Photo: Greg Linhares, City of Oakland


Photo: Greg Linhares, City of Oakland

Photo: Greg Linhares, City of Oakland


Photo: Greg Linhares, City of Oakland

City of

OAKLAND

2015 Greenhouse Gas Emissions Inventory Report

March 2018

Table of Contents

List of Figures

Credit and Acknowledgments

This report was prepared by the Environmental Services Division of Oakland Public Works. The primary authors of the report are Daniel Hamilton, Sustainability Program Manager, Mukta Kelkar, Climate Corps Fellow, and Ben Linthicum, CivicSpark Fellow. For inquiries, please contact Mr. Hamilton at DHamilton2@oaklandnet.com

Organization Which Provided Data or Assistance:
California Air Resources Board
County of Alameda
Alameda-Contra Costa Transit
Amtrak
Argonne National Laboratory
Bay Area Rapid Transit
CalRecycle
Carnegie Mellon
City of Oakland
East Bay Municipal Utility District
Federal Transit Administration
ICLEI – Local Governments for Sustainability USA
Metropolitan Transportation Commission
Pacific Gas and Electric
Port of Oakland
Renewable & Appropriate Energy Laboratory, UC Berkeley
StopWaste
Union Pacific Railroad
U.S. Department of Transportation
U. S. Environmental Protection Agency
Water Emergency Transportation Authority

Introduction

Oakland, California

Nationally recognized as one of America's greenest cities, Oakland aims its award-winning sustainability efforts toward building an ecologically sustainable, economically dynamic, and socially equitable future for the community. With 19 miles of shoreline, Oakland is vulnerable to volatile weather patterns, warming oceans, and changing tides; conditions making the city among the most threatened by impacts from climate change. The City's greenhouse gas (GHG) emissions reduction strategies, intended to address the ongoing impacts of a warming climate, are established in the Oakland Energy and Climate Action Plan (ECAP) that was adopted by Oakland City Council in 2012.

This GHG Emissions Inventory Report (Report) provides an update on the calculated emissions occurring in Oakland. It includes updates to the City's three previous GHG Emissions Inventories, covering the years 2005, 2010, 2013, and a new calculation of 2015 emissions. Additionally, this Report includes new GHG Emissions Inventories for each of the three subject years (2005, 2010, 2013, and 2015) to calculate consumption emissions. The differences between the standard core emissions and the new consumption emissions are described in the Report in detail.

Why We Report

The City calculates and reports its greenhouse gas emissions because addressing the impacts of climate change is a core value of Oakland and its people. This Report provides an overview of Oakland's path to emissions reduction and helps guide policy to better protect and provide for our community. By making a targeted and coordinated approach to reducing emissions, we can work to protect residents, businesses, and properties throughout the region from increased impacts of climate change over time. The City has adopted strong emissions reduction goals of 36 percent fewer emissions by 2020 and 83 percent fewer emissions by 2050, relative to a 2005 baseline. The periodic calculation and reporting of

these emissions helps the City to understand whether it is on track to meet its goals, and helps the community understand how well Oakland is responding to this global challenge.

Because climate change disproportionately affects low income residents and people of color in Oakland, our City's sustainability efforts prioritize projects and programs that improve equity while also addressing climate change. Issues such as housing affordability, access to public transit, air quality and community health, and climate justice are all affected by the City's approach to meeting its GHG emissions goals. By prioritizing strategies to focus on these co-benefits of GHG reduction, the City ensures that its GHG reduction efforts are also part of our approach to meeting broader community needs.

Inventory Methodologies

There are two methods of analyzing GHG emissions across a community. The first method, called a core emissions approach, looks at direct emissions from a geographical perspective, for example, gasses that are emitted within city limits. Select indirect emissions may be included, such as the emissions from creation of electricity in a distant location for use within city limits. The core emissions approach is the standard used by cities in the United States, and this Report includes core emissions accordingly.

The second method, referred to as a consumption emissions approach, employs a lifecycle perspective that includes, for example, gasses that are emitted globally due to demand for goods and services generated within city limits. The consumption emissions approach provides a more thorough portrayal of the emissions for which the community is responsible, and holds the potential to inspire deeper emissions reductions. For these reasons, the City also conducts a consumption-based analysis.

Each approach offers a different lens through which to see what emissions Oakland is responsible for, and provides a method of determining which areas of focus are most appropriate in establishing policies to minimize these emissions. Since climate change is a global issue that requires solutions on a global scale, Oakland prioritizes the findings of the consumption emissions approach. As a city, Oakland seeks to have a global impact by affecting not only those emissions resulting from our local activities, but also to understand and address how activities within Oakland create emissions around the world.

Core Emissions

Core emissions are GHGs emitted within city limits, such as those that result from using natural gas in homes or driving gasoline-powered cars. Measurement of core emissions is the typical method used by cities to measure GHG emissions, making comparisons from city to city easy.

Consumption Emissions

Consumption emissions are GHGs emitted due to community demand, including those used in production, transportation, and eventual disposal of goods and services. Measurement of consumption emissions is a relatively new method, and will continue to evolve as better data become available and more local governments refine and improve the approach.

CORE VS. CONSUMPTION EMISSIONS

These are the two scales of GHG emissions that may be calculated in a city. For example, when driving a car:

Core emissions are the carbon dioxide (CO_2) and nitrogen oxide (NO_x) that are emitted from vehicles while driving within city limits.

Consumption emissions include the core tailpipe emissions described above, plus emissions from the extraction, refinement, and distribution of the fuel.

This Report provides a summary and details of core emissions in Oakland to maintain consistency with international protocols and comparability to similar cities. However, the bulk of the analysis is focused on presentation of consumption emissions. This approach offers the greatest potential to impact GHG emissions at a global scale, and to ensure that the City and the community have the best and most applicable information on the full impacts of decisions and behaviors.

GHG Emissions Reporting

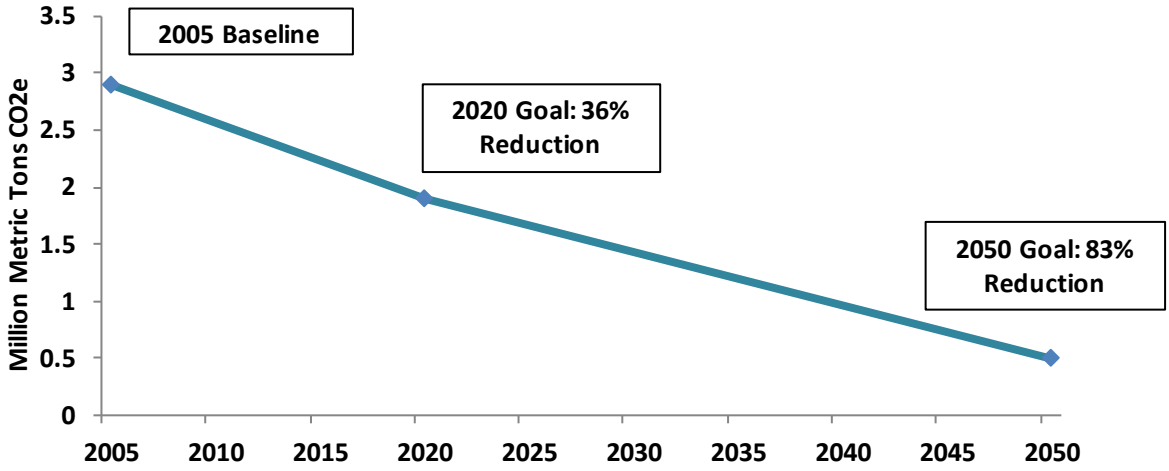
In recent years, local and regional governments across the world have been working to unify the approach to reducing GHG emissions. The City of Oakland has signed onto several of these efforts as part of its commitment, including the following:

- ***Compact of Mayors*** - Launched at the 2014 United Nations Climate Summit, the Compact of Mayors is the world's largest coalition of city leaders addressing climate change by pledging to reduce their greenhouse gas emissions, tracking their progress and preparing for the impacts of climate change. Beginning with the City's joining the Compact in 2015, this agreement requires the City of Oakland to inventory and report GHG emissions at least every three years, disclose climate vulnerabilities within two years, and disclose climate hazards within one year .
- ***Under 2 Memorandum of Understanding (Under 2 MOU)*** - This agreement was signed by Mayor Libby Schaaf in Paris at the U.N. Climate Change Conference of Parties, on December 6, 2015. Each signatory commits to limit emissions to 80 to 95 percent below 1990 levels, or below two metric tons per capita, by 2050, which is the level of emission reduction believed necessary to limit global warming to less than 2°C by the end of this century.
- ***Mayor's National Climate Action Agenda*** – This U.S.-based coalition of leading cities addressing climate change through policy and advocacy was started in 2015, and serves as a platform for furthering GHG reduction policies at the local and national levels.

GHG Reduction Goals

In 2009, the Oakland City Council adopted GHG reduction goals of 36 percent fewer emissions by 2020 and 83 percent fewer emissions by 2050. In pursuit of these goals, and in consistence with agreements, such as the Compact of Mayors and the Under 2 MOU, Oakland has committed to report on city-wide emissions every two years and strategize for meeting the 2020 and 2050 goals. **Figure 1** illustrates these goals in GHG emissions.

Figure 1: Oakland GHG Reduction Goals



Co-Benefits: Enhancing Equity through GHG Reduction

The City of Oakland strives to make a more livable and equitable city for all. In pursuing reductions of GHG emissions, the City has adopted a strategy of focusing on the emissions that not only contribute to climate change, but also create or exacerbate health, equity, and safety impacts for low income residents and communities of color. Examples of social benefits to be gained from GHG emissions reduction programs in Oakland include the following:

- Improved health outcomes, as indicated by measured rates of asthma and life expectancy, from air quality improvements in neighborhoods adjacent to freeways, industry, and the Port of Oakland
- Enhanced flood protection for low-lying neighborhoods resulting from lower runoff in the hill areas and reduced sea level rise
- Greater access to fresh and healthy foods to promote farmers markets, increase urban farming capacity, and better coordination among food providers
- Improved educational outcomes and experiences through collaboration with schools on water reduction, urban sustainability, and urban food growing efforts
- Lower utility bills and increased home comfort from energy efficiency retrofits of homes and apartments

In assessing new opportunities for programs and policies, the City actively considers these and other co-benefits to ensure that the approach to reducing emissions will also help address the health and equity of the community. While this Report is focused on GHG emissions rather than the co-benefits described above, additional discussion and details on social and climate justice considerations can be found in the Oakland ECAP.

Core Emissions Summary

Core emissions are GHGs emitted within city limits, such as those resulting from use natural gas in homes or gasoline in cars. This is the typical method cities use, making comparisons from city to city easy. In 2015, core emissions equaled 2,497,088 metric tons of carbon dioxide equivalent (MT CO2e). As shown in **Figure 2**, 56.6 percent of core emissions were generated in the transportation and land use sectors of the community, including both vehicle emissions and stationary emitters such as the wastewater treatment plant. 33.4 percent of emissions came from buildings and energy use, including electricity and natural gas use in homes, businesses, and other buildings. 2.6 percent came from material consumption and waste, specifically from emissions associated with breakdown of biological landfill contributions from Oakland homes and businesses. Finally, 6.1 percent came from the Port of Oakland and just 1.3 percent from City government activities.

Figure 2: Core Emissions

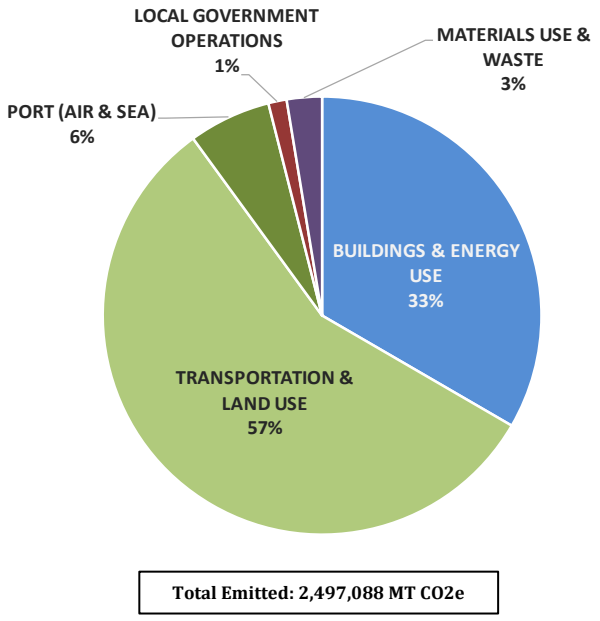
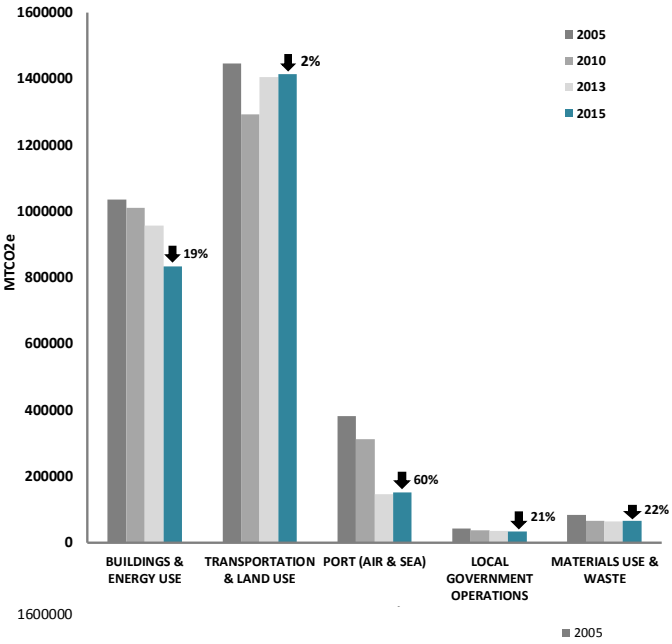


Figure 3: Core Emissions by Sector



Overall, core emissions are down in all activities compared to 2005. **Figure 3** provides details on the changes in core emissions since 2005, highlighting the areas in which emissions reductions have been achieved. It includes emissions associated with activities such as transportation, building energy and water use, solid waste, operating the sea and air ports, and operating the local government. The largest percentage reductions come from solid waste (22 percent reduction), maritime and airport operation (60 percent reduction), and local government operations (21 percent reduction). Overall, core emissions are 16.4% lower in 2015 than in 2005.

Consumption Emissions Summary

Consumption emissions are lifecycle GHGs emitted due to activities occurring within city limits, such as those required to produce, ship, and dispose of goods. In 2015, Oakland's consumption emissions equaled 7,482,738 metric tons of carbon dioxide equivalent (MT CO2e). This is more than double the core emissions shown on the previous page. As shown in **Figure 4**, 24 percent of these emissions were generated in the transportation and land use sectors of the community, compared to 56.6 percent in the core emissions analysis. 15.8 percent of emissions came from buildings and energy use, compared to 33.4 percent in the core analysis. Material consumption and waste emissions changed the most dramatically, increasing from 2.6 percent in the core analysis to 45 percent in the consumption analysis. This is due to the inclusion of emissions associated with manufacturing, processing, packaging, and shipping of products consumed by those living and working in Oakland.

Figure 4: Consumption Emissions

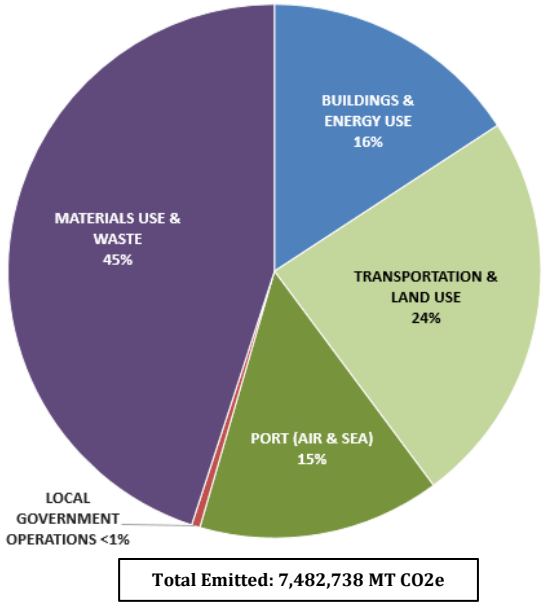
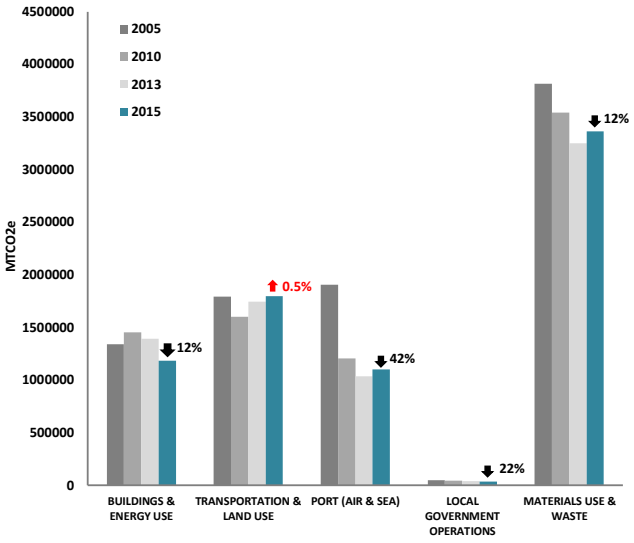


Figure 5: Consumption Emissions by Sector



The change in emissions associated with each sector is illustrated in **Figure 5**. This chart illustrates the changes in emissions associated with the same activities outlined in the core breakdown, but from a consumption perspective. Overall, consumption emissions are down in all activities except transportation and land use emissions, which are half a percent higher than in 2005. While population increases throughout the Bay area, there has been a corresponding increased number of vehicle miles traveled on Oakland's roads. Population growth is a known driver of increased emissions. The largest percentage reductions come from material use and waste, sea and air port operation, and building and energy use.

Consumption emissions are higher than core emissions due to the addition of upstream emissions, which include all aspects of extracting raw materials, and manufacturing and shipping products to the community. In this analysis, the full impact of materials consumption and waste in Oakland's emissions profile becomes apparent. It can be inferred from this the significant effect that a reduction in consumption, and particularly in the number of goods manufactured overseas and consumed in Oakland, would have on lowering GHG emissions.

As shown in **Figure 6**, there is significant difference in upstream emissions across these categories. Solid waste emissions, as described on the previous page, represent the largest difference between core and consumption emissions. However, differences are present in the port/airport, transportation/land use, and buildings/energy use categories as well. Local government operations do not have a significant difference between core and consumption emissions, and are approximately one percent of total emissions.

Both emissions summaries illustrate that the City has made substantial progress in reducing overall emissions, but additional progress is needed. **Figure 7** illustrates the progress made in meeting the emissions reduction goal from both the core and consumption approaches.

Figure 6: Core and Consumption Emissions by Category

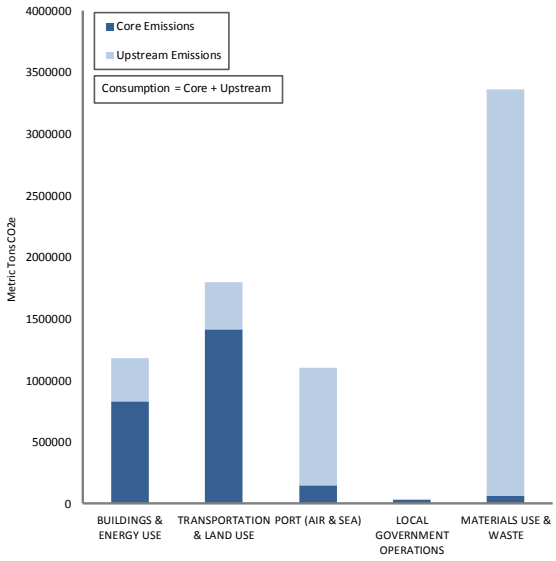
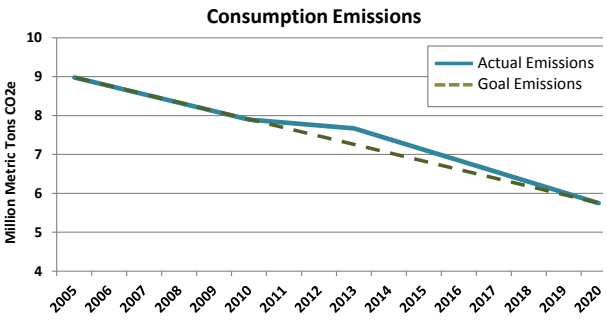
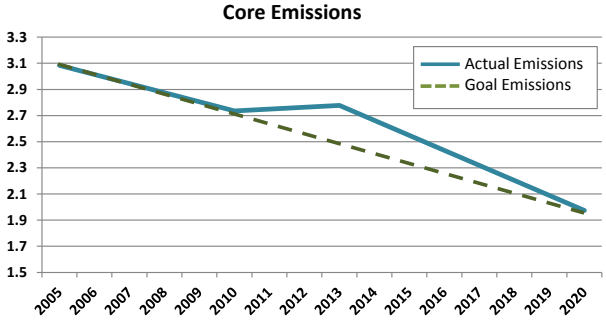


Figure 7: Core and Consumption Emissions Progress toward 2020 Goal





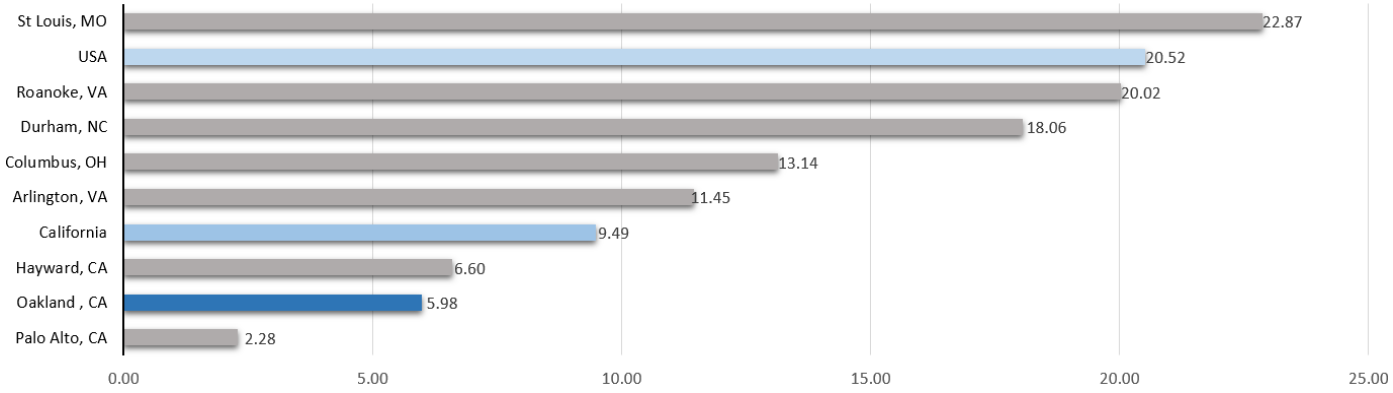
Core emissions are not on track to meet the 2020 goal, though they have been reduced more than sixteen percent since 2005. To meet this goal, Oakland must further reduce emissions by 585,000 MT

CO2e by 2020. Consumption emissions are also not on track to meet the 2020 goal, but have been reduced more than 16 percent since 2005, due largely to the City's work in reducing waste-related emissions. To meet the 2020 goal from a consumption standpoint, Oakland must reduce emissions by 1,782,000 MT CO2e by 2020.

Per Capita Emissions Comparison to Other Cities

Another method of understanding GHG emissions is by comparison of per capita emissions, showing the rate of emissions per person in the community. This type of comparison allows cities of different sizes to compare emissions, while also ensuring that emissions are counted using a consistent methodology. As shown in **Figure 8**, 2015 per capita core emissions for the City of Oakland are very low by national standards, averaging 5.90MT CO2e**, 46 percent lower than the California average and 71 percent lower than the national average.**

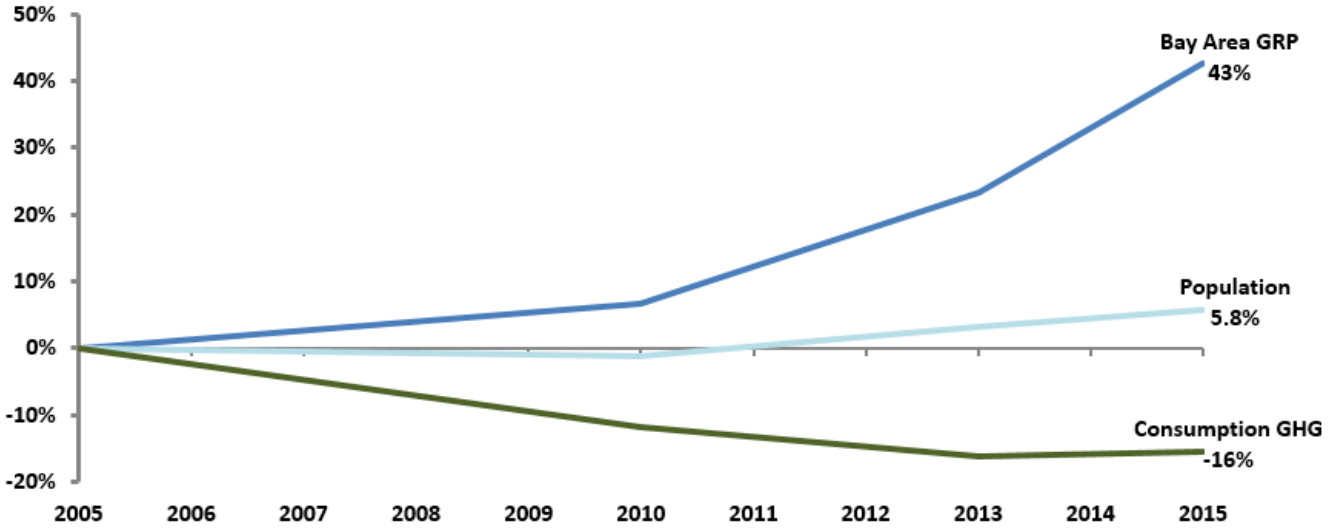
Figure 8: Per Capita Emissions of the U.S., California, and Selected Cities



Emissions Relative to Economic Growth

The rate of emissions is also trending downward during a time of overall economic growth. Between the baseline year of 2005 and the inventory year of 2015, the population of the city grew by 5.8 percent. While no specific Oakland economic activity numbers are available, the Gross Regional Product, a composite figure representing overall economic activity in the Bay Area, also increased by 43 percent over the same time frame. This indicates that the community is finding ways to reduce its emissions even as more people live and work in Oakland. **Figure 9** illustrates the reduction in emissions relative to economic and population growth.

Figure 9: Emissions Reductions with Economic and Population Growth



Conclusions

Oakland has made substantial progress in reducing GHG emissions across the city. While much work remains to be done to meet the City's 2020 goal, the City has set in place a wide variety of programs, policies, and efforts that have proven successful in lowering its carbon footprint. In its ongoing implementation of the ECAP, the City will continue this progress and capitalize on the opportunities presented to lower emissions, while continuing to grow and prosper. The ability of City government to work with residents, businesses, coalitions, and community advocates will increase the likelihood that the City's ambitious goals are met.

Consistent with the Compact of Mayors and the Under 2 MOU, the City of Oakland is committed to reporting on its GHG emissions every two years, using protocols agreed to by the international community and consistent with the best practices in the industry. The City's ongoing focus on equity as a priority in targeting emissions reductions strategies will serve to further strengthen the community, while addressing its environmental priorities, and ensure that the resources invested in fighting climate change also help support climate justice.

With the progress identified in this GHG Emissions Inventory Report, the City of Oakland is well positioned to pursue its targets and continue to report its progress to the community in a timely manner.

Appendix A
GHG Emissions Data and Methodology

Table of Contents

List of Tables

Emissions Data and Methodology Overview

The updates to the 2005, 2010, and 2013 GHG Emissions Inventories, and the newly created 2015 Inventory, were conducted following a review of similar inventories in U.S. cities, discussions and guidance from ICLEI Local Governments for Sustainability, and in coordination with a wide range of local and regional partners who maintain data necessary to complete a comprehensive analysis. This appendix sets forth the details regarding how each of the inventories were completed, the sources and details of the data used, and the demographic information used in completing the analysis.

Following the presentation of demographics and data sources used in the inventories, tables are provided showing the raw data, emissions in each of the major categories, and total carbon dioxide equivalent (CO2e) emissions for each activity type. These files are summaries of a broader range of inputs associated with the emissions model used. For more information on the model files, please contact the Environmental Services Division of Oakland Public Works.

Reporting Protocol

The City of Oakland used ICLEI U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions Version 1.1 as the overarching inventory methodology. ICLEI's ClearPath tool was used for many calculations and as a database. When applicable, updates were made per instruction from sources used within ICLEI protocol. The City has committed to measuring progress on a regular basis through various programs including the Compact of Mayors, Under 2 MOU, and the Mayor's National Climate Action Agenda. Per these requirements, the Core Inventory was also analyzed using the Global Protocol for Community-Scale Emissions (GPC). Both versions have been published and shared through the Compact of Mayors and *Carbonn*.

Demographics of Oakland

Table 1: Demographics

	2000 Census		2010 Census		2013 ACS Estimates		2015 ACS Estimates		% Increase
	#	% of Total	#	% of Total	#	% of Total	#	% of Total	from 2005
Population									
Population	397,931		390,724		407,667		419,278		5%
Race & Ethnicity									
White Alone	124,829	31.4%	134,800	34.5%	160,621	39.4%	154,160	36.8%	23%
Black or African American Alone	141,538	35.6%	109,403	28.0%	110,070	27.0%	104,481	24.9%	-26%
American Indian or Alaska Native Alone	2,639	0.7%	3,126	0.8%	2,854	0.7%	3,540	0.8%	34%
Asian Alone	60,805	15.3%	65,642	16.8%	67,265	16.5%	64,168	15.3%	6%
Native Hawaiian and Other Pacific Islander Alone	1,995	0.5%	2,344	0.6%	2,446	0.6%	1,756	0.4%	-12%
Two or More Races	19,843	5.0%	21,881	5.6%	23,237	5.7%	25,914	6.2%	31%
Hispanic or Latino (of any race)	86,954	21.9%	99,244	25.4%	104,770	25.7%	114,054	27.2%	31%
Housing									
Housing Units	157,508		169,710		170,977		169,213		7%
Households	150,790		155,918				161,104		7%
Persons per Household	2.52		2.47		2.52		2.56		2%

Data Sources

Table 2: Sources by Activity

Activity	Core Sources	Upstream Sources
Buildings and Energy Use		
Residential Energy	Pacific Gas & Electric	ICLEI, Pacific Gas & Electric
Commercial Energy	Pacific Gas & Electric	ICLEI, Pacific Gas & Electric
Industrial Energy	Unable to Include - CPUC 15/15 Rule*	Unable to Include - CPUC 15/15 Rule*
Water and Wastewater	East Bay Municipal Utiltiy District	---
Transportation and Mobile Sources		
State Highway Gasoline	Highway Performance Monitoring system, Air Resources Board EMFAC Database	GREET - Argonne National Laboratory
State Highway Diesel	Highway Performance Monitoring system, Air Resources Board EMFAC Database, Onthemap Census	GREET - Argonne National Laboratory
On-Road Gasoline	Metropolitan Transportaion Commission	GREET - Argonne National Laboratory
On-Road Diesel	Metropolitan Transportaion Commission	GREET - Argonne National Laboratory
Airport & Sea Port	Oakland Airport Monthly Reports, Port of Oakland GHG Inventory	GREET - Argonne National Laboratory *Sea Port: Unable to include*
Public Transit	Union Pacific Railroad GHG Inventory, National Transit Database, Bay Area Rapid Transit, Alameda-Contra Costa Transit, Water Emergency Transportation Authority, Amtrak, Onthemap Census	---
Materials Use & Waste		
Solid Waste	CalRecycle, StopWaste, Alameda County Waste Characterization	EPA WARM Model
Upstream Goods & Services	---	Cool Climate Calculator, UC Berkeley
Construction Upstream	---	Census Building Permit Data, EIO-LCA

* The 15/15 Rule states that an aggregation sample must have more than 15 customers and no single customer's data may comprise more than 15% of the total aggregated data in order for the data to be released.

Core Inventories

Table 3: 2005 Core Inventory – Community and Local Government

2005 Core Emissions		"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to Oak
Buildings & Energy Use								**1,034,747**
Residential Energy								**496,715**
Grid Electricity		669,162,847	kWh	2,283,800	148,474	9.106	3.339	149,696
Natural Gas Consumption		65,260,095	Therm	6,526,000	346,009	32.630	0.653	347,019
Commercial Energy								**526,672**
Grid Electricity		1,156,040,831	kWh	3,945,500	256,502	15.731	5.768	258,614
Natural Gas Consumption		50,410,690	Therm	5,041,100	267,277	25.205	0.504	268,058
Water and Wastewater					5,102	37.821	0.314	**11,360**
Transportation & Mobile Sources								**1,827,200**
Airport		146,619,264	Gallons	1,858,338	146,427	1.189	0.542	**146,618**
Jet Fuel		135,758,578	Gallons	1,689,400	134,728	-	0.524	134,884
Passenger		135,758,578	Gallons	1,689,400	134,728	-	0.524	134,884
Aviation Fuel		10,860,686	Gallons	168,938	11,699	1.189	0.019	11,734
Passenger		10,860,686	Gallons	168,938	11,699	1.189	0.019	11,734
Public Transit								**39,652**
BART		289,071,795	kWh	226,916	14,752	0.095	0.332	14,873
AC Transit		1,691,534	gallons diesel	233,593	17,271	--	--	17,271
Union Pacific Rail		2,755	route miles in C	--	--	--	--	5,100
WETA Ferry		506,700	gallons	17,493	1,293	0.094	0.033	1,306
Amtrak		106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline								**538,168**
Gasoline Tailpipe Emissions:		1,341,112,334	VMT	7,609,500	534,492	20.066	10.652	**538,168**
Passenger Vehicles	97.1%	1,301,670,289	VMT	7,385,705	518,773	19.476	10.339	522,341
Light-Duty Truck	2.2%	28,889,375	VMT	163,919	11,514	0.432	0.229	11,593
Heavy-Duty Truck	0.02%	334,801	VMT	1,900	133	0.005	0.003	134
State Highway Diesel								**21,122**
Diesel Tailpipe Emissions:		30,878,866	VMT	285,495	21,108	0.036	0.045	21,122
Passenger Vehicles	23.6%	7,277,291	VMT	67,283	4,975	0.009	0.011	4,978
Light-Duty Truck	48.3%	14,924,218	VMT	137,984	10,202	0.018	0.022	10,209
Heavy-Duty Truck	8.3%	2,571,881	VMT	23,779	1,758	0.003	0.004	1,759
On-Road Gasoline								**598,518**
Gasoline Tailpipe Emissions:				8,463,100	594,446	21.995	11.821	598,518
On-Road Diesel								**248,122**
Diesel Tailpipe Emissions:				3,353,800	247,960	0.380	0.513	248,122
Port of Oakland					no data	no data	no data	**235,000**
Materials Use & Waste								**82,977**
Solid Waste		618,451	tons				3,258	**82,977**
Solid Waste from Franchise Haul		238,392	tons				1,762	45,571
Solid Waste from ADC		201,625	tons				497	12,414
Solid Waste from Self Haul		178,434	tons				1,000	24,992
TOTAL COMMUNITY								**2,944,924**

Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							**21,998**
Buildings and Facilities Electricity							**14,635**
Electric	65,458,807	kWh	223,409	14,524	0.891	0.327	14,635
Buildings and Facilities Natural Gas							**7,363**
Natural Gas	1,384,412	therms	138,441	7,340	0.692	0.014	7,363
Streetlight & Traffic Controllers							**5,927**
	26,507,507	kWh	90,469	5,882	0.361	0.132	5,927
Municipal Vehicle Fleet							**10,577**
Fleet: Diesel							**2,628**
Diesel	257,266	gallons	35,513	2,627	0.006	0.006	2,628
Fleet: Gasoline							**7,519**
Gasoline	852,674	gallons	106,542	7,487	0.181	0.103	7,519
Fleet: CNG							**430**
Compressed Natural Gas	62,117	gallons			0.476	0.033	430
Municipal Waste Generation							**4,243**
	10,411	tons					**4,243**
TOTAL LOCAL GOVERNMENT							**42,745**
TOTAL COMMUNITY AND LOCAL GOVERNMENT							**2,987,669**

Table 4: 2010 Core Inventory – Community and Local Government

2010 Core Emissions		"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to Oak
Buildings & Energy Use								**1,010,526**
Residential Energy								**496,021**
Grid Electricity		704,867,306	kWh	2,405,700	142,277	9.109	1.928	143,079
Natural Gas Consumption		66,373,978	Therm	6,637,400	351,915	33.187	0.664	352,942
Commercial Energy								**503,282**
Grid Electricity		1,226,636,428	kWh	4,186,500	247,595	15.852	3.355	248,991
Natural Gas Consumption		47,821,731	Therm	4,782,200	253,551	23.911	0.478	254,291
Water and Wastewater					5,034	37.373	0.310	**11,223**
Transportation & Mobile Sources								**1,603,854**
Airport		78,063,264	Gallons	971,419	76,682	0.529	0.286	**76,781**
Jet Fuel		72,027,503	Gallons	896,310	71,481	0.000	0.278	71,564
Passenger		72,027,503	Gallons	896,310	71,481	0.000	0.278	71,564
Aviation Fuel		6,035,761	Gallons	75,109	5,201	0.529	0.008	5,217
Passenger		6,035,761	Gallons	75,109	5,201	0.529	0.008	5,217
Public Transit								**37,917**
BART		267,635,305	kWh	210,089	12,425	0.795	0.168	12,495
AC Transit		1,804,039	gallons diesel	249,129	18,419	--	--	18,419
Union Pacific Rail		2,755	route miles in C	--	--	--	--	5,100
WETA Ferry		310,855	gallons	10,732	793	0.058	0.020	801
Amtrak		106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline								**468,930**
Gasoline Tailpipe Emissions:		1,315,302,654	VMT	6,571,200	461,558	26.725	22.499	**468,930**
Passenger Vehicles	97.1%	1,276,619,669	VMT	6,377,941	447,984	25.939	21.837	455,139
Light-Duty Truck	2.2%	27,500,116	VMT	141,553	9,943	0.576	0.485	10,101
Heavy-Duty Truck	0.02%	6,865	VMT	1,640	115	0.007	0.006	117
State Highway Diesel								**19,436**
Diesel Tailpipe Emissions:		32,051,046	VMT	262,688	19,422	0.033	0.044	19,436
Passenger Vehicles	23.6%	7,553,542	VMT	61,908	4,577	0.008	0.010	4,581
Light-Duty Truck	48.3%	15,490,750	VMT	126,961	9,387	0.016	0.021	9,394
Heavy-Duty Truck	8.3%	2,669,511	VMT	21,879	1,618	0.003	0.004	1,619
On-Road Gasoline								**562,175**
Gasoline Tailpipe Emissions:				7,877,800	553,335	31.763	26.999	562,175
On-Road Diesel								**203,615**
Diesel Tailpipe Emissions:				2,752,200	203,480	0.310	0.427	203,615
Port of Oakland					no data	no data	no data	**235,000**
Materials Use & Waste								**65,898**
Solid Waste		555,970	tons				2,577	**65,898**
Solid Waste from Franchise Haul		184,786	tons				1,634	42,324
Solid Waste from ADC		264,995	tons				348	8,701
Solid Waste from Self Haul		106,189	tons				595	14,873
TOTAL COMMUNITY								**2,680,278**

Local Government Emissions			MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							**23,324**
Buildings and Facilities Electricity							**14,030**
Electric	69,133,236	kWh	235,950	13,954	0.893	0.189	14,030
Buildings and Facilities Natural Gas							**9,294**
Natural Gas	1,747,474	therms	174,747	9,265	0.874	0.017	9,294
Streetlight & Traffic Controllers							**5,912**
	29,132,671	kWh	99,429	5,880	0.376	0.080	5,912
Municipal Vehicle Fleet							**6,643**
Fleet: Diesel							**2,383**
Diesel	233,229	gallons	32,195	2,381	0.005	0.005	2,383
Fleet: Gasoline							**3,776**
Gasoline	426,173	gallons	53,250	3,742	0.126	0.116	3,776
Fleet: CNG							**485**
Compressed Natural Gas	70,000	gallons			0.537	0.038	485
Municipal Waste Generation							**1,753**
	7,439	tons					**1,753**
TOTAL LOCAL GOVERNMENT							**37,632**
TOTAL COMMUNITY AND LOCAL GOVERNMENT							**2,717,911**

Table 5: 2013 Core Inventory – Community and Local Government

2013 Core Emissions		"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to Oak
Buildings & Energy Use								**956,096**
Residential Energy								**472,983**
Grid Electricity		701,090,119	kWh	2,392,800	135,790	9.060	1.918	136,588
Natural Gas Consumption		63,262,073	Therm	6,326,200	335,416	31.631	0.633	336,395
Commercial Energy								**473,596**
Grid Electricity		1,187,906,499	kWh	4,054,300	230,079	15.351	3.249	231,431
Natural Gas Consumption		45,541,305	Therm	4,554,100	241,460	22.771	0.455	242,165
Water and Wastewater					5,084	31.782	0.313	**9,517**
Transportation & Mobile Sources								**1,552,581**
Airport		79,538,190	Gallons	989,773	78,170	0.513	0.292	**78,270**
Jet Fuel		73,688,026	Gallons	916,974	73,129	0.000	0.284	73,213
Passenger		73,688,026	Gallons	916,974	73,129	0.000	0.284	73,213
Aviation Fuel		5,850,164	Gallons	72,799	5,041	0.513	0.008	5,057
Passenger		5,850,164	Gallons	72,799	5,041	0.513	0.008	5,057
Public Transit								**36,113**
BART		279,617,965	kWh	200,409	13,291	0.759	0.161	13,358
AC Transit		1,525,069	gallons diesel	210,605	15,571	0.033	0.031	15,581
Union Pacific Rail		2,755	route miles in C	--	--	--	--	5,100
WETA Ferry		377,090	gallons	13,019	963	0.070	0.025	972
Amtrak		106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline								**574,370**
Gasoline Tailpipe Emissions:		1,642,134,179	VMT	8,046,200	565,168	33.383	28.078	**574,370**
Passenger Vehicles	97.1%	1,593,839,097	VMT	7,809,562	548,546	32.401	27.252	557,478
Light-Duty Truck	2.2%	35,373,793	VMT	173,326	12,174	0.719	0.605	12,373
Heavy-Duty Truck	0.02%	409,949	VMT	2,009	141	0.008	0.007	143
State Highway Diesel								**24,196**
Diesel Tailpipe Emissions:		42,238,621	VMT	327,017	24,178	0.043	0.057	24,196
Passenger Vehicles	23.6%	9,954,470	VMT	77,069	5,698	0.010	0.014	5,702
Light-Duty Truck	48.3%	20,414,557	VMT	158,052	11,686	0.021	0.028	11,694
Heavy-Duty Truck	8.3%	3,518,028	VMT	27,237	2,014	0.004	0.005	2,015
On-Road Gasoline		1,601,507,858	VMT					**556,044**
Gasoline Tailpipe Emissions:				7,789,400	547,130	32.030	27.226	556,044
On-Road Diesel		267,886,223	VMT					**215,348**
Diesel Tailpipe Emissions:				2,910,700	215,202	0.340	0.460	215,348
Port of Oakland					67,792	1.000	6.000	**68,240**
Materials Use & Waste								**63,205**
Solid Waste		568,713	tons				3,239	**63,205**
Solid Waste from Franchise Haul		185,690	tons				2,254	38,573
Solid Waste from ADC		271,074	tons				358	8,953
Solid Waste from Self Haul		111,949	tons				627	15,680
TOTAL COMMUNITY								**2,571,882**

Local Government Emissions				MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities								**22,386**
Buildings and Facilities Electricity								**13,373**
Electric		68,660,589	kWh	234,336	13,298	0.887	0.188	13,373
Buildings and Facilities Natural Gas								**9,013**
Natural Gas		1,694,597	therms	169,459	8,985	0.847	0.017	9,013
Streetlight & Traffic Controllers								**5,127**
		26,321,865	kWh	89,836	5,098	0.340	0.072	5,127
Municipal Vehicle Fleet								**5,194**
Fleet: Diesel								**1,295**
Diesel		126,764	gallons	17,499	1,294	0.003	0.003	1,295
Fleet: Gasoline								**3,328**
Gasoline		374,700	gallons	46,819	3,290	0.141	0.130	3,328
Fleet: CNG								**571**
Compressed Natural Gas		80,000	gallons		525	0.980	0.069	571
Municipal Waste Generation								**2,305**
		5,655	tons			82.307		2,305
TOTAL LOCAL GOVERNMENT								**35,011**
TOTAL COMMUNITY AND LOCAL GOVERNMENT								**2,606,893**

Table 6: 2015 Core Inventory – Community and Local Government

2015 Core Emissions		"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to Oak
Buildings & Energy Use								**833,582**
Residential Energy								**413,953**
Grid Electricity		667,931,952	kWh	2,279,600	129,974	10.028	1.212	130,586
Natural Gas Consumption		53,289,645	Therm	5,329,000	282,542	26.645	0.533	283,367
Commercial Energy								**410,285**
Grid Electricity		1,163,270,504	kWh	3,970,200	226,362	17.465	2.111	227,428
Natural Gas Consumption		34,387,860	Therm	3,438,800	182,324	17.194	0.344	182,857
Water and Wastewater					5,365	31.204	0.330	**9,344**
Transportation & Mobile Sources								**1,565,115**
Airport		85,782,051	Gallons	1,054,090	83,241	0.551	0.311	**83,348**
Jet Fuel		79,409,988	Gallons	975,790	77,819	0.000	0.302	77,909
Passenger		79,409,988	Gallons	975,790	77,819	0.000	0.302	77,909
Aviation Fuel		6,372,063	Gallons	78,300	5,422	0.551	0.009	5,439
Passenger		6,372,063	Gallons	78,300	5,422	0.551	0.009	5,439
Public Transit								**39,302**
BART		273,220,484	kWh	223,798	12,760	0.985	0.119	12,820
AC Transit		1,564,357	gallons diesel	216,030	15,972	0.036	0.034	15,983
Union Pacific Rail		2,755	route miles in C.	--	--	--	--	8,157
WETA Ferry		481,101	gallons	16,609	1,228	0.089	0.031	1,240
Amtrak		106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline								**574,259**
Gasoline Tailpipe Emissions:		1,670,071,447	VMT	8,010,600	563,488	32.804	39.826	**574,259**
Passenger Vehicles	97.3%	1,624,979,518	VMT	7,794,314	548,274	31.918	38.751	558,754
Light-Duty Truck	1.9%	31,731,357	VMT	152,201	10,706	0.623	0.757	10,911
Heavy-Duty Truck	0.03%	501,021	VMT	2,403	169	0.010	0.012	172
State Highway Diesel								**25,335**
Diesel Tailpipe Emissions:		43,902,853	VMT	342,409	25,316	0.045	0.061	25,335
Passenger Vehicles	26.8%	11,765,965	VMT	91,766	6,785	0.012	0.016	6,790
Light-Duty Truck	47.8%	20,985,564	VMT	163,672	12,101	0.022	0.029	12,110
Heavy-Duty Truck	8.3%	3,656,641	VMT	28,519	2,109	0.004	0.005	2,110
On-Road Gasoline		1,627,422,538	VMT					**555,741**
Gasoline Tailpipe Emissions:				7,764,400	545,373	32.548	32.060	555,741
On-Road Diesel		270,905,409	VMT					**218,890**
Diesel Tailpipe Emissions:				2,958,600	218,741	0.350	0.470	218,890
Port of Oakland					67,792	1.000	6.000	**68,240**
Materials Use & Waste								**64,727**
Solid Waste		567,026	tons				2,258	**64,727**
Solid Waste from Franchise Haul		184,717	tons				1,514	37,302
Solid Waste from ADC		268,685	tons				345	8,953
Solid Waste from Self Haul		113,624	tons				399	15,680
Transportation from Solid Waste								2,792
TOTAL COMMUNITY								**2,463,424**

Local Government Emissions			MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e	
Municipal Buildings & Facilities								**22,412**
Buildings and Facilities Electricity								**15,052**
Electric		76,995,007	kWh	262,782	14,983	1.156	0.140	15,052
Buildings and Facilities Natural Gas								**7,360**
Natural Gas		1,694,597	therms	138,378	7,337	0.692	0.014	7,360
Streetlight & Traffic Controllers								**3,721**
		19,031,777	kWh	64,955	3,703	0.286	0.035	3,721
Municipal Vehicle Fleet								**6,468**
Fleet: Diesel								**2,350**
Diesel		230,000	gallons	31,749	2,348	0.005	0.005	2,350
Fleet: Gasoline								**3,551**
Gasoline		396,000	gallons	49,480	3,477	0.892	0.185	3,551
Fleet: CNG								**568**
Compressed Natural Gas		80,000	gallons		525	0.889	0.066	568
Municipal Waste Generation								**1,063**
		5,655	tons			37.975		1,063
TOTAL LOCAL GOVERNMENT								**33,664**
TOTAL COMMUNITY AND LOCAL GOVERNMENT								**2,497,088**

Consumption Inventories

Table 7: 2005 Consumption Inventory – Community

2005 Consumption Emissions		"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to Oakland
Buildings & Energy Use								**1,341,782**
Residential Energy								**636,778**
Grid Electricity		669,162,847	kWh	2,283,800	148,474	9.106	3.339	149,696
Natural Gas Consumption		65,260,095	Therm	6,526,000	346,009	32.630	0.653	347,019
Upstream Electric Generation Emissions								48,783
Upstream Natural Gas Gerneration Emissions								78,688
Transmission Losses		61,796,724	kWh	211,701	12,520	0.802	0.170	12,591
Commercial Energy								**693,644**
Grid Electricity		1,156,040,831	kWh	3,945,500	256,502	15.731	5.768	258,614
Natural Gas Consumption		50,410,690	Therm	5,041,100	267,277	25.205	0.504	268,058
Upstream Electric Generation Emissions								84,278
Upstream Natural Gas Generation Emissions								60,783
Transmission Losses		107,540,968	kWh	368,410	21,788	1.395	0.295	21,911
Water and Wastewater					5,102	37.821	0.314	**11,360**
Transportation & Mobile Sources								**3,701,675**
Airport								**1,671,027**
Jet Fuel		35,195,411	Gallons	1,689,400	134,728	0.000	0.524	1,667,117
Passenger		14,078,164	Gallons	16,291,000	1,299,200	0.000	5.050	1,300,700
Freight		3,519,541	Gallons	4,072,800	324,802	0.000	1.263	325,179
Total Jet Fuel Upstream		17,597,706	Gallons		29,514	0.442	262	41,238
Aviation Fuel		48,641	Gallons	56,287	3,898	0.397	0.006	3,910
Passenger		38,913	Gallons	45,030	3,118	0.317	0.005	3,128
Freight		9,728	Gallons	11,257	780	0.080	0.001	782
Public Transit								**39,652**
BART		289,071,795	kWh	226,916	14,752	0.095	0.332	14,873
AC Transit		1,691,534	gallons diesel	233,593	17,271	--	--	17,271
Union Pacific Rail		2,755	route miles in CA	--	--	--	--	5,100
WETA Ferry		506,700	gallons	17,493	1,293	0.094	0.033	1,306
Amtrak		106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline								**679,219**
Gasoline Tailpipe Emissions:		1,341,112,334	VMT	7,609,500	534,492	20.066	10.652	**538,168**
Passenger Vehicles	97.1%	1,301,670,289	VMT	7,385,705	518,773	19.476	10.339	522,341
Light-Duty Truck	2.2%	28,889,375	VMT	163,919	11,514	0.432	0.229	11,593
Heavy-Duty Truck	0.02%	334,801	VMT	1,900	133	0.005	0.003	134
Gasoline Well to Pump Emissions:					127,640	2.050	1,145	**141,051**
Passenger Vehicles	97.1%				123,887	1.989	1,111	136,903
Light-Duty Truck	2.2%				2,750	0.044	25	3,038
Heavy-Duty Truck	0.02%				32	0.001	0.286	35
State Highway Diesel								**25,211**
Diesel Tailpipe Emissions:		30,878,866	VMT	285,495	21,108	0.036	0.045	21,122
Passenger Vehicles	23.6%	7,277,291	VMT	67,283	4,975	0.009	0.011	4,978
Light-Duty Truck	48.3%	14,924,218	VMT	137,984	10,202	0.018	0.022	10,209
Heavy-Duty Truck	8.3%	2,571,881	VMT	23,779	1,758	0.003	0.004	1,759
Diesel Well to Pump Emissions:					3,112	0.047	38.545	4,089
Passenger Vehicles	23.6%				733	0.011	9.084	964
Light-Duty Truck	48.3%				1,504	0.023	18.629	1,976
Heavy-Duty Truck	8.3%				259	0.004	3.210	341
On-Road Gasoline		1,496,269,740	VMT	8,463,100	722,086	24.045	1,157	**755,392**
Gasoline Tailpipe Emissions:				8,463,100	594,446	21.995	11.821	598,518
Gasoline Well to Pump Emissions (currently allocate 100% passenger cars)					127,640	2.050	1,145	156,874
On-Road Diesel		297,989,532	VMT	3,353,800	284,513	0.933	453	**296,174**
Diesel Tailpipe Emissions:				3,353,800	247,960	0.380	0.513	248,122
Diesel Well to Pump Emissions: (currently allocate 100% freight vehicles)					36,553	0.553	453	48,052
Port of Oakland					no data	no data	no data	**235,000**
Materials Use & Waste								**3,815,248**
Solid Waste								**1,408,762**
Landfill Methane		618,451	tons				3,258	82,977
Upstream from Franchise Hauled Waste		238,392	tons					650,421
Upstream from Self-Hauled Waste		142,747	tons					325,963
Upstream from Alternate Daily Cover		201,625	tons					284,274
Upstream Recycling		43,901	tons					56,374
Upstream Compost		39,495	tons					8,755
Upstream of Goods & Food								**2,241,486**
Goods		7.534	MTCO2e/Household					1,029,996
Food		8.039	MTCO2e/Household					1,211,490
Construction Upstream Emissions								**165,000**
Construction		252	New Buildings					165,000
TOTAL COMMUNITY								**8,858,704**
TOTAL COMMUNITY AND LOCAL GOVERNMENT								**8,907,638**

Table 8: 2005 Consumption Inventory – Local Government Operations

2005 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							**28,005**
Buildings and Facilities Electricity							**18,973**
Electric	65,458,807	kWh	223,409	14,524	0.891	0.327	14,635
Upstream Electric							4,338
Buildings and Facilities Natural Gas							**9,032**
Natural Gas	1,384,412	therms	138,441	7,340	0.692	0.014	7,363
Upstream Natural Gas							1,669
Streetlight & Traffic Controllers							**5,927**
	26,507,507	kWh	90,469	5,882	0.361	0.132	5,927
Municipal Vehicle Fleet							**10,759**
Fleet: Diesel							**2,688**
Diesel	257,266	gallons	35,513	2,627	0.006	0.006	2,628
Upstream Diesel				46	0.007	0.516	59
Fleet: Gasoline							**7,634**
Gasoline	852,674	gallons	106,542	7,487	0.181	0.103	7,519
Upstream Gasoline				84	0.002	1.428	115
Fleet: CNG							**438**
Compressed Natural Gas	62,117	gallons	7764.600	407.870	0.476	0.033	430
Upstream CNR				4.194	0.001	0.158	8
Municipal Waste Generation							**4,243**
	10,411	tons			151.53		
TOTAL LOCAL GOVERNMENT							**48,934**

Table 9: 2010 Consumption Inventory – Community

2010 Consumption Emissions		"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to Oakland
Buildings & Energy Use								**1,454,119**
Residential Energy								**687,685**
Grid Electricity		704,867,306	kWh	2,405,700	142,277	9.109	1.928	143,079
Natural Gas Consumption		66,373,978	Therm	6,637,400	351,915	33.187	0.664	352,942
Upstream Electric Generation Emissions								99,042
Upstream Natural Gas Gerneration Emissions								80,031
Transmission Losses		61,796,724	kWh	211,701	12,520	0.802	0.170	12,591
Commercial Energy								**755,211**
Grid Electricity		1,226,636,428	kWh	4,186,500	247,595	15.852	3.355	248,991
Natural Gas Consumption		47,821,731	Therm	4,782,200	253,551	23.911	0.478	254,291
Upstream Electric Generation Emissions								172,356
Upstream Natural Gas Generation Emissions								57,662
Transmission Losses		107,540,968	kWh	368,410	21,788	1.395	0.295	21,911
Water and Wastewater					5,034	37.373	0.310	**11,223**
Transportation & Mobile Sources								**2,809,909**
Airport								**972,592**
Jet Fuel		18,673,130	Gallons	10,804,100	876,991	0.168	139.9	886,167
Passenger		7,469,252	Gallons	8,643,300	689,303	-	2.379	690,102
Freight		1,867,313	Gallons	2,160,800	172,326	-	0.670	172,525
Total Jet Fuel Upstream		9,336,565	Gallons		15,362	0.168	136.8	23,540
Aviation Fuel		782,385	Gallons	905,364	62,696	6.374	0.100	62,885
Passenger		625,908	Gallons	724,291	50,157	5.099	0.080	50,308
Freight		156,477	Gallons	181,073	12,539	1.275	0.020	12,577
Public Transit								**37,917**
BART		267,635,305	kWh	210,089	12,425	0.795	0.168	12,495
AC Transit		1,804,039	gallons diesel	249,129	18,419	--	--	18,419
Union Pacific Rail		2,755	route miles in CA	--	--	--	--	5,100
WETA Ferry		310,855	gallons	10,732	793	0.058	0.020	801
Amtrak		106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline								**590,440**
Gasoline Tailpipe Emissions:		1,315,302,654	VMT	6,571,200	461,558	26.725	22.499	**468,930**
Passenger Vehicles	97.1%	1,276,619,669	VMT	6,377,941	447,984	25.939	21.837	455,139
Light-Duty Truck	2.2%	28,333,400	VMT	141,553	9,943	0.576	0.485	10,101
Heavy-Duty Truck	0.02%	328,358	VMT	1,640	115	0.007	0.006	117
Gasoline Well to Pump Emissions:					98,857	1.394	890	**121,510**
Passenger Vehicles	97.1%				95,950	1.353	863	117,936
Light-Duty Truck	2.2%				2,130	0.030	19.161	2,617
Heavy-Duty Truck	0.02%				25	0.000	0.222	30
State Highway Diesel								**23,189**
Diesel Tailpipe Emissions:		32,051,046	VMT	262,688	19,422	0.033	0.044	19,436
Passenger Vehicles	23.6%	7,553,542	VMT	61,908	4,577	0.008	0.010	4,581
Light-Duty Truck	48.3%	15,490,750	VMT	126,961	9,387	0.016	0.021	9,394
Heavy-Duty Truck	8.3%	2,669,511	VMT	21,879	1,618	0.003	0.004	1,619
Diesel Well to Pump Emissions:					2,853	0.036	35.492	3,753
Passenger Vehicles	23.6%				672	0.008	8.364	884
Light-Duty Truck	48.3%				1,379	0.017	17.154	1,814
Heavy-Duty Truck	8.3%				238	0.003	2.956	313
On-Road Gasoline		1,588,160,052	VMT	7,877,800	671,849	33.435	1,093	**707,847**
Gasoline Tailpipe Emissions:				7,877,800	553,335	31.763	26.999	562,175
Gasoline Well to Pump Emissions (currently allocate 100% passenger cars)					118,514	1.672	1,066	145,672
On-Road Diesel		255,046,920	VMT	2,752,200	233,374	0.687	372	**242,924**
Diesel Tailpipe Emissions:				2,752,200	203,480	0.310	0.427	203,615
Diesel Well to Pump Emissions: (currently allocate 100% freight vehicles)					29,894	0.377	372	39,309
Port of Oakland					no data	no data	no data	**235,000**
Materials Use & Waste								**3,543,252**
Solid Waste								**1,303,664**
Landfill Methane		555,970	tons				2,577	65,898
Upstream from Franchise Hauled Waste		184,786	tons					493,829
Upstream from Self-Hauled Waste		84,951	tons					192,798
Upstream from Alternate Daily Cover		264,995	tons					482,846
Upstream Recycling		44,220	tons					56,783
Upstream Compost		48,757	tons					11,509
Upstream of Goods & Food								**2,193,788**
Goods		6.653	MTCO2e/Household					928,175
Food		8.229	MTCO2e/Household					1,265,613
Construction Upstream Emissions								**45,800**
Construction		156	New Buildings					45,800
TOTAL COMMUNITY								**7,807,280**
TOTAL COMMUNITY AND LOCAL GOVERNMENT								**7,850,363**

Table 10: 2010 Consumption Inventory – Local Government Operations

2010 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							**27,231**
Buildings and Facilities Electricity							**15,830**
Electric	69,133,236	kWh	235,950	13,954	0.893	0.189	14,030
Upstream Electric							1,800
Buildings and Facilities Natural Gas							**11,401**
Natural Gas	1,747,474	therms	174,747	9,265	0.874	0.017	9,294
Upstream Natural Gas							2,107
Streetlight & Traffic Controllers							**5,912**
	29,132,671	kWh	99,429	5,880	0.376	0.080	5,912
Municipal Vehicle Fleet							**8,187**
Fleet: Diesel							**3,109**
Diesel	233,229	gallons	32,195	2,381	0.005	0.005	2,383
Upstream Diesel				565	0.091	6.319	726
Fleet: Gasoline							**4,594**
Gasoline	426,173	gallons	53,250	3,742	0.126	0.116	3,776
Upstream Gasoline				601	0.012	10.161	818
Fleet: CNG							**485**
Compressed Natural Gas	70,000	gallons	8750.000	459.630	0.537	0.038	485
Upstream CNR							
Municipal Waste Generation							**1,753**
	7,439	tons			62.596		
TOTAL LOCAL GOVERNMENT							**43,083**

Table 11: 2013 Consumption Inventory – Community

2013 Consumption Emissions		"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to Oakland
Buildings & Energy Use								**1,393,155**
Residential Energy								**662,589**
Grid Electricity		701,090,119	kWh	2,392,800	135,790	9.060	1.918	136,588
Natural Gas Consumption		63,262,073	Therm	6,326,200	335,416	31.631	0.633	336,395
Upstream Electric Generation Emissions								99,292
Upstream Natural Gas Gerneration Emissions								76,279
Transmission Losses		61,465,572	kWh	210,566	13,964	0.797	0.169	14,035
Commercial Energy								**721,049**
Grid Electricity		1,187,906,499	kWh	4,054,300	230,079	15.351	3.249	231,431
Natural Gas Consumption		45,541,305	Therm	4,554,100	241,460	22.771	0.455	242,165
Upstream Electric Generation Emissions								168,761
Upstream Natural Gas Generation Emissions								54,912
Transmission Losses		104,145,460	kWh	356,777	23,661	1.351	0.286	23,780
Water and Wastewater					5,084	31.782	0.313	**9,517**
Transportation & Mobile Sources								**2,780,834**
Airport								**967,450**
Jet Fuel				11,053,200	897,145	0.172	143	906,499
Passenger		7,641,448	Gallons	8,842,600	705,194	-	2.741	706,011
Freight		1,910,362	Gallons	2,210,600	176,299	-	0.685	176,503
Total Jet Fuel Upstream		9,551,810	Gallons		15,652	0.172	139	23,985
Aviation Fuel				877,525	5,041	0.513	0.008	60,951
Passenger		606,662	Gallons	702,020	48,615	4.942	0.077	48,761
Freight		151,666	Gallons	175,505	12,154	1.236	0.019	12,190
Public Transit								**36,113**
BART		279,617,965	kWh	200,409	13,291	0.759	0.161	13,358
AC Transit		1,525,069	gallons diesel	210,605	15,571	0.033	0.031	15,581
Union Pacific Rail		2,755	route miles in CA	--	--	--	--	5,100
WETA Ferry		377,090	gallons	13,019	963	0.070	0.025	972
Amtrak		106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline								**723,156**
Gasoline Tailpipe Emissions:		1,642,134,179	VMT	8,046,200	565,168	33.383	28.078	**574,370**
Passenger Vehicles	97.1%	1,593,839,097	VMT	7,809,562	548,546	32.401	27.252	557,478
Light-Duty Truck	2.2%	35,373,793	VMT	173,326	12,174	0.719	0.605	12,373
Heavy-Duty Truck	0.02%	409,949	VMT	2,009	141	0.008	0.007	143
Gasoline Well to Pump Emissions:					121,047	1.707	1,089	**148,786**
Passenger Vehicles	97.1%				117,487	1.657	1,057	144,410
Light-Duty Truck	2.2%				2,608	0.037	23.462	3,205
Heavy-Duty Truck	0.02%				30	0.000	0.272	37
State Highway Diesel								**28,865**
Diesel Tailpipe Emissions:		42,238,621	VMT	327,017	24,178	0.043	0.057	24,196
Passenger Vehicles	23.6%	9,954,470	VMT	77,069	5,698	0.010	0.014	5,702
Light-Duty Truck	48.3%	20,414,557	VMT	158,052	11,686	0.021	0.028	11,694
Heavy-Duty Truck	8.3%	3,518,028	VMT	27,237	2,014	0.004	0.005	2,015
Diesel Well to Pump Emissions:					3,552	0.045	44.183	4,669
Passenger Vehicles	23.6%				837	0.011	10.413	1,100
Light-Duty Truck	48.3%				1,717	0.022	21.354	2,257
Heavy-Duty Truck	8.3%				296	0.004	3.680	389
On-Road Gasoline		1,601,507,858	VMT	7,789,400	664,314	34	1,082	**700,094**
Gasoline Tailpipe Emissions:				7,789,400	547,130	32.030	27.226	556,044
Gasoline Well to Pump Emissions (currently allocate 100% passenger cars)					117,184	1.653	1,054	144,050
On-Road Diesel		267,886,223	VMT	2,910,700	246,818	1	394	**256,916**
Diesel Tailpipe Emissions:				2,910,700	215,202	0.340	0.460	215,348
Diesel Well to Pump Emissions: (currently allocate 100% freight vehicles)					31,616	0.398	393	41,568
Port of Oakland					67,792	1	6	**68,240**
Materials Use & Waste								**3,252,819**
Solid Waste								**1,245,812**
Landfill Methane		568,713	tons				3,239	63,205
Upstream from Franchise Hauled Waste		169,190	tons					451,162
Upstream from Self-Hauled Waste		84,951	tons					203,125
Upstream from Alternate Daily Cover		264,995	tons					459,350
Upstream Recycling		44,800	tons					57,529
Upstream Compost		48,417	tons					11,441
Upstream of Goods & Food								**1,947,907**
Goods		5.916	MTCO2e/Household					830,713
Food		7.218	MTCO2e/Household					1,117,194
Construction Upstream Emissions								**59,100**
Construction		61	New Buildings					59,100
TOTAL COMMUNITY								**7,426,808**
TOTAL COMMUNITY AND LOCAL GOVERNMENT								**7,467,640**

Table 12: 2013 Consumption Emissions – Local Government Operations

2013 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							**26,904**
Buildings and Facilities Electricity							**15,848**
Electric	68,660,589	kWh	234,336	13,298	0.887	0.188	13,373
Upstream Electric							2,475
Buildings and Facilities Natural Gas							**11,056**
Natural Gas	1,694,597	therms	169,459	8,985	0.847	0.017	9,013
Upstream Natural Gas							2,043
Streetlight & Traffic Controllers							**5,127**
				5,098	0.340	0.072	5,127
Municipal Vehicle Fleet							**6,497**
Fleet: Diesel							**1,690**
Diesel	126,764	gallons	17,499	1,294	0.003	0.003	1,295
Upstream Diesel				307	0.049	3.434	395
Fleet: Gasoline							**4,047**
Gasoline	374,700	gallons	46,819	3,290	0.141	0.130	3,328
Upstream Gasoline				528	0.011	8.934	719
Fleet: CNG							**760**
Compressed Natural Gas	80,000	gallons	10000.000	525.290	0.980	0.069	571
Upstream CNR							
Municipal Waste Generation							**2,305**
	5,655	tons			82.307		2,305
TOTAL LOCAL GOVERNMENT							**40,832**

Table 13: 2015 Consumption Inventory – Community

2015 Consumption Emissions		"raw" data	units	MMBtu	MTCO2	MTN2O	MTCH4	MTCO2e attributed to Oakland
Buildings & Energy Use								**1,182,682**
Residential Energy								**566,809**
Grid Electricity		667,931,952	kWh	2,279,600	129,974	10.028	1.212	130,586
Natural Gas Consumption		53,289,645	Therm	5,329,000	282,542	26.645	0.533	283,367
Upstream Electric Generation Emissions								77,109
Upstream Natural Gas Gerneration Emissions								64,255
Transmission Losses		58,558,548	kWh	200,608	11,438	0.882	0.107	11,492
Commercial Energy								**606,530**
Grid Electricity		1,163,270,504	kWh	3,970,200	226,362	17.465	2.111	227,428
Natural Gas Consumption		34,387,860	Therm	3,438,800	182,324	17.194	0.344	182,857
Upstream Electric Generation Emissions								134,767
Upstream Natural Gas Generation Emissions								41,464
Transmission Losses		101,985,587	kWh	349,378	19,920	1.537	0.186	20,014
Water and Wastewater					5,365	31.204	0.330	**9,344**
Transportation & Mobile Sources								**2,934,934**
Airport								**1,032,373**
Jet Fuel				11,911,500	960,525	0.190	172	965,984
Passenger		8,131,583	Gallons	9,529,200	759,954	-	2.954	760,834
Freight		2,032,896	Gallons	2,382,300	189,988	-	0.739	190,208
Total Jet Fuel Upstream		10,164,478	Gallons		10,583	0.190	169	14,942
Aviation Fuel				955,810	5,422	0.551	0.009	66,389
Passenger		652,499	Gallons	764,648	52,952	5.383	0.084	53,111
Freight		163,125	Gallons	191,162	13,238	1.346	0.021	13,278
Public Transit								**39,302**
BART		273,220,484	kWh	223,798	12,760	0.985	0.119	12,820
AC Transit		1,564,357	gallons diesel	216,030	15,972	0.036	0.034	15,983
Union Pacific Rail		2,755	route miles in CA	--	--	--	--	8,157
WETA Ferry		481,101	gallons	16,609	1,228	0.089	0.031	1,240
Amtrak		106,991	gallons diesel	14,775	1,092	0.086	0.028	1,103
State Highway Gasoline								**760,917**
Gasoline Tailpipe Emissions:		1,670,071,447	VMT	8,010,600	563,488	39.826	32.804	**574,259**
Passenger Vehicles	97.1%	1,620,954,730	VMT	7,775,009	546,916	38.655	31.839	557,370
Light-Duty Truck	2.2%	35,975,600	VMT	172,559	12,138	0.858	0.707	12,370
Heavy-Duty Truck	0.02%	416,924	VMT	2,000	141	0.010	0.008	143
Gasoline Well to Pump Emissions:					140,618	22.630	1,572	**186,658**
Passenger Vehicles	97.1%				136,483	21.964	1,526	181,168
Light-Duty Truck	2.2%				3,029	0.487	33.867	4,021
Heavy-Duty Truck	0.02%				35	0.006	0.392	47
State Highway Diesel								**30,854**
Diesel Tailpipe Emissions:		43,902,853	VMT	342,409	25,316	0.045	0.061	25,335
Passenger Vehicles	23.6%	10,346,684	VMT	80,696	5,966	0.011	0.014	5,971
Light-Duty Truck	48.3%	21,218,906	VMT	165,491	12,236	0.022	0.029	12,245
Heavy-Duty Truck	8.3%	3,656,641	VMT	28,519	2,109	0.004	0.005	2,110
Diesel Well to Pump Emissions:					3,863	0.078	65.335	5,519
Passenger Vehicles	23.6%				910	0.018	15.398	1,301
Light-Duty Truck	48.3%				1,867	0.038	31.577	2,667
Heavy-Duty Truck	8.3%				322	0.007	5.442	460
On-Road Gasoline		1,627,422,538	VMT	7,764,400	681,669	54	1,556	**736,661**
Gasoline Tailpipe Emissions:				7,764,400	545,373	32.548	32.060	555,741
Gasoline Well to Pump Emissions					136,296	21.934	1,524	180,920
(currently allocate 100% passenger cars)								
On-Road Diesel		270,905,409	VMT	2,958,600	252,117	1	565	**266,587**
Diesel Tailpipe Emissions:				2,958,600	218,741	0.350	0.470	218,890
Diesel Well to Pump Emissions:					33,376	0.676	565	47,697
(currently allocate 100% freight vehicles)								
Port of Oakland					67,792	1	6	**68,240**
Materials Use & Waste								**3,365,121**
Solid Waste								**1,171,141**
Landfill Methane		567,026	tons				2,258	64,727
Upstream from Franchise Hauled Waste		180,428	tons					481,129
Upstream from Self-Hauled Waste		59,038	tons					133,900
Upstream from Alternate Daily Cover		249,277	tons					422,414
Upstream Recycling		50,000	tons					57,529
Upstream Compost		57,290	tons					11,441
Upstream of Goods & Food								**2,069,981**
Goods		6.048	MTCO2e/Household					883,927
Food		7.362	MTCO2e/Household					1,186,054
Construction Upstream Emissions								**124,000**
Construction		144	New Buildings					124,000
TOTAL COMMUNITY								**7,482,738**
TOTAL COMMUNITY AND LOCAL GOVERNMENT								**7,520,929**

Table 14: 2015 Consumption Emissions – Local Government Operations

2015 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							**26,650**
Buildings and Facilities Electricity							**17,622**
Electric	76,995,007	kWh	262,782	14,983	1.156	0.140	15,052
Upstream Electric							2,570
Buildings and Facilities Natural Gas							**9,028**
Natural Gas	1,383,777	therms	138,378	7,337	0.692	0.014	7,360
Upstream Natural Gas							1,669
Streetlight & Traffic Controllers							**3,721**
				3,703	0.286	0.035	3,721
Municipal Vehicle Fleet							**6,757**
Fleet: Diesel							**1,690**
Diesel	230,000	gallons	31,749	2,348	0.005	0.005	2,350
Upstream Diesel				557	6.231	0.090	716
Fleet: Gasoline							**4,311**
Gasoline	396,000	gallons	46,819	3,477	0.892	0.185	3,551
Upstream Gasoline				558	9.441	0.011	760
Fleet: CNG							**757**
Compressed Natural Gas	80,000	gallons	10000.000	525.290	0.889	0.066	568
Upstream CNR							
Municipal Waste Generation							**1,063**
	4,306	tons			37.975		1,063
TOTAL LOCAL GOVERNMENT							**38,191**

Appendix B
Materials Use and Waste Emissions

Table of Contents

List of Figures

List of Tables

Introduction

This Appendix presents additional detail on the GHG emissions associated with the solid waste sector of the City of Oakland, providing context for the extent, type, and impacts of these emissions. As noted in the Report, the consumption GHGs generated from material use and waste is the largest category of emissions in the city, accounting for 45 percent of total emissions. Oakland has a unique waste profile, as the majority of tonnage to landfill is from self-hauled or industrial waste used as Alternative Daily Cover (ADC). Much of this tonnage originates in Oakland-based businesses and entities with a regional or multi-state service area, including wastewater sludge from the East Bay Municipal Utility District and auto shred waste from Schnitzer Steel. This waste is not necessarily generated in Oakland, however it is delivered to landfill from an Oakland collection facility and is therefore included in the inventory.

Emissions Data and Methodology Overview

The 2015 GHG Emissions Inventory was developed using the protocols, recommendations, and guidance of ICLEI Local Governments for Sustainability. The City maintains extensive data regarding its waste management activities, which allows for a thorough analysis of emissions. As the City refined its approach to calculating emissions associated with the materials in the waste stream, a multitude of decisions were made regarding the classification of materials and the emissions profile of each material type. To understand these classifications and emissions assumptions, it is important to begin with the fundamental understanding of GHG emissions generated from solid waste disposal and processing.

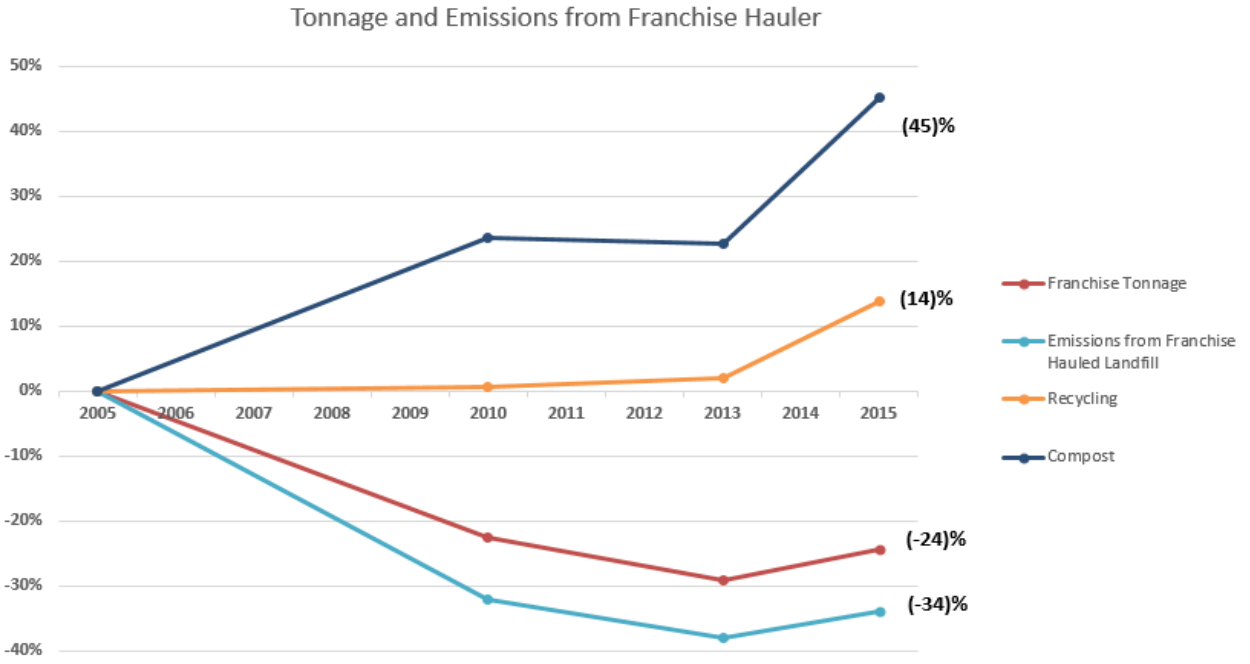
The core emissions of waste are comprised of the biologic carbon, methane, and nitrous oxide emitted during the natural decay of biologic wastes in the landfill. By contrast, the consumption emissions include the core emissions described previously, as well as gasses produced during the extracting, harvesting, processing, and transporting of all materials that end up in the landfill or compost. These additional emissions are referred to as upstream emissions, since they occur before the products reach the consumer. Beyond the emissions involved in making the product and shipping it to consumers, the method of eventual disposal also affects the total consumption emissions generated; materials that are recycled have a reduced consumption emission. The extent of the emissions reductions from recycling and composting are documented in this appendix.

The calculations for upstream emissions were completed using the EPA Waste Reduction Model (WARM), which includes all aspects of pre-consumer and post-consumer emissions. Because the core emissions analysis and the WARM model both evaluate transportation and landfill emissions as part of their methodologies, the core emissions were subtracted out of the WARM emissions factor to limit its analysis to pre-consumer emissions. This correction ensures that the emissions are not double-counted.

Franchise-Hauled Waste

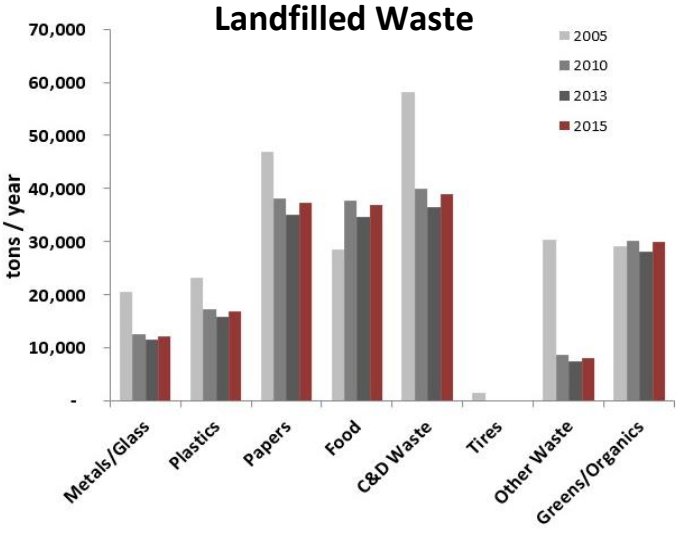
Waste disposed from Oakland is characterized by three types: franchise-hauling from residential, commercial, and City customers; self-hauling from private land uses such as construction sites, specialized operations, and City operations; and industrial waste put to use as Alternative Daily Cover (ADC). This section provides a detailed analysis of franchise-hauled waste, the largest component of the urban waste stream. **Figure 1** identifies the progress the City has made in reducing franchise-hauled waste as a part of the City's adopted Zero Waste Goal. Total landfill tonnage is down 29 percent from this source, resulting in an upstream emissions reduction of 34 percent from 2005 – 2015. In addition to landfill tonnage, metrics on recycling and compost were collected. Recycling tonnage has increased 14 percent since 2005, and Compost tonnage has increased 45 percent.

Figure 1: Oakland Tonnage and Emissions from Franchise-Hauled Waste



Emissions from landfilled waste decreased at a higher rate than tonnage to landfill due to the composition of Oakland's waste. Paper products have a higher emissions factor because the sequestration of carbon in trees is lost when the trees are cut down to make these products. Sequestration is the ability of plants to hold carbon in solid form, keeping it out of the atmosphere and eliminating its effects on climate change. Construction and demolition (C&D) waste contains a high percentage of lumber, resulting in the same sequestration loss. In **Figure 2**, it can be seen that landfill contributions for categories like paper and C&D waste sharply decreased from 2005 - 2015.

Figure 2: Oakland Tonnage Breakdown from Franchise-Hauled Landfilled Waste



Self-Hauled Waste

As described earlier in this Appendix, self-hauled waste typically is generated from properties on which private land uses such as construction and specialized operation occur. While the specific constituent content of self-hauled waste is unknown, it is characterized in this emissions analysis as primarily construction and demolition (C&D) waste. As shown in **Table 1**, self-hauled tonnage to landfill has decreased by 59 percent since 2005. The City has little influence over waste that is hauled directly to disposal facilities. However, the Alameda County Waste Management Authority has led emissions reductions in this sector through successful and targeted policies and programs. The City has passed a C&D Debris Waste Reduction and Recycling Ordinance to support these efforts.

Table 1: Oakland Tonnage from Self-Hauled Waste

Self-Hauled Waste		
Year	Tons	% Change from Baseline
2005	178434	
2010	106189	-40%
2013	111949	-37%
2015	73797	-59%

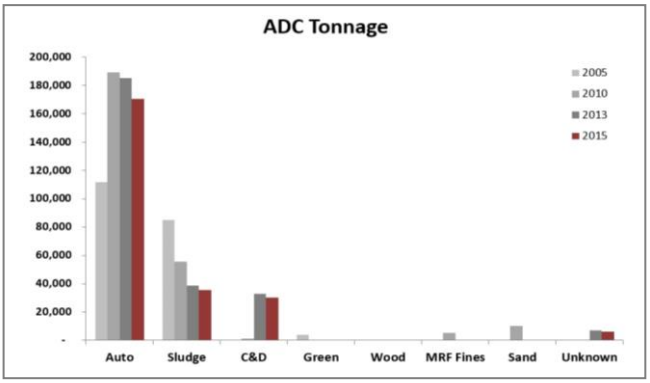
Alternative Daily Cover

Alternative Daily Cover (ADC) is non-earthen material placed on the surface of the landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging. The landfill operators use specified waste from large industrial generators in Oakland as ADC, e.g., auto shredder waste from scrap metal recyclers and wastewater sludge from regional wastewater treatment facilities. However, to remain consistent with the methodology of the consumption inventory, all ADC is accounted for in the inventory. **Table 2** shows ADC has increased by 24 percent since 2005.

Table 2: Oakland Tonnage from ADC

Alternative Daily Cover		
Year	Tons	% Change from Baseline
2005	201625	
2010	264995	31%
2013	271074	34%
2015	249277	24%

Figure 3: Oakland Tonnage Breakdown from ADC



The composition of ADC changes year to year depending on industrial needs and economic factors. As shown in **Figure 3**, auto recycling shredder waste and construction and demolition waste have increased over the years, while sludge has decreased. Other categories of ADC are minimal in comparison and fluctuate year to year.

Upstream Emissions from Waste Disposal

The following tables detail the upstream emissions of items found in the landfill per EPA WARM emissions factors. Items in the landfill are categorized by the Alameda County Waste Characterization Study. Natural organic items such as leaves and grass do not have a correlating upstream emissions factor as no emissions went into the processing or transportation of these items. Emissions from these items are accounted for in the downstream, landfill methane sector. The emissions associated with paper, metal, concrete, and other items is based on national averages, and includes the full lifecycle emissions associated with the extraction, processing, refinement, and manufacturing of products from these materials. As upstream emissions from city-wide waste flow is an emerging methodology for cities and calculating downstream emissions is widely practiced, this inventory only includes upstream emissions in the following tables.

Table 3: Oakland Total Franchise-Hauled Landfill Tonnage and Upstream Emissions

Upstream Emissions and Tonnage from Franchise-Hauled Landfill Waste											
	Emissions from Franchise Haul (Landfill)							Tons by Franchise (Landfill)			
	2005	2010	2013	2015	MT Reduction	% Change	Emissions Factor	2005	2010	2013	2015
Aluminum Cans	3,266	1,291	1,182	1,261	(2,005)	-61%	4.9	805	265	242	259
Aluminum Ingot	-	-	-	-	-	-	-	-	-	-	-
Steel Cans	3,284	3,031	2,775	2,960	(324)	-10%	3.0	1,087	1,003	918	979
Copper Wire	-	-	-	-	-	-	-	-	-	-	-
Glass	2,346	2,592	2,373	2,531	185	8%	0.5	4,855	5,365	4,912	5,238
HDPE	2,108	903	827	882	(1,226)	-58%	1.4	1,475	632	578	617
PET	2,098	1,575	1,442	1,538	(560)	-27%	2.2	967	726	665	709
Corrugated Containers	36,798	19,846	18,171	19,378	(17,419)	-47%	4.4	8,298	4,476	4,098	4,370
Magazines / Third-class mail	17,675	54,657	50,044	53,368	35,692	202%	7.5	2,362	7,305	6,688	7,133
Newspaper	28,653	6,119	5,603	5,975	(22,678)	-79%	4.3	6,656	1,422	1,302	1,388
Office Paper	27,560	14,560	13,331	14,217	(13,344)	-48%	6.3	4,354	2,300	2,106	2,246
Phonebooks	1,543	-	-	-	-		5.7	269	-	-	-
Textbooks	4,620	-	-	-	-		7.4	622	-	-	-
Dimensional Lumber	33,450	14,782	13,535	14,434	(19,017)	-57%	1.9	17,471	7,721	7,069	7,539
Yard Trimmings					-	-	-	8,540	-	-	-
Grass					-	-	-	5,304	3,901	3,572	3,809
Leaves					-	-	-	5,304	3,901	3,572	3,809
Branches					-	-	-	2,360	4,238	3,881	4,138
Mixed Paper (general)	138,427	11,677	10,691	11,401	(127,025)	-92%	5.7	24,428	2,061	1,887	2,012
Mixed Paper (primarily residential)	-	115,061	105,350	112,347	112,347		5.6	-	20,620	18,880	20,134
Mixed Metals	50,836	21,611	19,787	21,101	(29,735)	-58%	3.7	13,837	5,882	5,386	5,743
Mixed Plastics	38,818	30,029	27,495	29,321	(9,497)	-24%	1.9	20,668	15,988	14,639	15,611
Food Waste							2.9	28,536	37,761	34,574	36,870
Mixed Organics					-		-	7,629	18,195	17,048	18,180
Mixed MSW	77,125	21,934	19,094	20,362	(56,763)	-74%	2.5	30,331	8,626	7,509	8,008
Carpet	28,816	11,414	10,450	11,144	(17,671)	-61%	3.8	7,603	3,012	2,757	2,941
Concrete	11,711	14,406	13,190	14,066	2,355	20%	1.0	11,711	14,406	13,190	14,066
Fly Ash	-	-	-	-	-	-	-	-	-	-	-
Tires	6,283	844	773	824	(5,459)	-87%	4.2	1,481	199	182	194
Asphalt Concrete	-	-	-	-	-	-	0.1	-	-	-	-
Asphalt Shingles	323	150	138	147	(176)	-55%	0.2	2,122	987	904	964
Drywall	991	622	570	607	(383)	-39%	0.2	5,802	3,644	3,336	3,558
Wood Flooring	51,236	38,492	35,243	37,584	(13,652)	-27%	3.8	13,513	10,152	9,295	9,912
Total	**567,967**	**385,597**	**352,064**	**375,449**	**(186,355)**	**-34%**		**238,392**	**184,786**	**169,190**	**180,428**

Table 4: Oakland Total Recycling Tonnage and Emissions

	Recycling Tonnage									
	2005	2010	2013	2015	% Change to '05	MTCO2e Change ("-" indicates credit)	2005 MTCO2e	2010 MTCO2e	2013 MTCO2e	2015 MTCO2e
Aluminum Cans	156	157	159	178	14%	(14)	(661)	(665)	(674)	(752)
Aluminum Ingot	24	24	25	27	14%	(4)	(173)	(174)	(176)	(197)
Steel Cans	443	446	452	505	14%	11	537	541	548	612
Glass	7,258	7,310	7,406	8,266	14%	30	1,475	1,485	1,505	1,679
HDPE	1,220	1,229	1,245	1,232	1%	14	670	675	684	677
PET	726	731	740	826	14%	15	754	759	769	859
Corrugated Containers	5,966	6,009	6,088	6,795	14%	160	7,823	7,880	7,984	8,910
Magazines / Third-class mail	-	-	-	-	-					
Newspaper	19,224	19,364	19,618	21,895	14%	612	29,889	30,106	30,501	34,041
Office Paper	-	-	-	-	-		-	-		-
Phonebooks	-	-	-	-	-		-	-	-	
Textbooks		-	-	-	-		-	-	-	-
Dimensional Lumber	*Compost*									
Yard Trimmings	*Compost*									-
Grass	-	-	-	-	-		-	-	-	-
Leaves	-	-	-	-	-		-	-	-	-
Branches	-	-	-	-	-		-	-	-	-
Mixed Paper (general)	-	-	-	-	-		-	-		-
Mixed Paper (primarily residential)	*Compost*									
Mixed Paper (primarily from offices)	390	393	398	444	14%	29	1,401	1,411	1,430	1,596
Mixed Metals	4	4	4	5	14%	1	35	35	36	40
Mixed Plastics	5,028	5,065	5,131	5,727	14%	300	14,623	14,729	14,922	16,654
Food Waste	*Compost*									-
Mixed Organics	-	-	-	-	-		-	-	-	-
Mixed MSW	3,462	3,487	3,533	3,943	14%	180	8,803	8,867	8,984	10,026
Carpet	-	-	-	-						
Concrete	-	-	-	-						
Tires	-	-	-	-						
Asphalt Concrete	-	-	-	-						
Asphalt Shingles	-	-	-	-						
Drywall	-	-	-	-						
Wood Flooring	-	-	-	-						
Total	**43,901**	**44,220**	**44,800**	**49,843**	**14%**		**56,374**	**56,783**	**57,529**	**64,119**
	0%	1%	2%	14%			0%	1%	2%	14%

Table 5: Oakland Total Compost Tonnage and Emissions

	Compost Tonnage									
	2005	2010	2013	2015	% Change to '05	MTCO2e Change ("-" indicates credit)	2005 MTCO2e	2010 MTCO2e	2013 MTCO2e	2015 TCO2e
Aluminum Cans		-	-	-	-					
Aluminum Ingot		-	-	-	-					
Steel Cans		-	-	-	-					
Glass		-	-	-	-					
HDPE		-	-	-	-					
PET		-	-	-	-					
Corrugated Containers		-	-	-	-					
Magazines / Third-class mail		-	-	-	-					
Newspaper		-	-	-	-					
Office Paper		-	-	-	-					
Phonebooks		-	-	-	-					
Textbooks		-	-	-	-					
Dimensional Lumber	3,700	4,376	4,342	5,049	36%	2,678	7,342	8,684	8,616	10,020
Yard Trimmings	29,371	33,028	32,691	37,171	27%	-	-		-	-
Grass		-	-	-	-	-				-
Leaves		-	-	-	-	-				-
Branches		-	-	-	-	-				-
Mixed Paper (general)		-	-	-	-	-				-
Mixed Paper (primarily residential)	250	500	500	680	172%	2,430	1,413	2,825	2,825	3,842
Mixed Paper (primarily from offices)		-	-	-	-					
Mixed Metals		-	-	-	-					
Mixed Plastics		-	-	-	-					
Food Waste	6,175	10,853	10,884	14,390	133%	-	-	-	-	
Mixed Organics		-	-	-	-					
Mixed MSW		-	-	-	-					
Carpet		-	-	-	-					
Concrete		-	-	-	-					
Tires		-	-	-	-					
Asphalt Concrete		-	-	-	-					
Asphalt Shingles		-	-	-	-					
Drywall		-	-	-	-					
Wood Flooring		-	-	-	-					
Total	39,495	48,757	48,417	57,290	45%		8,755	11,509	11,441	13,862
	0%	23%	23%	45%			0%	31%	31%	58%

Table 6: WARM Upstream Emissions Factors

	WARM Emissions Factors		
	Landfill	Recycling	Compost
Aluminum Cans	4.88	-9.11	
Aluminum Ingot		-7.19	
Steel Cans	3.02	-1.81	
Glass	0.48	-0.28	
HDPE	1.43	-0.88	
PET	2.17	-1.13	
Corrugated Containers	4.43	-3.12	
Magazines / Third-class mail	7.48		
Newspaper	4.30	-2.75	
Office Paper	6.33		
Phonebooks	5.74		
Textbooks	7.43		
Dimensional Lumber	1.91		1.98
Yard Trimmings	-		-
Grass	-		
Leaves	-		
Branches	-		
Mixed Paper (general)	5.67		
Mixed Paper (primarily residential)	5.58		5.65
Mixed Paper (primarily from offices)		-3.59	
Mixed Metals	3.67	-4.38	
Mixed Plastics	1.88	-1.03	
Food Waste	2.87		2.87
Mixed Organics	-		
Mixed MSW	2.54		
Carpet	3.79		
Concrete	1.00		
Tires	4.24		
Asphalt Concrete	0.08		
Asphalt Shingles	0.15		
Drywall	0.17		
Wood Flooring	3.79		

Table 7: Total Upstream Emissions Breakdown

	Total Upstream Emissions				
	2005 MTCO2e	2010 MTCO2e	2013 MTCO2e	2015 MTCO2e	2005 - 2015 MTCO2e Reduction
Aluminum Cans	3,854	626	508	508	3,346
Aluminum Ingot	(173)	(174)	(176)	(197)	24
Steel Cans	4,312	3,572	3,323	3,571	741
Glass	11,085	8,242	14,261	12,632	(1,547)
HDPE	3,094	1,578	1,511	1,559	1,535
PET	3,166	2,334	2,211	2,396	770
Corrugated Containers	50,130	27,727	26,155	28,288	21,841
Magazines / Third-class mail	20,321	54,657	50,044	53,368	(33,046)
Newspaper	62,831	36,226	36,104	40,016	22,815
Office Paper	31,686	14,560	13,331	14,217	17,469
Phonebooks	1,774	-	-	-	1,774
Textbooks	5,312	-	-	-	5,312
Dimensional Lumber	86,889	48,218	57,273	50,054	36,835
Yard Trimmings	-	-	-	-	-
Grass	-	-	-	-	-
Leaves	-	-	-	-	-
Branches	-	-	-	-	-
Mixed Paper (general)	159,149	11,677	10,691	11,401	147,747
Mixed Paper (primarily residential)	1,413	117,886	108,175	116,189	(114,777)
Mixed Paper (primarily from offices)	1,401	1,411	1,430	1,596	(195)
Mixed Metals	79,507	34,312	71,815	65,526	13,981
Mixed Plastics	86,124	60,946	221,912	206,657	(120,533)
Food Waste	126,770	108,233	99,098	105,680	21,089
Mixed Organics	-	-	-	-	-
Mixed MSW	475,813	568,648	320,837	284,190	191,623
Carpet	33,129	11,414	10,450	11,144	21,985
Concrete	52,094	37,676	46,209	38,134	13,960
Tires	7,223	844	773	824	6,399
Asphalt Concrete	-	-	-	-	-
Asphalt Shingles	371	150	138	147	225
Drywall	1,139	622	570	607	532
Wood Flooring	58,906	38,492	35,243	37,584	21,322
Total	1,367,321	1,189,876	1,131,886	1,086,094	281,227
					-21%

Appendix C
City of Oakland Emissions Data and Reductions

Table of Contents

List of Tables

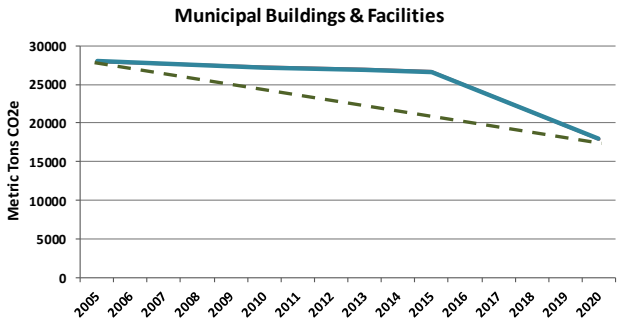
Introduction

Reducing GHG emissions to meet the City's goal will require each sector of the community to take actions to lower their carbon footprint. The City strives to be a leader not only in meeting community goals, but in implementing reductions in its own operations. To ensure that the City is doing its part, a variety of programs have been undertaken to reduce waste, energy use, and other factors that impact GHG emissions. These programs span all aspects of operations, and seek to lower emissions to the greatest degree feasible. In doing so, the City seeks to identify programs, technologies, practices, and ideas that can work across the community. By first reducing its own emissions, the City can demonstrate that they too are working towards reaching the 2020 GHG reduction goals.

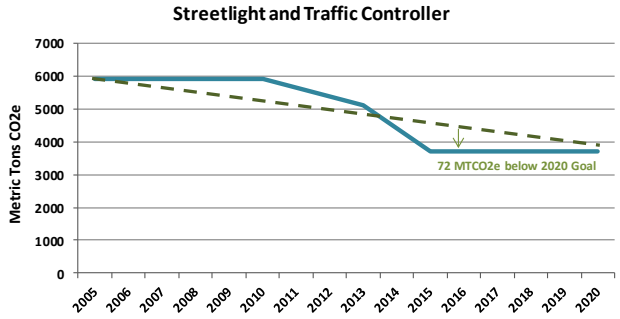
In addition to conducting an inventory of communitywide GHG emissions, the City assesses all emissions associated with the operation of City government. This approach ensures that the actions undertaken within the government sector are reviewed and their impacts evaluated. This Appendix sets forth the emissions associated with local government operations, including details on the programs and activities that have been employed to reduce emissions across departments and services.

Local Government Progress – Leading By Example

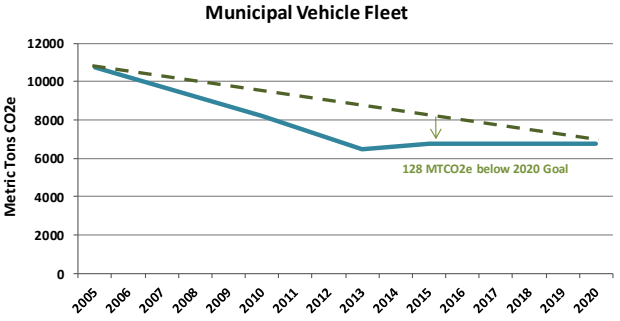
The local government operations inventory was created separately in an effort to better understand how government operations can reduce emissions on track with 2020 and 2050 goals. Within the local government, four main subsections were calculated: buildings and facilities, streetlights and traffic controls, vehicle fleet, and waste generation. The City of Oakland has made significant progress reducing emissions since 2005 due to the efforts of many key staff and programs, as described below.



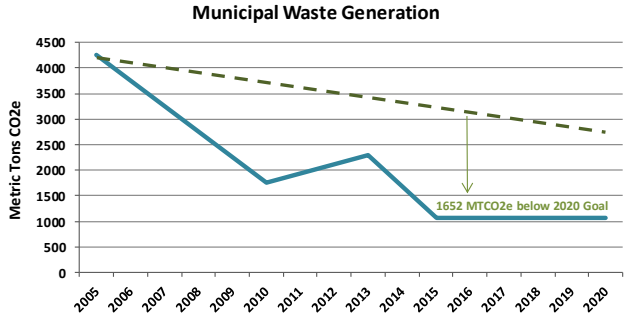
Oakland has reduced emissions in its municipal buildings by five percent since 2005. This is due to lighting and HVAC retrofits, engaging building managers and employees in conservation, and installing energy management systems. The City maintains 116 municipal buildings, and must reduce emissions by 8,700 MT CO2e to meet the 2020 goal in this category.



Oakland has reduced emissions associated with streetlights by 37 percent through replacing lamps with LEDs. By 2015, more than 30,000 high pressure sodium (HPS) streetlights, representing more than 90 percent of City total, were converted to LED. The City has more than 35,000 streetlights, and has met its 2020 goal in this category with existing measures.



Oakland reduced emissions from the City fleet by 37 percent since 2005 by reducing the number of vehicles in use, and replacing gasoline-powered vehicles with natural gas and hybrid electric vehicles. The City maintains more than 1,800 vehicles in its fleet, and has exceeded its 2020 goal in this category with existing measures.



Oakland has reduced its emissions from waste at city buildings by 75 percent by increasing recycling, launching compost service in buildings, and increased employee awareness and attention on waste reduction. The City has exceeded its 2020 goal in this category with existing measures.

Local Government Inventories

The following series of tables provides the GHG emissions information for all components of local government operations at the City of Oakland. These tables include the inventory information for the years 2005, 2010, and 2013. Consistent with the methodology described in this report, the Core inventory refers to emissions generated within the City limits, while Consumption emissions also include emissions associated with the extraction, production, and transportation of products consumed in Oakland.

Table 1: 2005 Oakland LGO Core Inventory

Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e	
Municipal Buildings & Facilities								**21,998**
Buildings and Facilities Electricity								**14,635**
Electric	65,458,807	kWh	223,409	14,524	0.891	0.327		14,635
Buildings and Facilities Natural Gas								**7,363**
Natural Gas	1,384,412	therms	138,441	7,340	0.692	0.014		7,363
Streetlight & Traffic Controllers								**5,927**
	26,507,507	kWh	90,469	5,882	0.361	0.132		5,927
Municipal Vehicle Fleet								**10,577**
Fleet: Diesel								**2,628**
Diesel	257,266	gallons	35,513	2,627	0.006	0.006		2,628
Fleet: Gasoline								**7,519**
Gasoline	852,674	gallons	106,542	7,487	0.181	0.103		7,519
Fleet: CNG								**430**
Compressed Natural Gas	62,117	gallons			0.476	0.033		430
Municipal Waste Generation								**4,243**
	10,411	tons						**4,243**
TOTAL LOCAL GOVERNMENT								**42,745**

Table 2: 2010 Oakland LGO Core Inventory

Local Government Emissions			MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e	
Municipal Buildings & Facilities								**23,324**
Buildings and Facilities Electricity								**14,030**
Electric	69,133,236	kWh	235,950	13,954	0.893	0.189		14,030
Buildings and Facilities Natural Gas								**9,294**
Natural Gas	1,747,474	therms	174,747	9,265	0.874	0.017		9,294
Streetlight & Traffic Controllers								**5,912**
	29,132,671	kWh	99,429	5,880	0.376	0.080		5,912
Municipal Vehicle Fleet								**6,643**
Fleet: Diesel								**2,383**
Diesel	233,229	gallons	32,195	2,381	0.005	0.005		2,383
Fleet: Gasoline								**3,776**
Gasoline	426,173	gallons	53,250	3,742	0.126	0.116		3,776
Fleet: CNG								**485**
Compressed Natural Gas	70,000	gallons			0.537	0.038		485
Municipal Waste Generation								**1,753**
	7,439	tons						**1,753**
TOTAL LOCAL GOVERNMENT								**37,632**

Table 3: 2013 Oakland LGO Core Inventory

Local Government Emissions			MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							**22,386**
Buildings and Facilities Electricity							**13,373**
Electric	68,660,589	kWh	234,336	13,298	0.887	0.188	13,373
Buildings and Facilities Natural Gas							**9,013**
Natural Gas	1,694,597	therms	169,459	8,985	0.847	0.017	9,013
Streetlight & Traffic Controllers							**5,127**
	26,321,865	kWh	89,836	5,098	0.340	0.072	5,127
Municipal Vehicle Fleet							**5,194**
Fleet: Diesel							**1,295**
Diesel	126,764	gallons	17,499	1,294	0.003	0.003	1,295
Fleet: Gasoline							**3,328**
Gasoline	374,700	gallons	46,819	3,290	0.141	0.130	3,328
Fleet: CNG							**571**
Compressed Natural Gas	80,000	gallons		525	0.980	0.069	571
Municipal Waste Generation							**2,305**
	5,655	tons			82.307		2,305
TOTAL LOCAL GOVERNMENT							**35,011**

Table 4: 2015 Oakland LGO Core Inventory

Local Government Emissions			MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							**22,412**
Buildings and Facilities Electricity							**15,052**
Electric	76,995,007	kWh	262,782	14,983	1.156	0.140	15,052
Buildings and Facilities Natural Gas							**7,360**
Natural Gas	1,694,597	therms	138,378	7,337	0.692	0.014	7,360
Streetlight & Traffic Controllers							**3,721**
	19,031,777	kWh	64,955	3,703	0.286	0.035	3,721
Municipal Vehicle Fleet							**6,468**
Fleet: Diesel							**2,350**
Diesel	230,000	gallons	31,749	2,348	0.005	0.005	2,350
Fleet: Gasoline							**3,551**
Gasoline	396,000	gallons	49,480	3,477	0.892	0.185	3,551
Fleet: CNG							**568**
Compressed Natural Gas	80,000	gallons		525	0.889	0.066	568
Municipal Waste Generation							**1,063**
	5,655	tons			37.975		1,063
TOTAL LOCAL GOVERNMENT							**33,664**

Table 5: 2005 Oakland LGO Consumption Inventory

2005 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							**28,005**
Buildings and Facilities Electricity							**18,973**
Electric	65,458,807	kWh	223,409	14,524	0.891	0.327	14,635
Upstream Electric							4,338
Buildings and Facilities Natural Gas							**9,032**
Natural Gas	1,384,412	therms	138,441	7,340	0.692	0.014	7,363
Upstream Natural Gas							1,669
Streetlight & Traffic Controllers							**5,927**
	26,507,507	kWh	90,469	5,882	0.361	0.132	5,927
Municipal Vehicle Fleet							**10,759**
Fleet: Diesel							**2,688**
Diesel	257,266	gallons	35,513	2,627	0.006	0.006	2,628
Upstream Diesel				46	0.007	0.516	59
Fleet: Gasoline							**7,634**
Gasoline	852,674	gallons	106,542	7,487	0.181	0.103	7,519
Upstream Gasoline				84	0.002	1.428	115
Fleet: CNG							**438**
Compressed Natural Gas	62,117	gallons	7764.600	407.870	0.476	0.033	430
Upstream CNR				4.194	0.001	0.158	8
Municipal Waste Generation							**4,243**
	10,411	tons			151.53		
TOTAL LOCAL GOVERNMENT							**48,934**

Table 5: 2010 Oakland LGO Consumption Inventory

2010 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							**27,231**
Buildings and Facilities Electricity							**15,830**
Electric	69,133,236	kWh	235,950	13,954	0.893	0.189	14,030
Upstream Electric							1,800
Buildings and Facilities Natural Gas							**11,401**
Natural Gas	1,747,474	therms	174,747	9,265	0.874	0.017	9,294
Upstream Natural Gas							2,107
Streetlight & Traffic Controllers							**5,912**
	29,132,671	kWh	99,429	5,880	0.376	0.080	5,912
Municipal Vehicle Fleet							**8,187**
Fleet: Diesel							**3,109**
Diesel	233,229	gallons	32,195	2,381	0.005	0.005	2,383
Upstream Diesel				565	0.091	6.319	726
Fleet: Gasoline							**4,594**
Gasoline	426,173	gallons	53,250	3,742	0.126	0.116	3,776
Upstream Gasoline				601	0.012	10.161	818
Fleet: CNG							**485**
Compressed Natural Gas	70,000	gallons	8750.000	459.630	0.537	0.038	485
Upstream CNR							
Municipal Waste Generation							**1,753**
	7,439	tons			62.596		
TOTAL LOCAL GOVERNMENT							**43,083**

Table 6: 2013 Oakland LGO Consumption Inventory

2013 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							**26,904**
Buildings and Facilities Electricity							**15,848**
Electric	68,660,589	kWh	234,336	13,298	0.887	0.188	13,373
Upstream Electric							2,475
Buildings and Facilities Natural Gas							**11,056**
Natural Gas	1,694,597	therms	169,459	8,985	0.847	0.017	9,013
Upstream Natural Gas							2,043
Streetlight & Traffic Controllers							**5,127**
				5,098	0.340	0.072	5,127
Municipal Vehicle Fleet							**6,497**
Fleet: Diesel							**1,690**
Diesel	126,764	gallons	17,499	1,294	0.003	0.003	1,295
Upstream Diesel				307	0.049	3.434	395
Fleet: Gasoline							**4,047**
Gasoline	374,700	gallons	46,819	3,290	0.141	0.130	3,328
Upstream Gasoline				528	0.011	8.934	719
Fleet: CNG							**760**
Compressed Natural Gas	80,000	gallons	10000.000	525.290	0.980	0.069	571
Upstream CNR							
Municipal Waste Generation							**2,305**
	5,655	tons			82.307		2,305
TOTAL LOCAL GOVERNMENT							**40,832**

Table 7: 2015 Oakland LGO Consumption Inventory

2015 Local Government Emissions	"raw data"	units	MMBtu	MTCO2	MTCH4	MTN2O	MTCO2e
Municipal Buildings & Facilities							**26,650**
Buildings and Facilities Electricity							**17,622**
Electric	76,995,007	kWh	262,782	14,983	1.156	0.140	15,052
Upstream Electric							2,570
Buildings and Facilities Natural Gas							**9,028**
Natural Gas	1,383,777	therms	138,378	7,337	0.692	0.014	7,360
Upstream Natural Gas							1,669
Streetlight & Traffic Controllers							**3,721**
				3,703	0.286	0.035	3,721
Municipal Vehicle Fleet							**6,757**
Fleet: Diesel							**1,690**
Diesel	230,000	gallons	31,749	2,348	0.005	0.005	2,350
Upstream Diesel				557	6.231	0.090	716
Fleet: Gasoline							**4,311**
Gasoline	396,000	gallons	46,819	3,477	0.892	0.185	3,551
Upstream Gasoline				558	9.441	0.011	760
Fleet: CNG							**757**
Compressed Natural Gas	80,000	gallons	10000.000	525.290	0.889	0.066	568
Upstream CNR							
Municipal Waste Generation							**1,063**
	4,306	tons			37.975		1,063
TOTAL LOCAL GOVERNMENT							**38,191**

City of Oakland Elected Officials

Mayor Libby Schaaf

Members of the City Council
Larry Reid (District 7), Council President
Annie Campbell Washington (District 4) Vice Mayor
Rebecca Kaplan (At Large)

Dan Kalb (District 1) • Abel J. Guillen (District 2) President Pro Tem

Lynette Gibson Mclhaney (District 3) • Noel Gallo (District 5) • Desley Brooks (District 6)

Barbara Parker, City Attorney • Brenda D. Roberts, City Auditor

Sustainable Oakland

This report was developed under the leadership of Oakland Public Works—Environmental Services Division with contributions from numerous City Staff and partners.

250 Frank Ogawa Plaza, Suite 5301
Oakland, CA 94612

www.sustainableoakland.com

CITY OF OAKLAND