derived from: California Energy Commission, Inventory of California Greenhouse Gas Emissions and Sinks: 1990-1999 (November 2002); and Energy Information Administration, Emissions of Greenhouse Gases in the United States 2000 (2001), Table B1, page 140.
	CH_4	0.0059 kg/MMBtu	CCAR. Emission factors are derived from: U.S. EPA, "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2000" (2002), Table C-2, page C-2. U.S. EPA obtained original emission factors from the Intergovernmental Panel on Climate Change, Revised IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual (1996), Tables 1-15 through 1-19, pages 1.53-1.57.
	N_20	0.001 kg/MMBtu	

Alameda County Transportation Sector Emission Factors:

CH_4 Rates (grams/mile)		N_2O Rates (grams/mile)		VMT Mix		CO_2 Rates- (grams/gallon)		Fuel Efficiency (miles/gallon)	
Gas	Diesel	Gas	Diesel	Gas (Passenger Vehicles)	Diesel (Heavy Trucks)	Gas	Diesel	Gas	Diesel
0.062	0.042	0.070	0.050	92.8%	7.2%	8,599	10,092	19.1	6.4

Provided by the Bay Area Air Quality Management District – Based upon the California Air Resources Board's EMFAC Model. Coefficients are specific to Alameda County jurisdictions.

Alameda County Waste Sector Emission Factors:

Waste Type	Methane Emissions (tonne CH_4 / tonne of waste disposed)	Sequestration (tonne CO_2e / tonne of waste disposed)[45]
Paper Products	2.138262868	0
Food Waste	1.210337473	0
Plant Debris	0.685857901	0
Wood/Textiles	0.605168736	0
All Other Waste	0	0

Methane recovery factor of 60% derived from the U.S. EPA AP 42 Emissions Factors report (http://www.epa.gov/ttn/chief/ap42/index.html).

[45] On the advice of StopWaste.org, the sequestration emission factors were "zeroed-out" to reflect uncertainty in the long-term capture of carbon in landfills. These emissions factors could change as more information becomes available.

Alameda County Government Operations Vehicle Fleet Sector Emission Factors:
This classification was used in Figure 5, to show the breakdown of emissions by vehicle type in the County fleet. This division was used to aggregate the vehicle types reported by various departments.

Vehicle Class Description	Definition
Passenger Cars	Sedans (of all sizes)
Light Truck / SUV	Trucks < 8,500 GVW*
Heavy Trucks and Buses	Vehicles > 8,500 GVW* and buses
Motorcycles	Motorcycles
Off Road	Construction equipment, sweepers, lifts, etc.

*GVW = gross vehicle weight

CO2 Rates- (grams/gallon)		
Gas	**Diesel**	**CNG**
9,393	9,511	7.6

		Motorcycle	Auto - Full-Size	Auto - Mid-Size	Heavy Truck	Heavy Truck- Large	Light Truck/ SUV/ Pickup	Light Truck/ SUV/ Pickup - Large	Transit Bus
CH_4 Rates (grams/mile)	Gas	.228	.053	.053	.178	N/A	.070	N/A	N/A
	Diesel	N/A	.016	N/A	.069	N/A	.016	N/A	.069
	CNG	N/A	.033	.033	N/A	1.071	N/A	.039	1.071
N_2O Rates (grams/mile)	Gas	.007	.056	.056	.123	N/A	.077	N/A	N/A
	Diesel	N/A	.016	N/A	.048	N/A	.032	N/A	.048
	CNG	N/A	.028	.028	N/A	.019	N/A	.036	.019
Fuel Efficiencies (miles/gallon)	Gas	25.01	18.254	19.584	4.827	N/A	13.490	N/A	N/A
	Diesel	N/A	18.825	N/A	5.469	N/A	16.342	N/A	5.469
	CNG	N/A	.028	.030	N/A	.008	N/A	.013	.008

The emission factors used in the County Government fleet analysis are national averages. They have been derived from a variety of sources (U.S. EPA, Energy Information Administration, International Panel on Climate Change, etc.) during the development of the CACP software. A thorough description of coefficients and their sources are available in the emissions factors portion of the software's help files.

Appendix D: Forecast Data from ABAG's Projections 2005

Forecast Table 1 – ABAG Projections on Job Growth in Alameda County

Jurisdictional Boundary	Total Jobs				
	2000	2005	2010	2015	2020
Alameda	27,380	27,960	34,750	37,990	41,080
Albany	5,190	4,940	5,560	5,650	5,670
Berkeley	78,320	76,890	79,080	80,580	81,690
Dublin	16,540	19,950	24,770	29,170	32,030
Emeryville	19,860	20,140	21,460	21,750	21,900
Fremont	104,830	96,530	105,060	119,360	136,770
Hayward	76,320	73,670	80,030	84,330	88,790
Livermore	32,820	33,660	40,420	46,170	55,070
Newark	21,420	21,180	23,310	23,810	24,230
Oakland	199,470	207,100	223,490	235,030	250,260
Piedmont	2,120	2,120	2,140	2,160	2,190
Pleasanton	58,670	58,670	66,050	72,020	73,410
San Leandro	44,370	42,790	44,840	50,460	54,380
Union City	19,310	19,920	24,000	29,010	34,900
Unincorporated	43,540	41,980	43,880	47,480	50,940

Forecast Table 2 – ABAG Projections on Population Growth in Alameda County

Jurisdictional Boundary	Total Population				
	2000	2005	2010	2015	2020
Alameda	72,259	75,400	77,600	79,900	82,300
Albany	16,444	16,800	17,200	17,400	17,800
Berkeley	102,743	105,300	107,200	109,500	111,900
Dublin	29,973	40,700	50,000	57,000	63,800
Emeryville	6,882	8,000	8,800	9,300	9,900
Fremont	203,413	211,100	217,300	226,900	236,900
Hayward	140,030	146,300	151,400	156,600	160,300
Livermore	73,345	78,000	84,300	90,200	96,300
Newark	42,471	44,400	46,000	47,400	49,000
Oakland	399,484	414,100	430,900	447,200	464,000
Piedmont	10,952	11,100	11,200	11,200	11,200
Pleasanton	63,654	68,200	72,600	76,500	80,400
San Leandro	79,452	82,400	84,300	87,500	90,800
Union City	66,869	71,400	75,100	78,600	82,600
Unincorporated	135,770	143,900	150,600	153,600	157,300

Forecast Table 3 – ABAG Projections on Households Growth in Alameda County

Jurisdictional Boundary	Number of Households				
	2000	2005	2010	2015	2020
Alameda	30,226	31,130	31,850	32,830	34,050
Albany	7,011	7,070	7,200	7,350	7,550
Berkeley	44,955	45,350	45,950	47,120	48,520
Dublin	9,325	13,030	16,340	18,950	21,600
Emeryville	3,975	4,580	4,990	5,290	5,640
Fremont	68,237	69,830	71,610	74,800	78,290
Hayward	44,804	46,200	47,600	49,490	51,000
Livermore	26,123	27,480	29,580	31,790	34,130
Newark	12,992	13,390	13,840	14,340	14,890
Oakland	150,790	154,330	160,390	168,380	176,810
Piedmont	3,804	3,810	3,820	3,830	3,840
Pleasanton	23,311	24,680	26,170	27,680	29,270
San Leandro	30,642	31,340	31,930	33,300	34,790
Union City	18,642	19,640	20,650	21,580	22,770
Unincorporated	48,529	50,680	52,860	54,150	55,720