

City of Oakland

Baseline Greenhouse Gas Emissions
Inventory Report

December 2006



Conducted by ICLEI's Cities for Climate Protection® Campaign
in partnership with the City of Oakland

City of Oakland Baseline Greenhouse Gas Emissions Inventory

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Acknowledgements

This Greenhouse Gas Emissions Inventory Report was completed through the generous support of many individuals and organizations. The staff at the City of Oakland has been most helpful in gathering the data and doing the subsequent analysis. Particular thanks go to Scott Wentworth, Energy Engineer at the City of Oakland.

Many thanks are also due to StopWaste.Org. Their generous support of ICLEI and the jurisdictions in Alameda County was instrumental to this project's success.

I. Introduction

Since the early 1990's scientific consensus holds that the world's population is releasing greenhouse gases faster than the earth's natural systems can absorb them. These gases are released as by-products of fossil fuel combustion, waste disposal, energy use, land-use changes, and other human activities. This release of gases, such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), creates a blanket around the earth that allows light to pass through but traps heat at the surface preventing its escape into space. Known as the greenhouse effect or global climate change, models show that this phenomenon will lead to a 2°F to 10°F temperature increase over the next 100 years. Already the Intergovernmental Panel on Climate Change warns that most of the warming observed over the last 50 years is attributable to human activities.

Changes in the earth's temperature will have impacts for residents of Alameda County, California. These impacts could include:

- Warmer weather associated with increased heat waves
- Wetter weather with an increase in annual rainfall of 20% to 30% leading to more serious storm events
- Rising sea levels that will threaten coastal infrastructure, ecosystems, and water supplies
- Decrease in the Sierra snow pack that will effect fresh water availability and tourism opportunities
- Increase in insect born diseases

Although one city cannot independently resolve the issue of climate change, local governments can make a positive impact through cumulative local action. Cities and counties have the ability to reduce greenhouse gas emissions through effective land use and transportation planning, wise waste management, and the efficient use of energy.

A. Baseline Emissions Inventory Report: Purpose

This report presents the results of the City of Oakland's baseline greenhouse gas emissions inventory. The inventory was conducted by ICLEI – Local Governments for Sustainability in partnership with the City of Oakland. The purpose of the baseline emissions inventory is to determine the levels of greenhouse gas emissions that the City of Oakland emits in its base year, 2005, on a municipal level and a community-wide level. This information will be used to help the city adopt an emissions reduction target and develop an emissions reduction action plan. The inventory provides important information on the jurisdictions emissions profile so that subsequent emissions reduction strategies can be tailored to the community's specific situation.

B. The Alameda County Climate Protection Project

In June 2006 the City of Oakland, along with 10 other local governments in Alameda County, committed to becoming a member of ICLEI and participating in the Alameda County Climate Protection Project. The project was launched by ICLEI in partnership with StopWaste.Org and the Alameda County Conference of Mayors. In committing to the project, the City of Oakland embarked on an ongoing, coordinated effort to reduce the emissions that cause global warming, improve air quality, reduce waste, cut energy use and save money.

C. ICLEI and the Cities for Climate Protection Campaign

ICLEI's mission is to improve the global environment through local action. The Cities for Climate Protection® (CCP) Campaign is ICLEI's flagship campaign designed to educate and empower local governments worldwide to take action on climate change. ICLEI provides resources, tools, and technical assistance to help local governments measure and reduce greenhouse gas emissions in their communities and their internal municipal operations.

ICLEI's CCP Campaign was launched in 1993 when municipal leaders, invited by ICLEI, met at the United Nations in New York and adopted a declaration that called for the establishment of a worldwide movement of local governments to reduce greenhouse gas emissions, improve air quality, and enhance urban sustainability. The CCP Campaign achieves these results by linking climate change mitigation with actions that improve local air quality, reduce local government operating costs, and improve quality of life by addressing other local concerns. The CCP Campaign seeks to achieve significant reductions in U.S. greenhouse gas emissions by assisting local governments in taking action to reduce emissions and realize multiple benefits for their communities.

ICLEI uses the performance-oriented framework and methodology of the CCP Campaign's Five Milestones to assist U.S. local governments in developing and implementing harmonized local approaches for reducing global warming and air pollution emissions, with the additional benefit of improving community livability. The milestone process consists of:

- Milestone 1: Conduct a baseline emissions inventory and forecast
- Milestone 2: Adopt an emissions reduction target
- Milestone 3: Develop a Climate Action Plan for reducing emissions
- Milestone 4: Implement policies and measures
- Milestone 5: Monitor and verify results

In 2006 the City of Oakland adopted a resolution to take action for climate protection and officially joined ICLEI's Cities for Climate Protection Campaign.

II. Emissions Inventory

A. Reasoning, Methodology & Model

ICLEI's Cities for Climate Protection methodology enables local governments to systematically estimate and track greenhouse gas emissions from energy use and waste related activities at the community-wide scale and those resulting directly from municipal operations. The municipal operations inventory is a subset of the community-scale inventory.

Once completed, these inventories provide the basis for creating an emissions forecast and reduction target, and enable the quantification of emissions reductions associated with implemented and proposed measures.

1. Emissions Analysis Software

To facilitate local government efforts to identify and reduce greenhouse gas emissions, ICLEI developed the Clean Air and Climate Protection (CACP) Software package with Torrie Smith Associates. This software estimates emissions derived from energy consumption and waste generation within a community. The CACP software determines emissions using specific factors (or coefficients) according to the type of fuel used. Emissions are aggregated and reported in terms of equivalent carbon dioxide units, or eCO₂. 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 in its capacity to trap heat, so the model converts one ton of methane emissions to 21 tons of eCO₂.

The emissions coefficients and methodology employed by the 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 GHG Emissions Inventories), the U.S. Voluntary Greenhouse Gas Reporting Guidelines (EIA form 1605), and, for emissions generated from solid waste, the U.S. EPA's Waste Reduction Model (WARM).

The CACP software has been and continues to be used by over 200 U.S. cities and counties to quantify the reduction in their greenhouse gas emissions. However, it is worth noting that, although the software provides cities/counties with a sophisticated and useful tool, calculating emissions from energy use with precision is difficult. The model depends upon numerous assumptions, and it is limited by the quantity and quality of available data. With this in mind, it is useful to think of any specific number generated by the model as an approximation, rather than an exact value.

2. Inventory Sources and Data Collection Process

An inventory of greenhouse gas emissions requires the collection of information from a variety of sectors and sources. For community electricity and natural gas data, ICLEI consulted Pacific Gas & Electric Company (PG&E). The Metropolitan Transportation Commission (MTC), Bay Area Air Quality Management District (BAAQMD), and Bay Area Rapid Transit (BART) served as sources of transportation data. Solid waste data was gathered from StopWaste.Org, Waste Management, Inc., Alameda County Industries, Republic Services, Inc. and the U.S. Environmental Protection Agency (U.S. EPA).

Scott Wentworth, Energy Engineer at the City of Oakland, coordinated the City's municipal data collection process.

These data were entered into the software to create a community emissions inventory and a municipal emissions inventory. The community inventory represents all the energy used and waste produced within the City of Oakland and its contribution to greenhouse gas emissions. The municipal inventory is a subset of the community inventory, and includes emissions derived from internal government operations.

There are two main reasons for completing separate emissions inventories for community and municipal operations. First, the government is committed to action on climate change, and has a higher degree of control to achieve reductions in its own municipal emissions than those created by the community at large. Second, by proactively reducing emissions generated by its own activities, the Oakland government takes a visible leadership role in the effort to address climate change. This is important for inspiring local action in Oakland as well as for inspiring other communities.

The City of Oakland’s inventory is based on the year 2005. When calculating Oakland’s emissions inventory, all energy consumed within the city limits was included. This means that, even though the electricity used by Oakland’s residents is produced elsewhere, the energy and emissions associated with it appears in Oakland’s inventory. The decision to calculate emissions in this manner reflects the general philosophy that a community should take full ownership of the impacts associated with its energy consumption, regardless of whether the generation occurs within the geographical limits of the community.

B. Inventory Results

The results below represent the City of Oakland’s completion of the first milestone of ICLEI’s CCP campaign.

1. Community Emissions Inventory

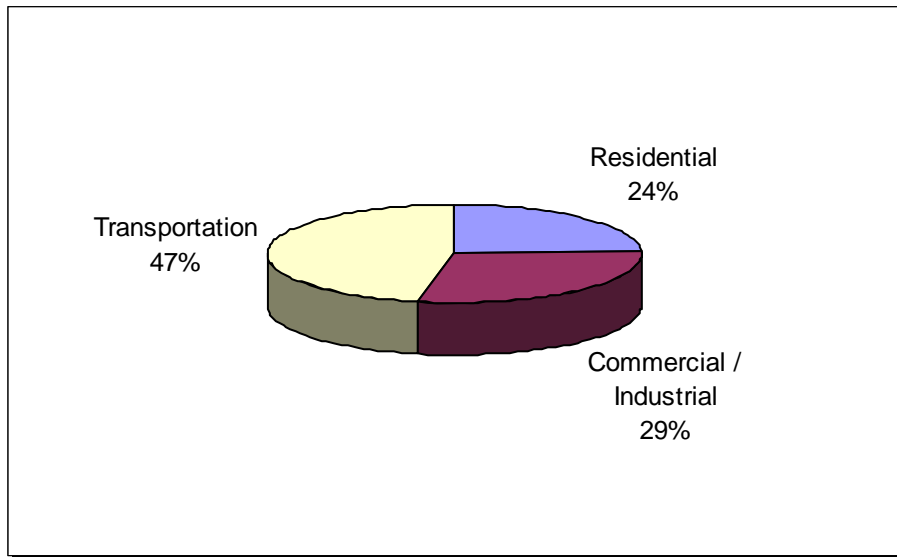
In the base year 2005, the City of Oakland emitted approximately 2,248,667 tons of eCO₂ from the residential, commercial/industrial, transportation and waste sectors. Burning fossil fuels in vehicles and for energy use in buildings and facilities is a major contributor to Oakland’s greenhouse gas emissions. Fuel consumption in the transportation sector is the single biggest source of emissions, contributing 46.9% of total emissions. Table (1) and Figure (a) below show Oakland’s total greenhouse gas emissions from all major sources for the year 2005. The residential and commercial/industrial sectors represent emissions that result from electricity and natural gas used in both private and public sector buildings and facilities. The transportation sector includes emissions from private, commercial and fleet vehicles driven within the City’s geographical boundaries as well as the emissions from transit vehicles and the city-owned fleet.

Table (1): Oakland Community Emissions Summary

Potential Sources	Equiv eCO ₂ (tons)	Energy (MMBtu)
Residential	580,710	8,838,214
Commercial/Industrial	709,199	10,282,046
Transportation	1,138,767	13,250,101
TOTAL	2,248,667	32,370,361

Source: CACP Model output

Figure (a): Oakland Community Greenhouse Gas Emissions - Year 2005



Source: CACP Model output

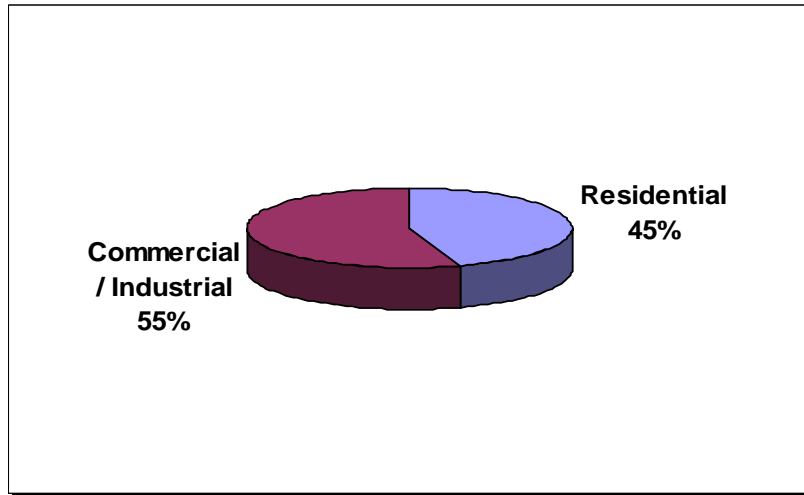
Energy / Stationary Source Emissions

In 2005, Oakland's total stationary energy consumption was about 2,103,387,324 kWh of electricity and 119,414,639 therms of natural gas. Stationary energy use by all sectors (residential, commercial and industrial activities) accounts for 53.1% of total greenhouse gas emissions in Oakland. These emissions are a result of the combustion of fossil fuel. Oakland's stationary energy use resulted in a total of approximately 1,289,909 tons of eCO₂ emissions in 2005.

The City of Oakland receives its electricity from Pacific Gas & Electric Company (PG&E). The 2005 emissions coefficients for electricity provided by PG&E are included in the notes in Appendix B. The types of power sources that make up a utility's electricity generation mix have a significant impact on a city's greenhouse gas emissions. A coal fired power plant, for example, releases 1.3 tons of eCO₂ per megawatt-hour of electricity generated versus 0.7 tons for gas turbines and 0 tons for renewable sources such as solar, wind, or hydroelectric power.

Figure (b) shows the breakdown of greenhouse gas emissions by sector for both electricity and natural gas combined. Of the total 1,289,909 tons of eCO₂ emitted due to stationary energy use, 45% was from residential buildings and 55% was from commercial/industrial buildings.

Figure (b): Oakland Community Greenhouse Gas Emissions Breakdown (Residential and Commercial/Industrial) - Year 2005



Source: CACP Model output

Residential

In 2005, Oakland's 414,100 residents consumed 671,311,906 kWh of electricity, or about 4,350 kWh per household, and 65,470,470 therms of natural gas, or about 424 therms per household. This consumption resulted in a release of 580,710 tons of eCO₂. Major residential energy uses include refrigeration, lighting and water heating.

Commercial/Industrial

In 2005, Oakland's commercial/industrial sector buildings consumed 1,432,075,418 kWh of electricity and 53,944,169 therms of natural gas. This consumption resulted in a release of 709,199 tons of eCO₂ into the atmosphere.

Transportation Emissions

The transportation sector is responsible for about 46.9% of Oakland's greenhouse gas emissions. Motor vehicles driven within the City's geographical boundaries emitted approximately 1,138,767 tons of eCO₂ in 2005.

Calculations for transportation emissions are based on figures for total vehicle miles traveled (VMT) in the City of Oakland. MTC supplied the necessary VMT data, while BAAQMD provided data that enabled us to break down total VMT by percentage driven by a given vehicle type.

As a side note, ICLEI (in partnership with staff from the Bay Area Rapid Transit (BART) district) also developed a methodology for allocating the greenhouse gases that BART emits as a major regional transit provider. *The results of this quantification are meant to be illustrative and are not included in Oakland's CO₂ baseline.* ICLEI generated the emissions estimates for BART travel by collecting 2005 electricity consumption data from BART and then allocating that consumption to Alameda County jurisdictions based on ridership (exit counts from the relevant BART stations). A portion of ridership at the Macarthur station has been allocated to Emeryville, based on Emery-Go-Round data, and has been subtracted from this analysis. As BART's source of electricity through the year 2005 is hydropower, 2005 BART-related emissions are zero. That being said, BART's future fuel mix will not rely solely on hydropower. As such, based on ICLEI's methodology for allocating BART emissions to the jurisdictions that have access to a BART station, Oakland is projected to be allocated 18,328 tons of eCO₂ in 2020 (based on PG&E emissions factors).

Solid Waste Emissions

In 2005, Oakland sent approximately 618,468 tons of solid waste to landfills. Oakland also has recycling and composting measures in place; however, due to lack of data availability, the emissions impact of these practices is not included in this analysis.

The way in which ICLEI's CACP software calculates solid waste emissions deserves detailed explanation. The software is designed to be used in communities with a variety of waste disposal methods, including open dumping, landfilling and incineration. The emissions calculations from waste disposal are based on the U.S. EPA's Waste Reduction Model (WARM) and are consistent with national standards. The CACP software calculates waste sector emissions based on a number of factors, including: the methane recovery factor at the landfills to which the city's solid waste is sent; the total amount of solid waste sent to the landfill(s); the composition of the waste sent to the landfill(s); and emissions coefficients derived from the WARM model.

A weighted average of the methane recovery factors for the landfills to which Oakland sends its waste equals approximately 73.2 percent. This estimate is based on data supplied by the U.S. EPA's Landfill Methane Outreach Program (LMOP).

Based on emissions coefficients for the waste sector, and because more than 73.2 percent of the methane produced from Oakland's solid waste is estimated to be recovered (either captured perpetually under the liner of the landfill or captured and then flared), waste emissions appear to be slightly negative, -91,378 tons of eCO₂ in 2005.

However, because the model does not capture the emissions credit achieved through the city's recycling efforts, we are choosing to "zero out" the emissions credit attributed to landfilling for the purposes of this inventory. Zeroing out the emissions credit for landfilling is consistent with the action taken by a number of ICLEI members, including the City and County of San Francisco.

Furthermore, the benefits gained from recycling and the associated reduction in "upstream" energy use far outweigh sending waste to the landfill. For example, if Oakland recycled an additional 20,000 tons of waste, then the City would reduce its annual eCO₂ emissions by an additional amount of 53,000 tons.

Recycling reduces CO₂ emissions because manufacturing products with recovered materials avoids emissions from the energy that would have been used during extraction, transporting and processing of virgin raw materials. Recycling paper also conserves forests, which contribute to carbon sequestration – a process that removes carbon from the atmosphere and stores it for long periods of time. Both forests and organic material in the soil sequester carbon.

Further, recent studies have begun to question the U.S. EPA's estimates for the amount of methane that is actually captured by methane recovery systems at landfills. Many hypothesize that the efficiency with which methane recovery systems capture methane is currently overestimated, and that much more of the potent greenhouse gas is actually escaping from landfills into the atmosphere. The CACP software is designed to follow EPA guidelines and the tool will be updated appropriately when those guidelines change.

Table (2) shows the approximate breakdown of the materials Oakland sent to landfills in 2005. Organic materials such as food and yard waste disposed of in landfills decompose and emit methane, a greenhouse gas 21 times more potent than CO₂. Materials that do not breakdown and release greenhouse gases are aggregated into the "All Other Waste" category.

Table (2): Oakland Waste Composition

Waste Type	Waste Share
Paper Products	19.7%
Food Waste	12.0%
Plant Debris	8.0%
Wood/Textiles	16.9%
All Other Waste	43.4%
Total	100%

Source: StopWaste.Org

2. Municipal Operations Emissions Inventory

ICLEI's emissions analysis software and methodology enable a jurisdiction to inventory the emissions that result from municipal operations. As was noted earlier, the municipal inventory is a subset of the community inventory.

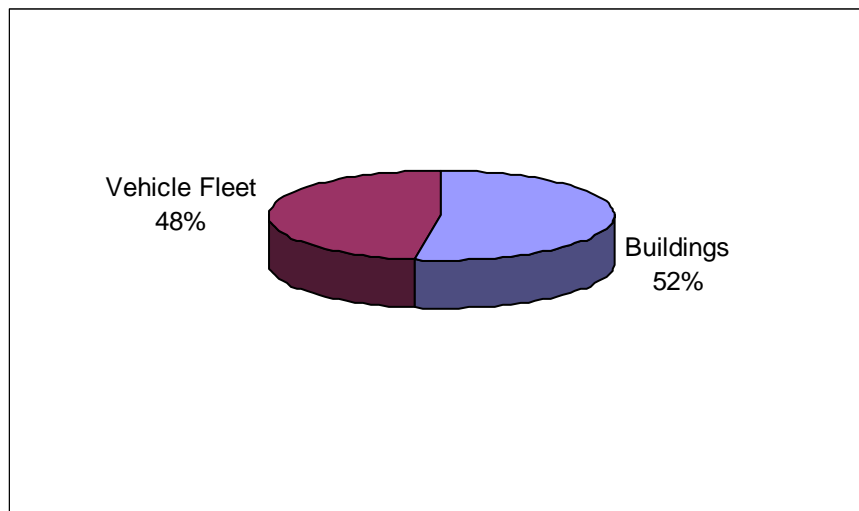
In the base year of 2005, Oakland's municipal operations generated 35,519 tons of eCO₂. As Table (3) and Figure (c) show, the City's buildings accounted for the majority of emissions, followed by the vehicle fleet.

Table (3): Oakland Municipal Emissions Summary

Potential Sources	Equiv eCO ₂ (tons)	Energy (MMBtu)	Cost (\$)
Buildings	18,600	255,799	6,803,642
Vehicle Fleet	16,919	198,720	3,720,838
TOTAL	35,519	454,499	10,524,480

Source: CACP Model output

Figure (c): Oakland Municipal Greenhouse Gas Emissions – Year 2005



Source: CACP Model output

Municipal emissions in Oakland constitute about 1.5% of Oakland’s total emissions. Local government emissions typically fall between 1 to 5 percent of overall community emissions. As a minor contributor to total emissions, actions to reduce municipal energy use may have a limited impact on Oakland’s overall community emissions levels. However, municipal action has symbolic value and demonstrates leadership that extends beyond the magnitude of emissions actually reduced.

Energy/Stationary Source Emissions

In 2005, Oakland municipal buildings and facilities consumed 54,120,982 kWh of electricity and 803,138 therms of natural gas, which resulted in a release of 18,580 tons of eCO₂ emissions into the atmosphere.

Transportation Emissions

The City’s vehicle fleet consumed approximately 1,099,948 gallons of gasoline equivalent and emitted about 11,668 tons of eCO₂. The municipal fleet includes all vehicles owned and operated by the City of Oakland plus some contractor vehicles performing City functions (e.g., Waste Management garbage trucks).

Solid Waste Emissions

The City sent 12,727 tons of solid waste to landfills in 2005. Based on available data and the methodology employed by U.S. EPA’s WARM model, municipal waste emissions appear to be slightly negative at -2,876 tons of eCO₂. As was discussed in the section on community solid waste emissions (see page 10), this negative number will be zeroed out for the purpose of this inventory.

Table (4): Oakland’s Emissions Summary

Oakland’s Emissions Summary		
	Community Analysis	Municipal Operations Analysis
Base year	2005	2005
Quantity of eCO ₂ emissions in base year (tons)	2,248,667	35,519

Source: CACP Model Output

III. Forecast for Greenhouse Gas Emissions

Based on the community and municipal operations emissions inventories developed for Oakland for the base year 2005, the next step was to forecast future emissions for the year 2020. The emission forecast represents a business-as-usual prediction of how greenhouse gas (GHG) emissions may change in the City of Oakland over time for the community sector.

The forecast projects the growth (or reduction) in greenhouse gas emissions that will occur in a given future year. Projections are based on the assumption that energy consumption will grow as population increases. For the community analysis, the forecast was conducted by applying population growth factors to Oakland’s base year residential, commercial/industrial, and transportation data. For the municipal government analysis, no growth was anticipated in the municipal government operations. Table (5) provides an emissions summary for Oakland’s base year and forecast year.

Table (5): Oakland’s Emissions Summary

Oakland’s Emissions Summary		
	Community Analysis	Municipal Operations Analysis
Base year	2005	2005
Indicators used to generate forecast	0.75% (Annual population growth rate based on ABAG data)	No growth anticipated
Quantity of eCO ₂ emissions in base year (tons)	2,248,667	35,519
Forecast year	2020	2020
Business-as-usual projection of eCO ₂ emissions in 2020 (tons)	2,686,505	35,519

Source CACP Model Output and ABAG

Conducting an emissions forecast is essential for setting an emissions reduction target, since the amount of GHG emissions Oakland pledges to reduce will be derived from projected emissions.

IV. Conclusion

This baseline greenhouse gas emissions inventory report represents a “snapshot” of the greenhouse gases that the City of Oakland emits in its base year, 2005, on a community-wide level and a municipal level. The report also approximates the greenhouse gases that the City will emit in the year 2020.

This information will be used to help the City adopt an emissions reduction target and develop a climate action plan. The climate action plan consists of policies and measures that, when implemented, will serve to get the City to its target. The inventory also serves to inform the City regarding the major sources of greenhouse gas emissions. For example, the community-wide inventory for the City of Oakland reveals that the transportation sector is responsible for 46.9% of total emissions.

The inventory also reveals the fact that in Oakland, like in most cities, the municipal government emissions represent a small percentage of community-wide emissions, in this case only 1.5%. That being said, by proactively reducing emissions generated by its own activities, the Oakland government takes a visible leadership role in the effort to address climate change. This is important for inspiring local action in Oakland as well as for inspiring action in other communities.

**Appendix A – Data Summary Reports, Data Sources, Assumptions and Notes
for the Municipal Inventory**

Oakland

Government Greenhouse Gas Emissions in 2005

Summary Report

	Equiv CO ₂ (tons)	Equiv CO ₂ (%)	Energy (MMBtu)	Cost (\$)
Buildings	18,600	52.4	255,779	6,803,642
Vehicle Fleet	16,919	47.6	198,720	3,720,838
Waste	0	0.0		0
Total	35,519	100.0	454,499	10,524,480

Government Greenhouse Gas Emissions in 2005

Detailed Report

	Equiv CO ₂ (tons)	Equiv CO ₂ (%)	Energy (MMBtu)	Cost (\$)
Buildings				
Oakland, CA				
<i>Fire Department</i>				
Electricity	524	1.5	6,813	262,390
Natural Gas	561	1.6	9,080	37,461
<i>Subtotal Fire Department</i>	1,085	3.1	15,894	299,851
<i>Lease / Concession</i>				
Electricity	150	0.4	1,957	79,211
Natural Gas	79	0.2	1,278	4,948
<i>Subtotal Lease / Concession</i>	229	0.6	3,234	84,159
<i>Library</i>				
Electricity	372	1.0	4,838	207,096
Natural Gas	347	1.0	5,619	22,942
<i>Subtotal Library</i>	719	2.0	10,456	230,038
<i>Museum</i>				
Electricity	633	1.8	8,230	301,246
Natural Gas	548	1.5	8,871	19,785
<i>Subtotal Museum</i>	1,181	3.3	17,100	321,031
<i>Parks and Rec</i>				
Electricity	826	2.3	10,742	420,611
Natural Gas	1,590	4.5	25,738	96,642
<i>Subtotal Parks and Rec</i>	2,416	6.8	36,480	517,253
<i>Police</i>				
Electricity	1,782	5.0	23,171	870,553
Natural Gas	634	1.8	10,267	36,522
<i>Subtotal Police</i>	2,417	6.8	33,439	907,075
<i>Public Works Agency</i>				
Electricity	7,540	21.2	98,037	3,097,355
Natural Gas	297	0.8	4,801	16,989
<i>Subtotal Public Works Agency</i>	7,837	22.1	102,838	3,114,344

Government Greenhouse Gas Emissions in 2005 Detailed Report

	Equiv CO ₂ (tons)	Equiv CO ₂ (%)	Energy (MMBtu)	Cost (\$)
<i>Redevelopment</i>				
Electricity	31	0.1	406	15,077
Natural Gas	6	0.0	92	1,358
<i>Subtotal Redevelopment</i>	37	0.1	498	16,435
<i>Shared</i>				
Electricity	1,846	5.2	24,002	964,930
Natural Gas	302	0.9	4,892	25,309
<i>Subtotal Shared</i>	2,148	6.0	28,893	990,239
<i>Unknown</i>				
Electricity	501	1.4	6,517	315,522
Natural Gas	9	0.0	145	2,085
Propane	21	0.1	283	5,610
<i>Subtotal Unknown</i>	531	1.5	6,946	323,217

Notes:

1. The PG&E coefficient set is based on the PG&E-specific eCO₂ emissions factor for 2005 and default criteria air pollutant emissions factors for the 2004 Region 13 - Western Systems Coordinating Council/CNV Average Grid Electricity Set. The PG&E coefficient set does not have emissions factors for CH₄ and N₂O as the eCO₂ emissions factor includes CH₄ and N₂O emissions in CO₂ equivalents.
2. The eCO₂ emissions factor is pending independent verification and certification by the California Climate Action Registry; the confirmed eCO₂ factor will be made public by CCAR at the end of 2006, at which time the emissions factor used in this analysis should be updated if it has changed.
3. Redevelopment Agency, Housing Authority, Oakland Unified School District and the Port of Oakland are not included in this inventory due to lack of ownership/operational control. Therefore, the electricity generated by the Oakland Ice Center's solar PV array is not included in this inventory as it is owned by the Redevelopment Agency.
4. Electricity consumption of four Rav-4 electric vehicles is contained within the Building sector as the charging station is not sub-metered.
5. All propane in this record is consumed by equipment. The CACP software does not contain a fleet coefficient set for propane use in various types of equipment technology; however, the Buildings sector Fuel CO₂ coefficient set provides a very close approximation of CO₂ emissions.

Data Sources:

1. Electricity, natural gas, propane and no-growth projection data provided on October 4, 2006 by Scott Wentworth, Energy Engineer, Public Works Agency, City of Oakland, swentworth@oaklandnet.com, (510) 615-5421
2. PG&E-specific eCO₂ emissions factor of 0.525 lbs/kWh (or 262.5 short tons CO₂/GWh) of delivered electricity in 2005 provided by Greg San Martin

Data collected and entered by Brooke Owyang Lee, Program Assistant, ICLEI, brooke.lee@iclei.org
Last updated October 6, 2006

Subtotal Buildings	18,600	52.4	255,779	6,803,642
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Government Greenhouse Gas Emissions in 2005

Detailed Report

	Equiv CO ₂ (tons)	Equiv CO ₂ (%)	Energy (MMBtu)	Cost (\$)
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Vehicle Fleet

Oakland, CA

City Fleet

Gasoline	8,080	22.7	94,395	1,601,420
Diesel	2,982	8.4	34,230	635,099
CNG	606	1.7	9,532	9,524
Subtotal City Fleet	11,668	32.8	138,156	2,246,043

Notes:

1. Aggregate fuel consumption as reported to the Chicago Climate Exchange is used in this analysis due to the lack of fuel consumption data outside of the RNI system. Fuel consumption cannot be broken out by vehicle type and is entered in the default Passenger Vehicle category, a weighted mix of all sizes of automobile and trucks.
2. Fuel use in equipment is included in this record. The CACP software does not contain fleet coefficient sets for fuel use in various types of equipment technology; however, the Passenger Vehicle category provides a very close approximation of actual CO₂ emissions.
3. Propane consumption is reported in the Buildings sector.
4. CNG consumption was extracted from the Buildings sector (MSC Vehicles records) and entered in the Vehicle Fleet sector.
5. Helicopter fuel is entered as unleaded gasoline in the default Passenger Vehicle category. The CACP software does not contain fleet coefficient sets for fuel use in helicopters; however, the Passenger Vehicle category provides a very close approximation of actual CO₂ emissions.

Data Sources:

1. Fuel quantities, fuel costs and no-growth projection provided by Scott Wentworth, Energy Engineer, Public Works Agency, City of Oakland, swentworth@oaklandnet.com, (510) 615-5421 (AP Fuel Summary with actuals Jun 9 2006.xls)

Data collected and entered by Brooke Owyang Lee, Program Assistant, ICLEI, brooke.lee@iclei.org
Last updated December 07, 2006

Reimbursed Mileage

Gasoline	86	0.2	1,009	65,155
Subtotal Reimbursed Mileage	86	0.2	1,009	65,155

Data Sources:

1. Reimbursed mileage, federal reimbursement rate per mile and no-growth projection provided by Scott Wentworth, Energy Engineer, Public Works Agency, City of Oakland, swentworth@oaklandnet.com, (510) 615-5421 (AP Fuel Summary with actuals Jun 9 2006.xls)

Data collected and entered by Brooke Owyang Lee, Program Assistant, ICLEI, brooke.lee@iclei.org
Last updated October 7, 2006

Waste Management, Inc

Gasoline	16	0.0	192	6,439
CNG	2	0.0	26	243,987
Diesel (ULSD)	5,147	14.5	59,337	1,159,214
Subtotal Waste Management, Inc	5,165	14.5	59,555	1,409,640

Notes:

Government Greenhouse Gas Emissions in 2005

Detailed Report

	Equiv CO ₂ (tons)	Equiv CO ₂ (%)	Energy (MMBtu)	Cost (\$)
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1. LNG fuel consumption is grouped with CNG fuel consumption, as CACP software lacks emissions factors for LNG. LNG emissions profile is comparable with CNG.
2. Cost data provided by Waste Management, Inc. for gasoline is currently under review by Waste Management staff. ICLEI will provide updated cost data should the numbers need to be revised.
3. CNG data provided by Waste Management, Inc. is currently under review by Waste Management staff. ICLEI will provide updated CNG data should the numbers need to be revised.
4. The City of Oakland does not own or operate the Waste Management Inc. fleet. However, it is included in the government emissions inventory because waste hauling is an essential municipal service. This record comprises the portion of fuel consumed by the WM fleet for all service within the city, including the commercial/industrial, residential and government sectors.

Data Sources:

1. Fuel consumption and fleet data provided on October 4, 2006 by David Tucker, Waste Management, DTucker2@wm.com
2. Diesel consumption specified as ULSD on August 14, 2006 by Jason Silva Waste Management, JSilva4@wm.com

Data collected and entered by Brooke Owyang Lee, Program Assistant, ICLEI, brooke.lee@iclei.org

Last updated October 7, 2006

Data summary file: City of Oakland GHG Data.xls

Subtotal Vehicle Fleet	16,919	47.6	198,720	3,720,838
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Waste

Oakland, CA

Government Facilities

Disposal Method - Managed Landfill

	Equiv CO ₂ (tons)	Equiv CO ₂ (%)		Cost (\$)
Paper Products	0	0.0		0
Food Waste	0	0.0		0
Plant Debris	0	0.0		0
Wood/Textiles	0	0.0		0
Subtotal Government Facilities	0	0.0		0

Notes:

1. In 2005, the City of Oakland's government operations sent an estimated 12,727 tons of solid waste to landfills. Because 73.2% of the methane produced by Oakland's solid waste is estimated to be recovered, waste emissions appear to be negative: -2,876 tons of eCO₂. Many cities choose to eliminate this emissions "credit" by replacing the waste tonnage input data with zero. StopWaste.Org urged ICLEI to do so for the purposes of this inventory. For future reference, the notes below include the original waste data that resulted in the negative emissions number.
2. Oakland's estimated waste composition:
 - a. Paper products: 21%
 - b. Food Waste: 10%
 - c. Plant Debris: 4%
 - d. Wood/Textiles: 22%
 - e. All Other Waste: 43%
3. The weighted average methane recovery factor for Oakland (73.2%) is based on tonnage hauled to each landfill.
4. Waste characterization provided by Becky Dowdakin is based on the 2000 Waste Characterization study. A mean of commercial and roll off composition was applied to known and estimated tonnages. No adjustment was made for facility types.
5. Solid waste tonnage was estimated by Becky Dowdakin. A conversion factor of 0.15 tons per cubic yard was applied to service volume, with the assumption that the containers were 75% full.

Data Sources:

1. Government operations solid waste data (*included in the notes above*) provided on July 25, 2006 by Becky Dowdakin, Solid Waste/Recycling Program Supervisor, Public Works Agency/Environmental Services Division, City of Oakland, bdowdakin@oaklandnet.com, (510) 238-6981
2. Waste characterization data (*included in the notes above*) is based on the 2000 Alameda County Waste Characterization study available online at <http://www.stopwaste.org/home/index.asp?page=590>
3. Methane recovery factors for individual landfill sites (*explained in the notes above*) provided by Victoria Ludwig, Program Manager EPA Landfill

Government Greenhouse Gas Emissions in 2005 Detailed Report

	Equiv CO ₂ (tons)	Equiv CO ₂ (%)	Energy (MMBtu)	Cost (\$)
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Methane Outreach Program, Ludwig.Victoria@epamail.epa.gov

Data collected and entered by Brooke Owyang Lee, Program Assistant, ICLEI, brooke.lee@iclei.org

Last updated December 13, 2006

Data summary file: City of Oakland Community Waste Data 2005.xls

Subtotal Waste	0	0.0		0
Total	35,519	100.0	454,499	10,524,480

**Appendix B – Data Summary Reports, Indicator Report, Data Sources,
Assumptions and Notes for the Community Inventory**

Oakland

Community Greenhouse Gas Emissions in 2005

Summary Report

	Equiv CO₂ (tons)	Equiv CO₂ (%)	Energy (MMBtu)
Residential	580,710	23.9	8,838,214
Commercial	709,199	29.2	10,282,046
Transportation	1,138,767	46.9	13,250,101
Waste	0	0.0	
Total	2,428,677	100.0	32,370,361

Community Greenhouse Gas Emissions in 2005 Detailed Report

	Equiv CO ₂ (tons)	Equiv CO ₂ (%)	Energy (MMBtu)
Residential			
Oakland, CA			
<i>Residential</i>			
Electricity	176,219	7.3	2,291,167
Natural Gas	404,491	16.7	6,547,047
<i>Subtotal Residential</i>	580,710	23.9	8,838,214
Subtotal Residential	580,710	23.9	8,838,214
Commercial			
Oakland, CA			
<i>Commercial</i>			
Electricity	375,920	15.5	4,887,629
Natural Gas	333,279	13.7	5,394,417
<i>Subtotal Commercial</i>	709,199	29.2	10,282,046
Subtotal Commercial	709,199	29.2	10,282,046

Notes:

1. The PG&E coefficient set is based on the PG&E-specific eCO₂ emissions factor for 2005 and default criteria air pollutant emissions factors for the 2004 Region 13 - Western Systems Coordinating Council/CNV Average Grid Electricity Set. The PG&E coefficient set does not have emissions factors for CH₄ and N₂O as the eCO₂ emissions factor includes CH₄ and N₂O emissions in CO₂ equivalents.
2. The eCO₂ emissions factor is pending independent verification and certification by the California Climate Action Registry; the confirmed eCO₂ factor will be made public by CCAR at the end of 2006, at which time the emissions factor used in this analysis should be updated if it has changed.
3. Industrial consumption data is reported within the Commercial sector due to PUC confidentiality rules that prohibit the release of such data in certain cases.

Data Sources:

1. Electricity and natural gas data provided on October 4, 2006 by Scott Wentworth, Energy Engineer, Public Works Agency, City of Oakland, swentworth@oaklandnet.com, (510) 615-5421
2. Request for electricity and natural gas data processed by Greg San Martin, Climate Protection Program Manager, PG&E, GJS8@pge.com, (415) 973-6905, and Jasmin Ansar, Manager, Environmental Policy, PG&E, JxA2@pge.com, (415) 973-4570
3. PG&E-specific eCO₂ emissions factor of 0.525 lbs/kWh (or 262.5 short tons CO₂/GWh) of delivered electricity in 2005 provided by Greg San Martin

Data collected and entered by Brooke Owyang Lee, Program Assistant, ICLEI, brooke.lee@iclei.org

Last updated October 31, 2006

Data summary file: City of Oakland GHG Data 2005.xls

Community Greenhouse Gas Emissions in 2005 Detailed Report

	Equiv CO ₂ (tons)	Equiv CO ₂ (%)	Energy (MMBtu)
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Transportation

Oakland, CA

Community Transportation

Gasoline	724,879	29.8	8,479,170
Diesel	413,888	17.0	4,770,931
Subtotal Community Transportation	1,138,767	46.9	13,250,101

Notes:

1. VMT data for 2005 is not currently available. The estimated 2005 VMT data was calculated by applying an annual population growth rate to 2004 MTC VMT data.
2. The VMT data provided by MTC includes Daily VMT (DVMT) for weekdays only. VMT including weekends is calculated with the MTC's weekdays/weekends VMT ratio: 1.1489. Hence Annual VMT = DVMT x (number of weekdays in the base year) + DVMT/1.1489 x (365 - number of weekdays in the base year).
3. The VMT by fuel and vehicle type is calculated using Alameda County VMT % (by vehicle type) and the default CACP fleet breakdown by fuel type.

Data Sources:

1. Citywide VMT data provided on July 18, 2006 by Harold Brazil, Air Quality Associate, Metropolitan Transportation Commission (MTC) hbrazil@mtc.ca.gov, (510) 817-5747
2. VMT by vehicle type data provided on July 5, 2006 by Amir Fanai, Principal Air Quality Engineer, Bay Area Air Quality Management District, AFanai@baaqmd.gov

Data collected by Brooke Owyang Lee, Program Assistant, ICLEI, brooke.lee@iclei.org
 Data entered by Brooke Owyang Lee and Palak Joshi, Program Assistant, ICLEI, palak.joshi@iclei.org
 Last updated October 11, 2006

Subtotal Transportation	1,138,767	46.9	13,250,101
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Waste

Oakland, CA

ADC

Disposal Method -

Plant Debris	0	0.0	
Subtotal ADC	0	0.0	

Notes:

1. In 2005, the City of Oakland sent an estimated 196,147 tons of ADC to landfills. Because 73.2% of the methane produced by Oakland's solid waste is estimated to be recovered, waste emissions appear to be negative: approximately -3,506 tons of eCO₂. Many cities choose to eliminate this emissions "credit" by replacing the waste tonnage input data with zero. StopWaste.Org urged ICLEI to do so for the purposes of this inventory. For future reference, the notes below include the original waste data that resulted in the negative emissions number.
2. Oakland's ADC tonnage by landfill:
 - a. Altamont: 62,054 tons
 - b. Forward, Inc.: 48,854 tons
 - c. Potrero Hills: 13,522 tons
 - d. Vasco Road: 41,126 tons
 - e. West Contra Costa: 27,568 tons
 - f. Other landfills: 2,882
3. Oakland's waste composition:
 - a. Plant Debris: 2.7%
 - b. All Other Waste: 97.3%
4. The weighted average methane recovery factor for Oakland (73.2%) is based on tonnage hauled to each landfill. Other landfills include B & J/Hay Road, Bena, Foothill, Guadalupe, Hillside, John Smith Road, Kettleman Hills Facility, Newby Island, North County, Ox Mountain, Pacheco Pass, Tri-

Community Greenhouse Gas Emissions in 2005

Detailed Report

Equiv CO ₂ (tons)	Equiv CO ₂ (%)	Energy (MMBtu)
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Cities, Zanker MPF, and Zanker Road. These landfills receive less than 1% of the total waste from the city of Oakland.

Data Sources:

1. Landfill data (*included in the notes above*) provided on July 20, 2006 by Meghan Starkey, Senior Program Manager, Alameda County Waste Management Authority (StopWaste.org), mstarkey@stopwaste.org, (510) 614-1699
<http://www.stopwaste.org/home/index.asp?page=590>
2. Methane recovery factors for individual landfill sites (*explained in the notes above*) provided by Victoria Ludwig, Program Manager EPA Landfill Methane Outreach Program, Ludwig.Victoria@epamail.epa.gov

Data collected and entered by Brooke Owyang Lee, Program Assistant, ICLEI, brooke.lee@iclei.org
 Last updated December 13, 2006
 Data summary file: City of Oakland Community Waste Data 2005.xls

Community-wide Waste

Disposal Method - Managed Landfill

Paper Products	0	0.0
Food Waste	0	0.0
Plant Debris	0	0.0
Wood/Textiles	0	0.0
All Other Waste	0	0.0
<hr/>		
Subtotal Community-wide Waste	0	0.0

Notes:

1. In 2005, the City of Oakland sent an estimated 422,321 tons of non-ADC solid waste to landfills. Because 73.2% of the methane produced by Oakland's solid waste is estimated to be recovered, waste emissions appear to be negative: approximately -87,872 tons of eCO₂. Many cities choose to eliminate this emissions "credit" by replacing the waste tonnage input data with zero. StopWaste.Org urged ICLEI to do so for the purposes of this inventory. For future reference, the notes below include the original waste data that resulted in the negative emissions number.
2. Oakland's waste tonnage by landfill:
 - a. Altamont: 297,514 tons
 - b. Keller Canyon: 16,473 tons
 - c. Vasco Road: 21,304 tons
 - d. West Contra Costa: 37,583 tons
 - e. Redwood: 36,606 tons
 - f. Forward, Inc.: 6,421 tons
 - g. Other landfills: 6,420 tons
3. Oakland's waste composition:
 - a. Paper products: 19.7%
 - b. Food Waste: 12.0%
 - c. Plant Debris: 8.0%
 - d. Wood/Textiles: 16.9%
 - e. All Other Waste: 43.4%
4. The weighted average methane recovery factor for Oakland (73.2%) is based on tonnage hauled to each landfill. Other landfills include B & J/Hay Road, Bena, Foothill, Guadalupe, Hillside, John Smith Road, Kettleman Hills Facility, Newby Island, North County, Ox Mountain, Pacheco Pass, Tri-Cities, Zanker MPF, and Zanker Road. These landfills receive less than 1% of the total waste from the city of Oakland.
5. Recycling and compost tonnage has been omitted from this analysis as complete recycling and compost data was not available.

Data Sources:

1. Landfill data (*included in the notes above*) provided on July 20, 2006 by Meghan Starkey, Senior Program Manager, Alameda County Waste Management Authority (StopWaste.org), mstarkey@stopwaste.org, (510) 614-1699
2. Waste characterization data (*included in the notes above*) is based on the 2000 Alameda County Waste Characterization study available online at <http://www.stopwaste.org/home/index.asp?page=590>
3. Methane recovery factors for individual landfill sites (*explained in the notes above*) provided by Victoria Ludwig, Program Manager EPA Landfill Methane Outreach Program, Ludwig.Victoria@epamail.epa.gov

Community Greenhouse Gas Emissions in 2005 Detailed Report

	Equiv CO ₂ (tons)	Equiv CO ₂ (%)	Energy (MMBtu)
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Data collected and entered by Brooke Owyang Lee, Program Assistant, ICLEI, brooke.lee@iclei.org
 Last updated December 13, 2006
 Data summary file: City of Oakland Community Waste Data 2005.xls

Subtotal Waste	0	0.0	
Total	2,428,677	100.0	32,370,361

Oakland

Community Greenhouse Gas Emissions in 2005

Indicators Report

	Equip CO ₂ (tons)	Energy (MMBtu)
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Residential

Residential

Per household

3.8

57.3

Sector Average

Per capita

1.4

21.3

Per household

3.8

57.3

Commercial

Sector Average

Per capita

1.7

24.8

Transportation

Sector Average

Per capita

2.7

32.0

Waste

Sector Average

Per capita

0.0

**Appendix C – Data Summary Reports, Data Sources, Assumptions and Notes
for the Community Emissions Forecast**

Oakland

Community Greenhouse Gas Emissions in 2020

Summary Report

	Equiv CO₂ (tons)	Equiv CO₂ (%)	Energy (MMBtu)
Residential	649,720	24.2	9,888,510
Commercial	793,477	29.5	11,503,921
Transportation	1,243,309	46.3	14,486,869
Waste	0	0.0	
Total	2,686,505	100.0	35,879,300

Community Greenhouse Gas Emissions in 2020 Detailed Report

	Equiv CO ₂ (tons)	Equiv CO ₂ (%)	Energy (MMBtu)
Residential			
Oakland, CA			
<i>Residential</i>			
Electricity	197,161	7.3	2,563,440
Natural Gas	452,559	16.8	7,325,070
<i>Subtotal Residential</i>	649,720	24.2	9,888,510
Subtotal Residential	649,720	24.2	9,888,510
Commercial			
Oakland, CA			
<i>Commercial</i>			
Electricity	420,593	15.7	5,468,455
Natural Gas	372,885	13.9	6,035,467
<i>Subtotal Commercial</i>	793,477	29.5	11,503,921
<p>Notes:</p> <ol style="list-style-type: none"> 1. The PG&E coefficient set is based on the PG&E-specific eCO₂ emissions factor for 2005 and default criteria air pollutant emissions factors for the 2004 Region 13 - Western Systems Coordinating Council/CNV Average Grid Electricity Set. The PG&E coefficient set does not have emissions factors for CH₄ and N₂O as the eCO₂ emissions factor includes CH₄ and N₂O emissions in CO₂ equivalents. The business-as-usual projections assume no change in the PG&E eCO₂ emissions factor. 2. The eCO₂ emissions factor is pending independent verification and certification by the California Climate Action Registry; the confirmed eCO₂ factor will be made public by CCAR at the end of 2006, at which time the emissions factor used in this analysis should be updated if it has changed. 3. Industrial consumption data is reported within the Commercial sector due to PUC confidentiality rules that prohibit the release of such data in certain cases. 4. Projections are based on the assumption that consumption (and therefore emissions) will grow as the population increases. The annual population growth rate is extrapolated from the Association of Bay Area Governments' population projection data for 2000-2020 as published in Projections 2005. <p>Data Sources:</p> <ol style="list-style-type: none"> 1. Electricity and natural gas data provided on October 4, 2006 by Scott Wentworth, Energy Engineer, Public Works Agency, City of Oakland, swentworth@oaklandnet.com, (510) 615-5421 2. Request for electricity and natural gas data processed by Greg San Martin, Climate Protection Program Manager, PG&E, GJS8@pge.com, (415) 973-6905, and Jasmin Ansar, Manager, Environmental Policy, PG&E, JxA2@pge.com, (415) 973-4570 3. PG&E-specific eCO₂ emissions factor of 0.525 lbs/kWh (or 262.5 short tons CO₂/GWh) of delivered electricity in 2005 provided by Greg San Martin 4. Population and household indicator data are published by the Association of Bay Area Governments <p>Data collected and entered by Brooke Owyang Lee, Program Assistant, ICLEI, brooke.lee@iclei.org Last updated October 31, 2006 Data summary file: City of Oakland GHG Data 2005.xls</p>			
Subtotal Commercial	793,477	29.5	11,503,921

Community Greenhouse Gas Emissions in 2020 Detailed Report

	Equiv CO ₂ (tons)	Equiv CO ₂ (%)	Energy (MMBtu)
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Transportation

Oakland, CA

Community Transportation

Gasoline	781,151	29.1	9,159,426
Diesel	462,158	17.2	5,327,443
Subtotal Community Transportation	1,243,309	46.3	14,486,869

Notes:

1. VMT data for 2005 is not currently available. The estimated 2005 VMT data was calculated by applying an annual population growth rate to 2004 MTC VMT data.
2. The VMT data provided by MTC includes Daily VMT (DVMT) for weekdays only. VMT including weekends is calculated with the MTC's weekdays/weekends VMT ratio: 1.1489. Hence Annual VMT = DVMT x (number of weekdays in the base year) + DVMT/1.1489 x (365 - number of weekdays in the base year).
3. The VMT by fuel and vehicle type is calculated using Alameda County VMT % (by vehicle type) and the default CACP fleet breakdown by fuel type.
4. Projections are based on the assumption that consumption (and therefore emissions) will grow as the population increases. The annual population growth rate is extrapolated from the Association of Bay Area Governments' population projection data for 2000-2020 as published in Projections 2005.

Data Sources:

1. Citywide VMT data provided on July 18, 2006 by Harold Brazil, Air Quality Associate, Metropolitan Transportation Commission (MTC) hbrazil@mtc.ca.gov, (510) 817-5747
2. VMT by vehicle type data provided on July 5, 2006 by Amir Fanai, Principal Air Quality Engineer, Bay Area Air Quality Management District, AFanai@baaqmd.gov
3. Population and household indicator data are published by the Association of Bay Area Governments

Data collected by Brooke Owyang Lee, Program Assistant, ICLEI, brooke.lee@iclei.org
 Data entered by Brooke Owyang Lee and Palak Joshi, Program Assistant, ICLEI, palak.joshi@iclei.org
 Last updated October 11, 2006

Subtotal Transportation	1,243,309	46.3	14,486,869
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Waste

Oakland, CA

ADC

Disposal Method -

Plant Debris	0	0.0
Subtotal ADC	0	0.0

Community-wide Waste

Disposal Method - Managed Landfill

Paper Products	0	0.0
Food Waste	0	0.0
Plant Debris	0	0.0
Wood/Textiles	0	0.0
All Other Waste	0	0.0
Subtotal Community-wide Waste	0	0.0

Community Greenhouse Gas Emissions in 2020 Detailed Report

	Equiv CO ₂ (tons)	Equiv CO ₂ (%)	Energy (MMBtu)
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Notes:

1. Given the fact that the community-wide waste and ADC tonnage were entered as zero tons in the base year inventory, the forecast for waste emissions is also zero. Reference 2005 Greenhouse Gas Emissions in 2005 waste sector notes for waste emissions analysis methodology and rationale.

Subtotal Waste	0	0.0	
Total	2,686,505	100.0	35,879,300