

Source Inventory of Bay Area Greenhouse Gas Emissions



November 2006



939 Ellis Street
San Francisco, California 94109

**SOURCE INVENTORY OF BAY AREA
GREENHOUSE GAS EMISSIONS**

BASE YEAR 2002

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

November 2006

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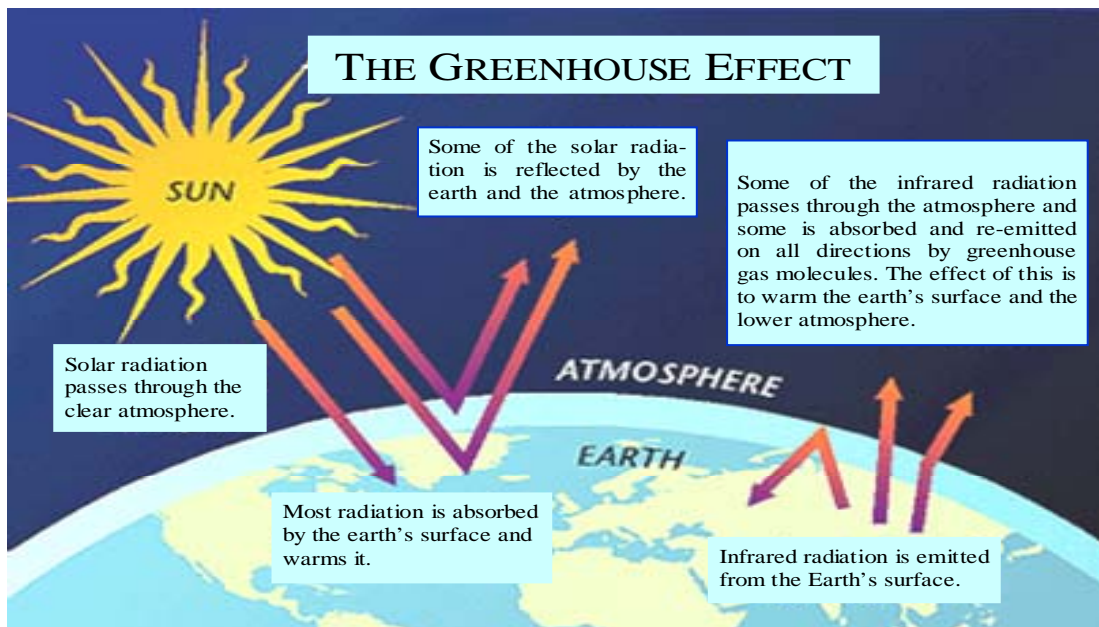
Bay Area Greenhouse Gas Emissions Inventory: 2002

Introduction

Climate Change and Greenhouse Gas Emissions

Once, all climate changes on Earth occurred naturally. However, during the Industrial Revolution, we began altering our climate and environment through changing agricultural and industrial practices. Before the Industrial Revolution, human activity released very few gases into the atmosphere, but now through fossil fuel burning, deforestation and growing population (e.g. waste disposal), we are affecting the natural mixture of gases in the Earth's atmosphere.

The greenhouse effect is a natural process by which some of the radiant heat from the Sun is captured in the lower atmosphere of the Earth, thus maintaining the temperature and making Earth habitable. The gases that help capture the heat are called greenhouse gases. All of these gases have been identified as forcing the earth's atmosphere and oceans to warm above naturally occurring temperatures.



Some greenhouse gases occur naturally in the atmosphere, while others result from human activities. Naturally occurring greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and ozone. Certain human activities, however, add to the levels of most of these naturally occurring gases.

Carbon Dioxide (CO₂) is released to the atmosphere when solid waste, fossil fuels (oil, natural gas, and coal), and wood and wood products are burned.

Methane (CH₄) is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from the decomposition of organic waste in municipal solid waste landfills, and the raising of livestock.

Nitrous oxide (N₂O) is emitted during agricultural and industrial activities, as well as during combustion of solid waste and fossil fuels.

Very powerful greenhouse gases, also known as high global warming potential (GWP) gases that are not naturally occurring, include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆), are generated in a variety of industrial processes.

Each greenhouse gas differs in its ability to absorb heat in the atmosphere. High GWP gases such as HFCs, PFCs, and SF₆ are the most heat-absorbent. Methane traps over 21 times more heat per molecule than carbon dioxide, and nitrous oxide absorbs 310 times more heat per molecule than carbon dioxide. Often, estimates of greenhouse gas emissions are presented in carbon dioxide equivalents, which weight each gas by its GWP. Table A shows the global warming potentials for different greenhouse gases for 100 year time horizon.

Table A: Global Warming Potentials (GWPs) for Greenhouse Gases

Gas	GWP
CO ₂	1
CH ₄	21
N ₂ O	310
HFCs/PFCs	6,500
SF ₆	23,900

Greenhouse Gas Emissions Inventory

An emissions inventory is a detailed estimate of the amount of air pollutants discharged into the atmosphere of a given area by various emission sources during a specific time period.

This emission inventory focuses on direct greenhouse gas (GHG) emissions due to human activities only and compiles emission estimates that result from industrial, commercial, transportation, domestic, forestry, and agriculture activities in the San Francisco Bay Area region of California.

This GHG emission inventory reports direct emissions generated from sources within the Bay Area Air Quality Management District (BAAQMD). The report does not include indirect emissions, for example, a source using electricity has no

direct emissions because emissions are emitted at the power plants. Emissions of CO₂, CH₄, N₂O, HFCs, PFCs, and SF₆ are estimated using the most current activity and emission factor data from various sources. Emission factor data was obtained from the U.S. Department of Energy's (DOE's) Energy Information Administration (EIA), the California Energy Commission (CEC), and the California Air Resources Board (CARB).

Methodology

Emission sources can be broadly divided between stationary and mobile sources. Stationary sources can be further divided between point and area sources. Stationary emission sources identified on an individual basis or as a single source are called point sources. Electric power generating plants and oil refineries are examples of point sources. The Air District maintains a computer database with detailed information on operations and emission characteristics for nearly 4,000 facilities, which include roughly 25,000 different sources, throughout the Bay Area. Activity data on the sources are collected at the process level from each facility and are updated regularly. The greenhouse gas emissions from these sources are calculated by multiplying activity data by standardized emission factors for each greenhouse gas. These emission factors take into account fuel-specific carbon content and the percent of carbon that oxidizes to convert to carbon dioxide emissions. Some of the combustion emission factors for various fuels used for this emissions inventory are shown in Table B. Examples of activity data used to develop the inventory are shown in Table C.

Stationary emission sources that are not identified individually are called area sources. Area sources are groups of numerous small emission sources, which individually do not emit significant amounts of pollutants but together make an appreciable contribution to the emission inventory. Many area sources do not require permits from the Air District, such as residential heating, restaurants, and the wide range of consumer products such as paints, solvents, and cleaners. Some facilities considered area sources do require permits from the Air District, such as gas stations and dry cleaners. Emissions estimates for area sources are developed based on estimated activities and emission factors for various categories.

Mobile sources consist of on-road motor vehicles and other mobile sources. Examples of on-road motor vehicles are cars, trucks, buses and motorcycles. Other mobile sources include boats, ships, trains, aircraft, and garden, farm and construction equipment. Greenhouse gas emissions for on-road motor vehicles were obtained from CARB's EMFAC2002 model. Other off and on- road mobile source emissions were calculated based on estimated fuel used and emission factors in Table B.

Table B: Emission Factors (Lbs./Usage Unit)

Fuel	CO ₂	CH ₄	N ₂ O	Unit
Petroleum Products				
Distillate Fuel (Fuel Oil, Diesel)	22.384	0.000534	0.0001928	Gallon
Jet Fuel	21.095	0.0005198	0.0001877	Gallon
Kerosene/Naphtha	21.537	0.0005	0.00018	Gallon
Liquified Petroleum Gases (LPG)	12.805	0.0002538	0.0000216	Gallon
Motor Gasoline	19.564	0.00055	0.0002	Gallon
Residual Fuel (Bunker C Fuel Oil)	26.033	0.0002245	0.0002081	Gallon
Aviation Gasoline	18.355	0.0005198	0.0001877	Gallon
Bio-diesel	20.74	0.0004948	0.0001786	Gallon
Gaseous Fuels				
Propane	12.669	0.000003	2.3E-07	Gallon
Butane	14.655	0.000003	2.3E-07	Gallon
Natural Gas	120.593	0.0002	0.0002	1000 ft ³
Landfill Gas	110.445	0.210503	0.000236	1000 ft ³
Digester Gas	104.654	0.02997	0.0003	1000 ft ³
Carbon Monoxide	116.095	0.0027	0.000193	1000 ft ³
Refinery Waste Gases	135.0	0.0029	0.00022	1000 ft ³
Solids				
Refuge/Waste	2,000	0.2979	0.0898	Ton
Wood and Other	3,814	0.2979	0.0898	Ton
Agriculture Waste Burning	173.8	0.14	0.35	Ton
Petroleum Coke	6,768.67	0.4492	0.1063	Ton

Table C: 2002 General Statistics

County	Population (1000's)	Daily Electricity Usage (Megawatt hours)	Daily Natural Gas Usage (million cu.ft.)	Daily Gasoline Sales (1000's gal.)	Daily Vehicle Miles Traveled** (Millions)
Alameda	1,480	30,124	131.1	1,771	29.0
Contra Costa	975	19,358	589.5	1,171	21.7
Marin	250	4,454	22.2	355	5.7
Napa	128	2,795	11.2	153	2.6
San Francisco	785	16,327	104.8	1,106	10.5
San Mateo	718	14,586	69.0	1,077	19.4
Santa Clara	1,725	50,684	182.0	2,368	39.0
Solano*	295	6,511	43.0	328	5.8
Sonoma*	416	7,388	27.4	487	7.8
	6,772	152,228	1,180.2	8,816	141.5

* Portion within Bay Area Air Quality Management District.

** VMT (for passenger cars and light duty trucks only) from EMFAC2002 v2.2

Summary of Bay Area GHG Emissions

In 2002, 85.4 million tons of CO₂-equivalent greenhouse gases were emitted in the Bay Area. Bay Area GHG emissions breakdown by pollutant is shown in Figure 1 and Table D.

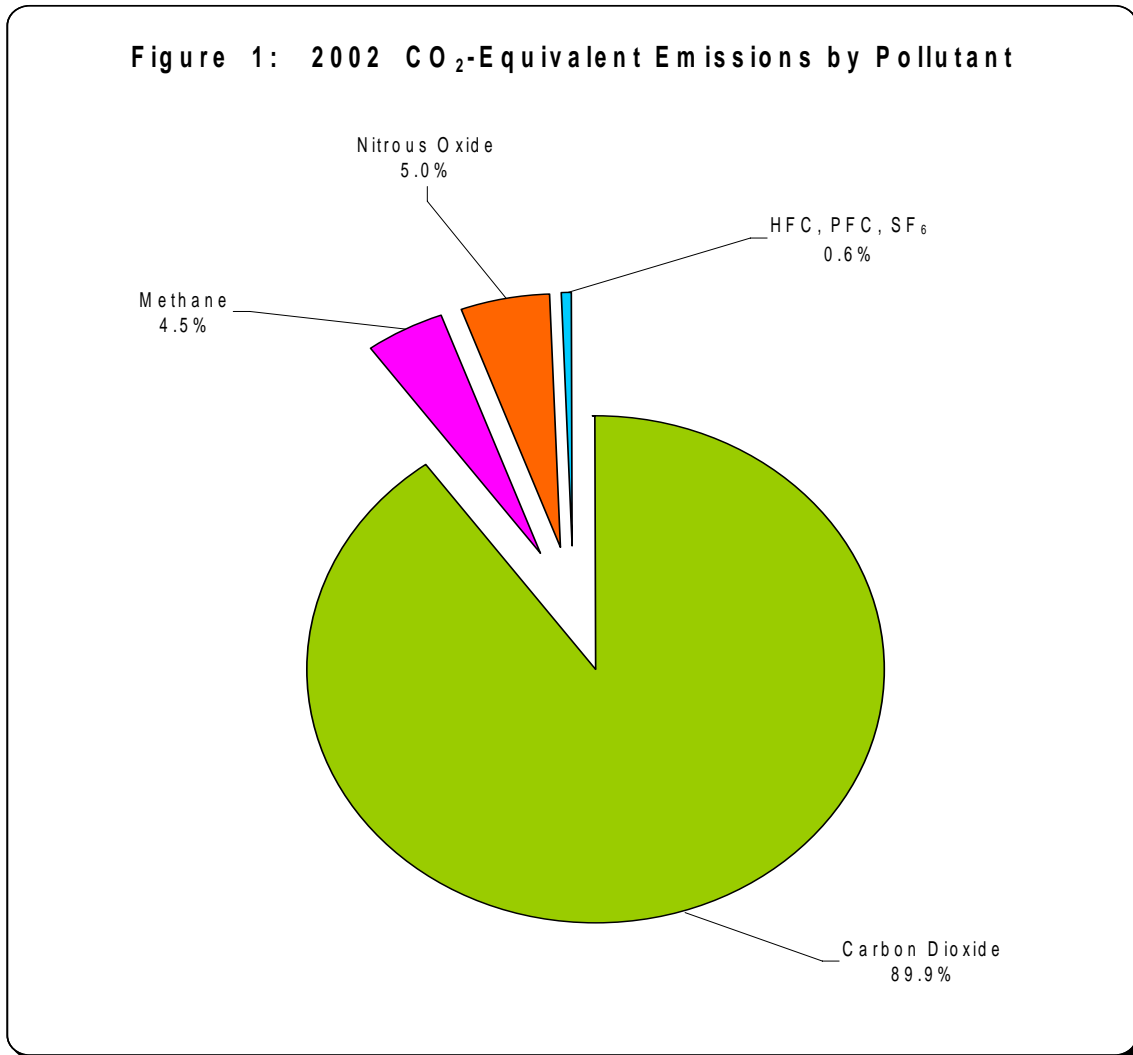


Table D: 2002 CO₂-Equivalent Emissions by Pollutant

Pollutant	Percentage	CO ₂ -Equivalent (Million Tons/Year)
Carbon Dioxide	89.9%	76.79
Methane	4.5%	3.83
Nitrous Oxide	5.0%	4.26
HFC, PFC, SF ₆	0.6%	0.51
Total	100%	85.4

Composition of Emissions by Pollutant

The greenhouse gas with the greatest emissions is carbon dioxide (CO₂). Carbon dioxide emissions from various activities in the Bay Area represented 89.9 percent of total greenhouse gas emissions in 2002. Carbon dioxide emissions are mainly associated with combustion of carbon-bearing fossil fuels such as gasoline, diesel, and natural gas used in mobile sources and energy-generation-related activities. Other activities that produce CO₂ emissions include cement manufacturing, waste combustion, and waste and forest management.

Methane (CH₄) emissions from various sources represent 4.5 percent of Bay Area's total CO₂-equivalent GHG emissions. Landfills, natural gas distribution systems, agricultural activities, fireplaces and wood stoves, stationary and mobile fuel combustion, and gas and oil production fields categories are the major sources of these emissions.

Nitrous oxide (N₂O) emissions represent approximately 5 percent of the overall greenhouse gas emissions inventory. Municipal wastewater treatment facilities, fuel combustion, and agricultural soil and manure management are the major contributors of nitrous oxide emissions in the Bay Area.

Emissions from high GWP gases such as HFCs, PFCs and SF₆ make up approximately one half percent of the total CO₂-equivalent emissions. Industrial processes such as semiconductor manufacturing and electric power transmission and distribution systems are the major sources of HFCs, PFCs and SF₆ emissions in the Bay Area.

GHG Emissions by Major Categories

Direct GHG emissions by major source categories are shown in Figure 2 and Table E. Fossil fuel consumption in the transportation sector was the single largest source of Bay Area's GHG emissions in 2002. The transportation sector alone contributed 50.6 percent of GHG emissions in the Bay Area. Categories included in this sector are on-road motor vehicles, off-highway mobile sources, and aircraft.

Industrial and commercial sources (excluding petroleum refining and power plants, which are reported separately) were the second largest contributors of GHG emissions with 25.7 percent of total emissions. Industrial, commercial, and other sources include emissions from industrial processes such as waste management, cement manufacturing, fuel distribution, agriculture and forest management, and some other small sources.

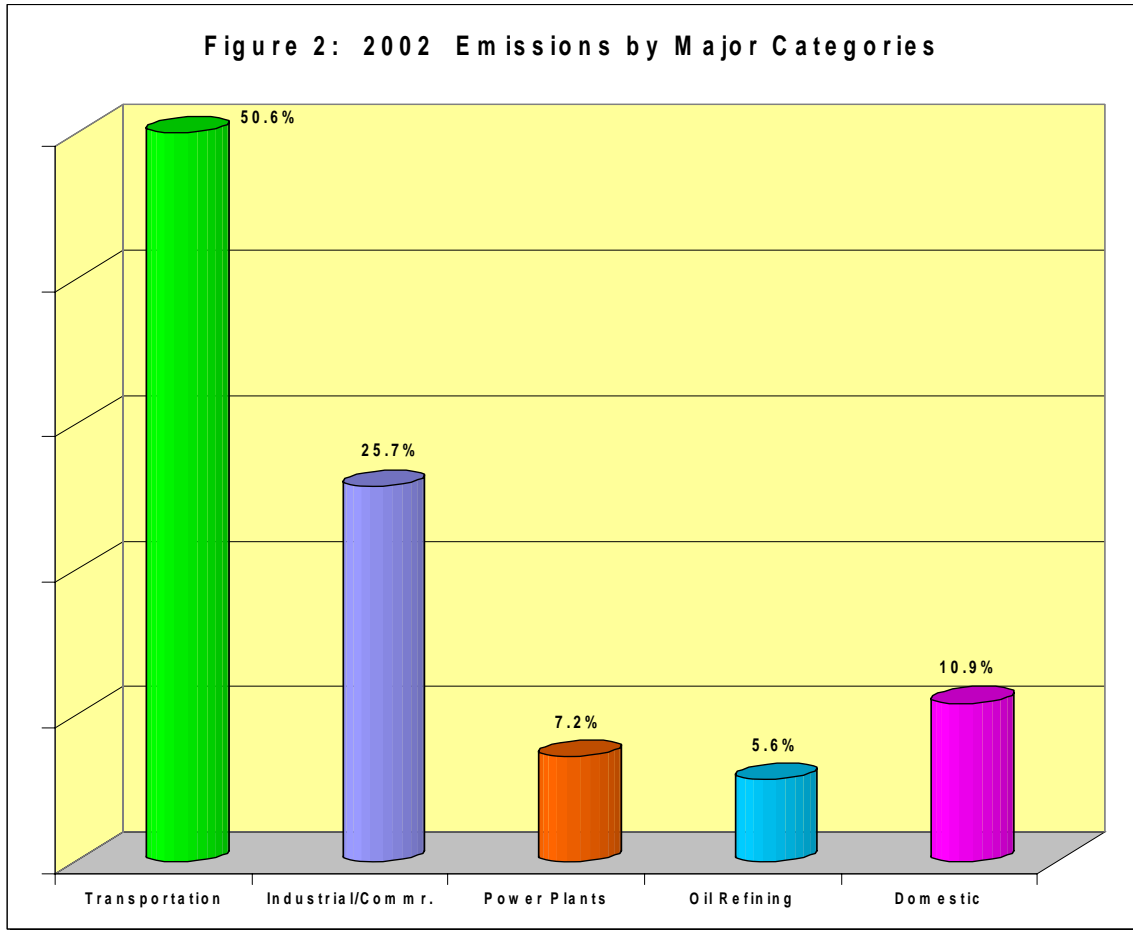


Table E: 2002 Emissions by Major Categories

Pollutant	Percent	CO ₂ -Equivalent (Million Tons/Year)
Transportation	50.6%	43.2
Industrial/Commercial	25.7 %	22.0
Power Plants	7.2%	6.1
Oil Refining	5.6%	4.8
Domestic	10.9%	9.3
Total	100%	85.4

The contribution from crude oil refining, domestic fuel combustion, and electricity generation at power plants were 5.6 percent, 10.9 percent, and 7.2 percent respectively. More detailed information on major emission sources is provided in Tables H and I.

Electricity generation in the Bay Area is mainly from natural gas-fired power plants. This emissions inventory does not include GHG emissions from electricity generated outside of the Bay Area. California imports about twenty to thirty percent of its total electricity, mainly from the northwestern and southwestern states. The Bay Area used about 55 million megawatt hours of

electricity in 2002, generating about 17 million tons of CO₂-equivalent. The Bay Area power plants and co-generation facilities generated 6.1 and 3.6 million tons of CO₂-equivalent emissions respectively, and are reported in this inventory.

GHG Emissions by County

Greenhouse gas emissions for the nine Bay Area counties under the District’s jurisdiction are summarized in Figure 3 and Table F.

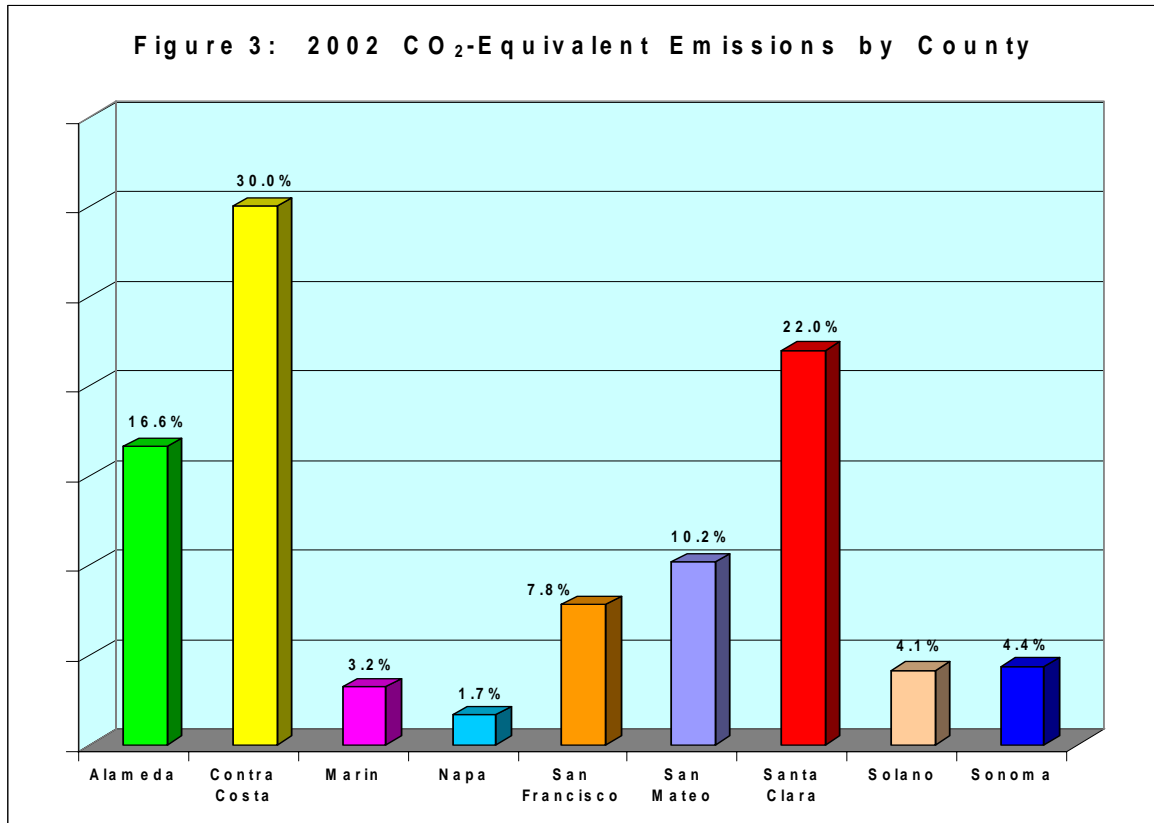
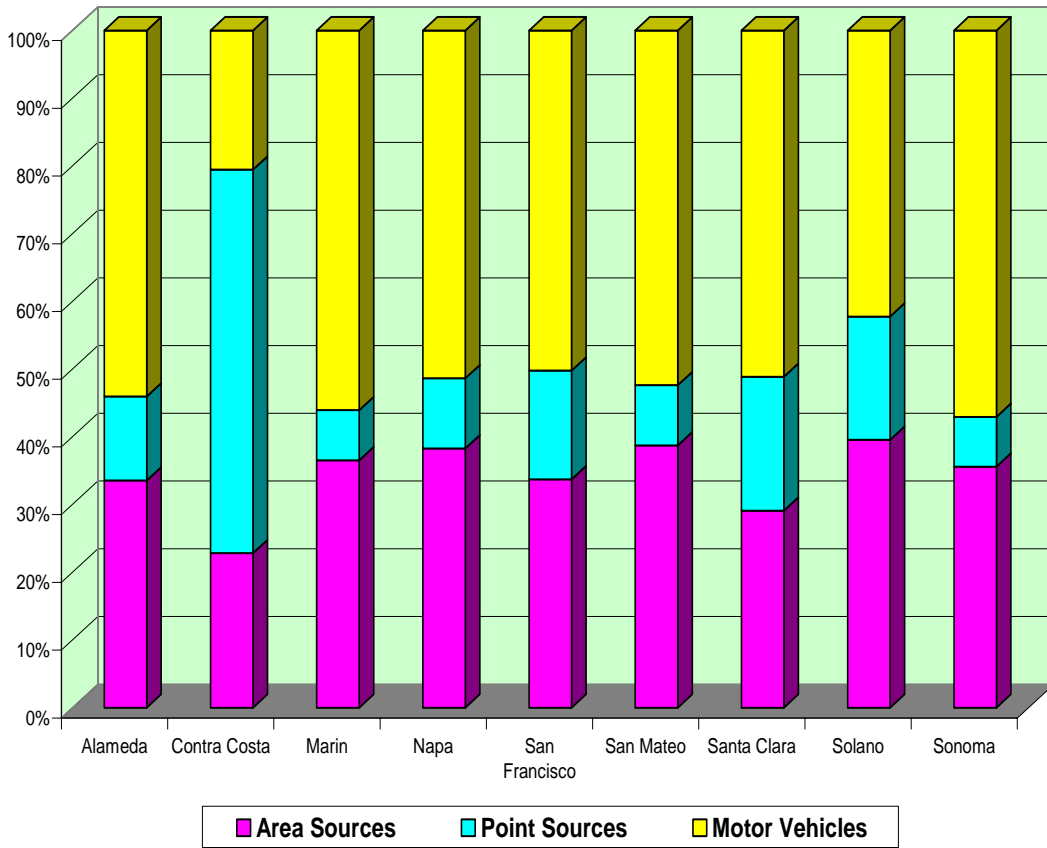


Table F: 2002 CO₂- Equivalent Emissions by County

County	Percentage	CO ₂ -Equivalent (Million Tons/Year)
Alameda	16.6%	14.2
Contra Costa	30.0%	25.6
Marin	3.2%	2.7
Napa	1.7%	1.4
San Francisco	7.8%	6.7
San Mateo	10.2%	8.7
Santa Clara	22.0%	18.8
Solano	4.1%	3.5
Sonoma	4.4%	3.7
Total	100%	85.4

A breakdown of emissions by major source categories for each county is shown in Figure 3a. This figure shows much higher point source emissions in Contra Costa County due to the refineries and power plants. The other counties fairly consistently show a higher contribution from motor vehicles relative to point sources.

Figure 3a: 2002 County Emissions Breakdown by Major Source Category



GHG Emission Trends for Bay Area

Under “business as usual” conditions, greenhouse gas emissions are expected to grow in the future due to population growth and economic expansion. Figure 4 and Table G show emissions trends by major sources for the period 1990 to 2016.

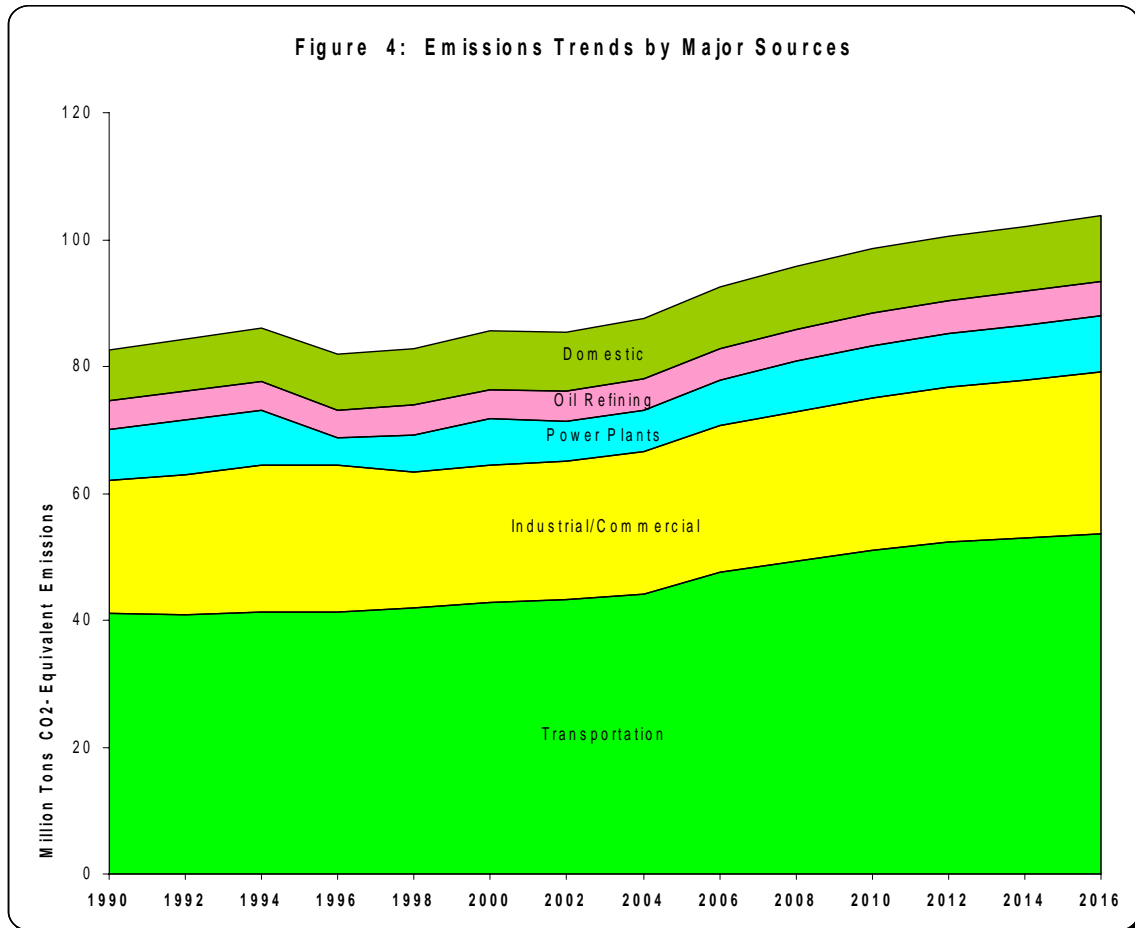
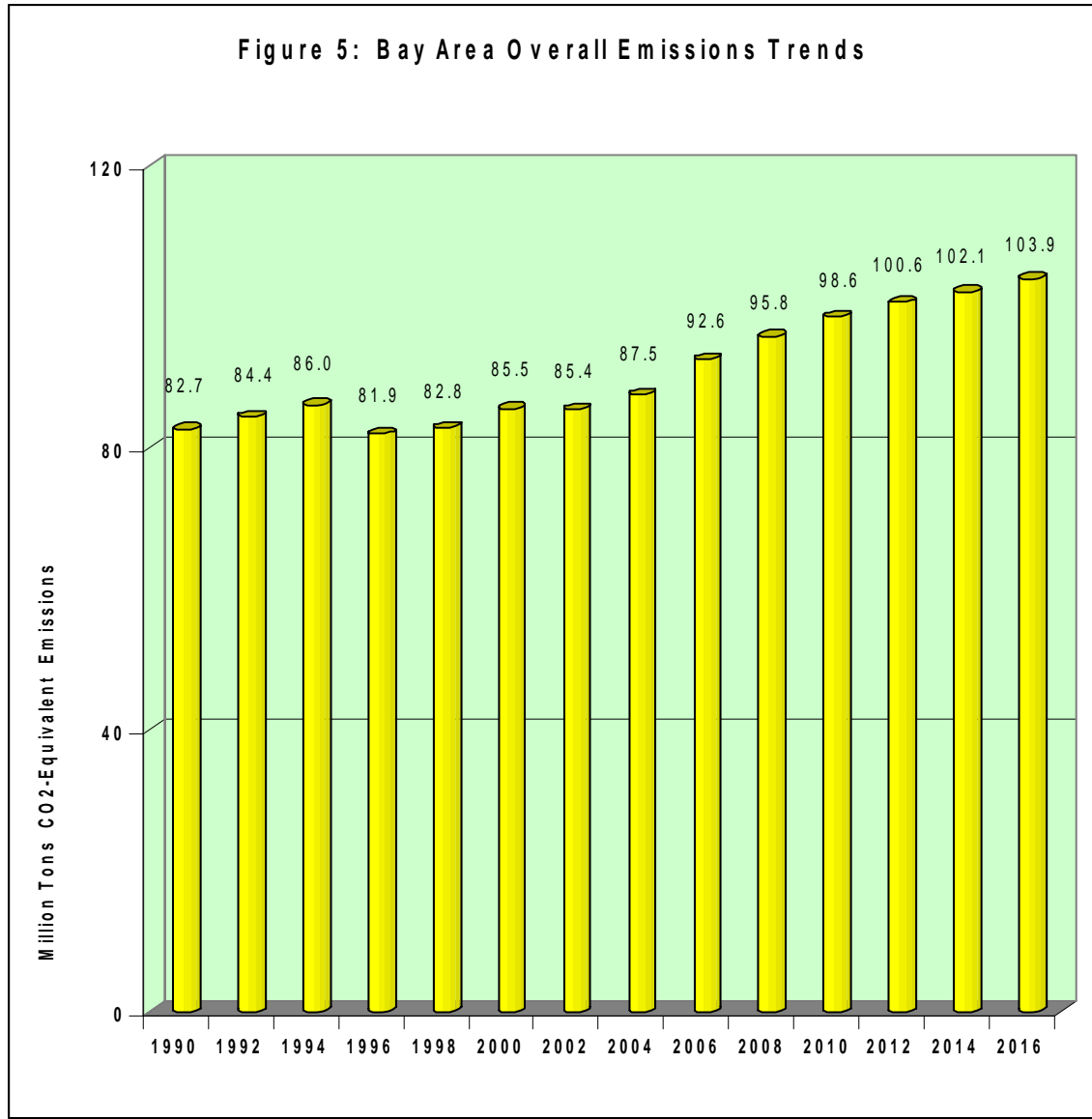


Table G: Emissions Trends by Major Sources

Category	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014	2016
Transportation	41.2	40.8	41.4	41.3	41.9	42.7	43.2	44.1	47.6	49.3	51.1	52.3	52.9	53.7
Ind./Commercial	20.9	22.1	23.1	23.2	21.5	21.7	22.0	22.4	23.0	23.5	24.0	24.5	24.9	25.4
Power Plants	7.9	8.8	8.6	4.2	5.8	7.3	6.1	6.6	7.2	8.1	8.2	8.4	8.6	8.8
Oil Refining	4.6	4.4	4.4	4.5	4.7	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5
Domestic	8.1	8.3	8.5	8.7	8.9	9.1	9.3	9.6	9.7	9.9	10.0	10.2	10.3	10.4
Total	82.7	84.4	86.0	81.9	82.8	85.5	85.4	87.5	92.6	95.8	98.6	100.6	102.1	103.9

Figure 5 shows the San Francisco Bay Area region's overall greenhouse gas emissions trends. More details on emissions trends are provided in Table I.



If the current trends continue, Bay Area GHG emissions are expected to increase at a rate of approximately 1.4 percent per year. Even though 2002 emissions were a little lower than some historical years' emissions due to economic slowdown and the events of September 11, 2001, the long term GHG emissions trends are expected to go upwards absent policy changes. Year-to-year fluctuation in emissions trends is due to variation in economic activity and the fraction of electric power generation in this region. Power generation in the Bay Area varies

year-to-year depending on various factors including the availability of hydroelectric and other imported power.

Greenhouse gas emissions are projected based on estimated growth at various source categories. For example, CARB's On- and Off-road Mobile computer models were utilized to project GHGs. In these models, fuel consumption estimates were based on the change of fleet mix and the growth of various types of on-road and off-road vehicles. For aircraft categories, the fleet mix and the growth data from the Metropolitan Transportation Commission's 2000 Regional Airport Systems Plan was incorporated into the GHG projection models.

The projected GHG emissions from power plants operating in the Bay Area were based on the 2003 California Energy Commission's Fuel Usage Report.

The GHG projections from other major sources such as landfills, natural gas fuel distribution, and cement manufacturing were estimated by using Association of Bay Area Government's employment and population data. California Integrated Waste Management data were also considered in the landfill projection process.

This GHG emission inventory will be updated as additional information about activity data, emission factors and other inputs becomes available.

Table H: 2002 Bay Area Greenhouse Gas Emissions* (Tons/year)

SOURCE CATEGORY	CO₂	CH₄	N₂O	PFC/HFC	SF₆
Industrial/Commercial Processes					
Petroleum Refining Processes	470,485	796	18	--	--
Waste Management	--	125,673	1,643	--	--
Animal Waste	--	16,104	672	--	--
Natural Gas Fuels Distribution	--	20,524	--	--	--
Other Industrial/Commercial Processes	682,550	967	--	4	--
Other Organic Compounds Evaporation	--	--	--	26	--
Sub-Total	1,153,035	164,064	2,332	29	--
Combustion - Stationary Sources					
Domestic	9,057,475	6,796	234	--	--
Cogeneration	3,554,370	204	7	--	--
Power Plants	5,862,995	47	11	--	11
Oil Refinery External Combustion	4,795,005	442	40	--	--
Landfill Combustion	11,406,250	3,208	157	--	--
Burning of Waste Material	112,785	7	--	--	--
Other Combustion Sources	751,900	420	--	--	--
Sub-Total	35,540,780	11,125	449	--	11
Combustion - Mobile Sources					
On-Road Motor Vehicles	33,452,250	5,307	8,935	--	--
Aircraft	3,137,175	1,146	80	--	--
Other Mobile Sources	3,518,965	683	445	--	--
Sub-Total	40,108,390	7,136	9,461	--	--
Miscellaneous Other Sources	13,870	62	1,518	--	--
Grand Total	76,816,075	182,387	13,761	29	11

* The symbol -- indicates a quantity less than 0.5 Ton/year. Entries are rounded to the nearest whole number; totals may not equal to sums of column entries.

Table I: Bay Area Greenhouse Gas Emission Inventory Projections : 1990-2016
Million Tons CO₂- Equivalent

SOURCE CATEGORY	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014	2016
INDUSTRIAL/COMMERCIAL PROCESSES														
Refinery Processes	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6
Metallurgical & Minerals Manufacturing	0.8	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8
Animal Waste	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Landfills	4.3	3.9	3.4	2.9	3.1	3.1	3.1	3.4	3.5	3.6	3.6	3.7	3.7	3.7
Subtotal	6.6	6.0	5.5	5.1	5.3	5.3	5.4	5.6	5.7	5.9	6.0	6.0	6.1	6.2
COMBUSTION - STATIONARY SOURCES														
Domestic	8.1	8.3	8.5	8.7	8.9	9.137	9.3	9.6	9.7	9.9	10.0	10.2	10.3	10.4
Cogeneration	5.5	4.9	4.7	4.4	3.4	3.5	3.6	3.6	3.7	3.8	3.9	3.9	4.0	4.1
Power Plants	7.9	8.8	8.6	4.2	5.8	7.3	6.1	6.6	7.2	8.1	8.2	8.4	8.6	8.8
Oil Refineries External Combustion	4.6	4.4	4.4	4.5	4.7	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5
Glass Melting Furnaces - Natural Gas	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Reciprocating Engines	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7
Turbines	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Combustion at Landfills	7.7	9.9	11.7	12.4	11.6	11.6	11.5	11.8	12.1	12.4	12.7	13.0	13.2	13.5
Incineration	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Subtotal	34.6	37.2	38.8	35.1	35.2	37.1	36.2	37.4	38.7	40.2	41.0	41.8	42.6	43.4
Subtotal (Stationary Sources)	41.2	43.3	44.3	40.3	40.5	42.4	41.6	43.0	44.4	46.1	47.0	47.8	48.7	49.6
COMBUSTION - MOBILE SOURCES														
ON-ROAD MOTOR VEHICLES														
Passenger Cars	15.9	16.0	16.0	15.7	15.7	15.6	15.7	16.0	17.7	18.2	18.7	19.1	19.2	19.3
Light Duty Trucks<6000lbs	7.1	7.2	7.5	7.6	8.0	8.3	8.5	8.7	9.7	10.1	10.6	11.1	11.4	11.8
Medium Duty Trucks 6001-8500 lbs	1.7	2.0	2.5	2.9	3.3	3.4	3.4	3.4	3.8	4.1	4.4	4.6	4.7	4.8
Light Heavy Duty Trucks 8501-14000lbs	1.0	0.9	0.9	0.9	0.9	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1
Medium Heavy Duty Trucks 14001-33000lbs	1.5	1.5	1.4	1.5	1.5	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6
Heavy Heavy Duty Trucks>33000 lbs	5.3	4.8	4.6	4.7	4.5	4.5	4.5	4.7	4.8	5.0	5.1	5.1	5.1	5.0
School/Urban Buses	0.9	0.9	0.9	0.9	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.3
Motor-Homes	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4
Motorcycles	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal	33.8	33.5	34.1	34.4	35.1	35.7	36.3	37.0	40.4	41.8	43.4	44.4	44.8	45.4

Table I: Bay Area Greenhouse Gas Emission Inventory Projections : 1990-2016
Million Tons CO₂- Equivalent

SOURCE CATEGORY	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014	2016
OFF-HIGHWAY MOBILE SOURCES														
Lawn and Garden Equipment	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Transportation Refrigeration Units	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Agricultural Equipment	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3
Construction and Mining Equipment	1.4	1.5	1.6	1.6	1.7	1.7	1.8	1.8	1.9	1.9	2.0	2.0	2.0	2.0
Industrial Equipment	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Light Duty Commercial Equipment	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
Trains	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Off Road Recreational Vehicles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ships	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4
Commercial Boats	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Recreational Boats	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Subtotal	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.9	4.0	4.1	4.2	4.3
AIRCRAFT														
Commercial Aircraft	2.0	2.0	2.1	2.2	2.2	2.3	2.1	2.2	2.3	2.4	2.5	2.7	2.8	2.9
General Aviation	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Military Aircraft	2.0	1.7	1.5	1.0	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Airport Ground Support Equipment	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Subtotal	4.3	4.1	4.0	3.5	3.3	3.4	3.2	3.3	3.4	3.5	3.7	3.8	4.0	4.1
Subtotal (Mobile Sources)	41.2	40.8	41.4	41.3	41.9	42.7	43.2	44.1	47.6	49.3	51.1	52.3	52.9	53.7
GRAND TOTAL EMISSIONS	82.7	84.4	86.0	81.9	82.8	85.5	85.4	87.5	92.6	95.8	98.6	100.6	102.1	103.9