CITY OF SAN DIEGO

CLIMATE PROTECTION

ACTION PLAN

July 2005

ENVIRONMENTAL SERVICES DEPARTMENT

City of San Diego

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Executive Summary

Investing in actions and institutionalizing policies to reduce greenhouse gas (GHG) emissions have collateral benefits for San Diego: economic vitality; public health and safety; natural resource protection; and infrastructure stability. Just as importantly, the City of San Diego's leadership may catalyze significant reductions of GHG emissions by others in the region. Regardless of national policies on global climate change, each town, city, and region can choose to do what is feasible. The collective impact of these actions can make a substantial difference.

On January 29, 2002, the San Diego City Council unanimously approved the San Diego Sustainable Community Program. Actions identified include:

1. Participation in the Cities for Climate Protection (CCP) program coordinated through the International Council of Local Environmental Initiatives (ICLEI);
2. Establishment of a 15% GHG reduction goal set for 2010, using 1990 as a baseline; and
3. Direction to use the recommendations of a scientific *Ad Hoc* Advisory Committee as a means to improve the GHG Emission Reduction Action Plan within the City organization and to identify additional community actions.

This report includes many of the recommendations provided by the *Ad Hoc* Advisory Committee and City staff. By implementing these recommendations the City could directly address the following challenges:

- Mitigation for State and Federal Ozone Standards non-attainment, with associated health benefits ; and

- Enhanced economic prosperity, specifically related to the tourism and agricultural sectors.

San Diego Citywide Greenhouse Gas Emissions

The following series of tables lay out three important contentions:

1. The GHG projection in 2010 resulting from no action taken to curb emissions;
2. The GHG emission reductions due to City of San Diego actions implemented between 1990 and 2003; and
3. The GHG reductions needed by 2010 to achieve 15% reduction.

Table 1. Greenhouse Gas Emissions 1990 Baseline and 2010 "No Action" Projection

Source	1990 Baseline % of Total	1990 Baseline Tons/Yr GHG	2010 "No Action" Projection % of Total	2010 "No Action" Projection Tons/Yr GHG
Energy	29%	4,507,000*	43%	9,749,000
Transportation	51%	7,892,000**	40%	8,951,000
Waste	20%	3,148,000***	17%	3,817,000

*based on SDG&E data for total consumption of electricity and natural gas within the City limits
**based on SANDAG historical data, with the City having 49% of VMT in the San Diego region
***includes emissions from waste already in landfills some closed, which will diminish over time

Table 2. Greenhouse Gas Reductions Resulting From 1990-2003 Actions

Source	13-year Cumulative Tons Reduced
Energy	127,000
Transportation	56,000
Waste	3,631,000
Total	3,814,000

Table 3. San Diego Citywide Greenhouse Gas Emissions Overview

Milestone	Total Tons of GHG per year
1990 Baseline	15,547,000
2010 "No Action" Projection (Status Quo)	22,517,000
2010 CCP Projection (Goal)	13,215,000
Difference Between Status Quo and Goal	9,302,000
Reduction Achieved from 1990-2003	3,814,000*
Remaining Reduction Needed by 2010	5,488,000

*The cumulative reductions from 1990-2003 have eliminated the listed tonnage of GHG and thus can be assumed to prevent this same amount from accumulating on a per year basis going forward.

Actions taken in the waste sector, including the capture of methane gas from solid waste landfills and sewage treatment plants, combined with recycling programs, have resulted in a significant portion of the decrease in overall GHG emissions, as shown above in Table 2. Actions taken thus far to incorporate energy efficiency and alternative renewable energy have been impressive, but have contributed much less to the overall reduction goal. The transportation sector remains a significant source of GHG emissions and has had the lowest GHG reductions. Thus, the community could stand to benefit greatly from any major reductions in this sector.

The City of San Diego can do more as an organization through policies and practices to reduce the volume of GHG emission. However, if the largest one-hundred companies in San Diego put forward the same level of commitment, actively working to reduce the GHG emissions associated with their energy, water and transportation operations, we would be much closer to reaching the 2010 target for the community. With that in mind, the contribution of every individual in the community to reduce energy and vehicle use is the final factor that translates the 15% goal into a reality.

Summary of Recommendations[*]

Transportation

- <u>Develop and Adopt ***Community Fuel Efficiency Policy***</u>
    1. City Departments will develop and implement a plan to reduce fuel consumption 15% each year (in place of reductions, fuel switching to alternative fuels will be allowed provided there are both emission reductions and economic benefits);
    2. The City will provide incentives for vehicles that meet the Super Ultra Low Emission Vehicle (SULEV) California tailpipe emission standard, such as providing preferred parking at City parking facilities and free meter parking.

- <u>Annually Review and Revise Existing Policies</u>

  200-17 Alternative Fuels

  500-02 Taxicabs Permits

- <u>State of California Incentives and Regulations</u>
    1. *AB 2628, Vehicles: preferential lanes*. As of January 1, 2004 the State of California allows single-occupant alternative fuel vehicles meeting the state's Advanced Technology Partial Zero-Emission Vehicle (AT PZEV) standard and achieving 45 miles per gallon (mpg) or greater fuel economy to use HOV lanes. While AB 2628 allows certain gasoline electric hybrids access to HOV lanes, they do not yet qualify for access under current Federal regulations.
    2. *SB 552, Clean and Fuel-Efficient State Fleet*. Signed by the Governor October 2003, this bill requires state vehicle fleet to purchase and use more fuel-efficient vehicles, and also requires

[*] A more detailed summary of City policies, resolutions, and initiatives highlighted in this section is provided in Appendix C.

state offices and agencies that have so called dual-fuel vehicles (that can use either gasoline or a cleaner alterative fuel) to actually use, to the maximum practicable extent, the cleaner alternative fuel in their vehicle.

Energy

- *Resolution R-298412 (R-2004-227), 50-Megawatt Renewable Energy Goal*. This resolution establishes the goal for adding 50-Megawatts of renewable energy for City operations by 2013. Track and report compliance with Resolution on a quarterly basis.

- Continue to upgrade energy conservation in City buildings and support community outreach efforts to achieve similar goals in the community.

- Annually Review and Revise Existing Policies

400-02	Biosolids Beneficial Use
400-11	Action Plan for Implementation of Water Conservation Techniques
900-02	Energy Conservation and Management
900-14	Sustainable Building
900-18	Purchase of Energy Efficient Products

- State Incentives and Regulations

1. *CALIFORNIA CODES, PUBLIC UTILITIES CODE SECTION 399.11-399.16.* In order to attain a target of 20 percent renewable energy for the State of California and for the purposes of increasing the diversity, reliability, public health and environmental benefits of the energy mix, it is the intent of the Legislature that the California Public Utilities Commission and

the State Energy Resources Conservation and Development Commission implement the California Renewables Portfolio Standard Program. This legislation requires electricity providers to increase their procurement of renewable energy resources to 20 percent no later than December 31, 2017.

Waste

- Continue to use methane as an energy source from inactive and closed landfills

- Consider bolder incentives to expand waste minimization efforts:
  - Develop and adopt a construction and demolition recycling ordinance;
  - Develop and adopt a commercial paper recycling ordinance;
  - Develop and adopt a multiple family recycling ordinance.

- Annually Review and Revise Existing Policies

100-14	Procurement Policy: Recycled Products
900-06	Solid Waste Recycling

Urban Heat Island

- Develop and Adopt ***Urban Heat Island Mitigation Policy***

  Dark materials used on roofs and roads absorb heat during the day and hold it long after the sun sets. A decrease in vegetation to provide shade and cool the air compounds the heating effect. These are the primary factors that cause the "urban heat island effect". As a result, ground-level ozone concentrations increase because of the chemical reaction between car exhaust and heat—the more heat, the more ozone is produced. This problem is linked with health risks, and is the reason San Diego is not in compliance with State air pollution requirements. Adopting the Mayor's goal of planting 5,000 shade trees per year on public property for twenty years would contribute to the mitigation of urban heating; however, more studies are needed to access the specific reductions needed. Additionally, alternative materials are available for roads and roofing, and general land use design improvements could serve to reduce the heating process.

- Annually Review and Revise Existing Policies

200-05	Planting of Trees on City Streets
200-09	Street Tree Plan-Central Business District
400-12	Implementation of Water Reclamation/Reuse
600-23	Open Space Preservation and Maintenance
600-39	Land Guidance

Environmentally Preferable Purchasing

- Develop and Adopt ***Environmentally Preferably Purchasing Policy***

In an effort to address the social, environmental, and economic aspects of sustainability, this policy supports a "triple bottom line" approach. Just as financial accounting is an indicator of an organization's economic performance (i.e., the bottom line), the triple bottom line approach accounts for social and environmental performance, in addition to the economic. The broad goals of the triple bottom line include "a clean and productive environment which provides renewable resources and essential life support services; societies which allow everyone access to a good quality of life; and a vibrant economy which works with nature and society" (Centre for Human Ecology 1998).

- Annually Review and Revise Existing Policies

100-13	Procurement Limitations Adjustments Based on the Consumer Price Index
100-14	Procurement Policy: Recycled Products
900-14	Sustainable Building
900-18	Purchase of Energy Efficient Products

Introduction

Policy development for the City of San Diego must take into account international, national, and state impacts and concerns while considering how to proceed on a local level. Although the main focus of this document is the City of San Diego, international and national effects are cumulative and cannot be overstated. Table 4 summarizes some of the main concerns; international and national global issues are explored in more detail in Appendix A:

Table 4. Summary of Impacts: International, National, and State

Area	**Impacts**		
	International	**National**	**State**
Human Health	• increased heat mortality and illness • more respiratory illness caused by higher concentrations of smog • increased transmission of vector-borne infectious diseases	• increased discomfort, especially in cities • loss of national treasures of American landscape	• increased ozone levels
Natural Infrastructure	• restricted ranges of plants and animals • regional extinction due to inability to adapt • change in species, geographic extent and health of forests	• extreme stress to fragile ecosystems • inability of natural ecosystems to rapidly adapt to change • change in species composition • loss of coastal wetlands if sea level rises	• increase in number of endangered animals and extinctions • ecosystem destruction

Area	Impacts		
	International	**National**	**State**
Economics	• decreased revenue from tourism • loss of profitable coastline • destruction of crops • shift in location of agricultural and industrial centers	• loss of bounty from the nation's lands, waters, and native plant and animal communities • loss of coastal property	• difficulty for farmers and their crops • increased pest infestation and fire hazards on the forestry industry
Public Infrastructure	• inability of reservoirs to hold increased runoff • evaporation of groundwater supplies • increased duration of droughts • reduced availability of hydro power • water and energy shortages	• change in timing and amount of water supplies due to reduction in snow pack	• decreased water supplies
Weather	• large increases in heat index (temperature + humidity) • increased frequency of heat waves • more intense storms		

Local Impacts from Climate Change

Summary of Local Global Warming Impacts

- water and energy shortages
- loss of beaches and coast property
- higher average temperatures
- decrease in revenue from tourism and agriculture

As previously mentioned, the City of San Diego faces the same challenges as those for the nation and state. More specifically, the following characteristics of the San Diego region affect its vulnerability to climate change:

- increasing population
- 52 miles of shoreline
- reliance on imported energy and water
- urban sprawl
- vulnerable economic sectors—agriculture and tourism

Natural Infrastructure

The relationship of these factors to increasing GHG emissions is the ever-growing imbalance of "sinks", which absorb and store CO2 emissions, and "sources", which produce CO2 emissions. By 2030, the San Diego-Tijuana region's population is expected to soar to 8 million, which is almost double the 2003 population. San Diego is currently growing at 1.7% per year, and such growth may outstrip current infrastructure planning, financing capabilities, and available land.

Sea level rise could lead to flooding of low-lying property, loss of coastal wetlands, erosion of beaches, and decreased longevity of low-lying roads, causeways, and bridges. In addition, sea level rise could increase the vulnerability of coastal areas to storms and associated flooding. Along much of California's coast, sea level already is rising by 3–8 inches per century, and for San Diego that rise is 8 inches. Sea level is likely to rise by another 13–19 inches by 2100. The beaches stretching across San Diego have been replenished with sand, and undoubtedly will be replenished further or protected with structures if threatened by sea level rise. Costs for sand replenishment to protect San Diego's coastline from a 20-inch sea level rise through 2100 could be $51 million to $1 billion.

Urban Heat Island Effect

The removal of vegetation and an increase in urbanization in San Diego will contribute to rising temperatures and create an effect known as an "urban heat island." Dark materials used to build roofs and roads absorb heat during the day and hold it long after the sun sets, keeping cities hot hours longer than outlying rural areas. This increase in temperature often causes a disruption in natural weather patterns. When the city heats up, air pressure falls and the colder, denser air rushes in from surrounding areas, causing the warm air to rise. As a result, the city essentially creates its own wind and the upward-rushing hot air can trigger convective thunderstorms. In addition to weather changes, the increased heat intensifies air-quality problems, especially with ground-level ozone – the chemical reaction that creates ozone can double with a ten-degree rise in temperature. When the land is covered with vegetation, however, the heat absorbed during the day is quickly removed by evaporation and plant transpiration.

The Urban Heat Island Effect can be mitigated through public policy. Governments can help the problem by revising building codes and specifications for pavements, roofs, and other building materials. An increase in the albedo, or reflective capacity, of a material can greatly reduce the amount of heat it traps, and therefore prevent the air temperature from rising. Using whiter materials during new constructions and resurfacing would also reduce energy costs associated with cooling buildings. Additionally, the use of cooler pavements would increase its lifespan, as the pavement is softened at higher temperatures and is thereby more easily damaged by traffic. Urban forests have also been shown to be highly effective in minimizing the urban heat island effect. Implementing these mitigation measures on a city-wide level would lower ambient air temperature and reduce energy consumption which, in turn, would lower air pollution from energy production and minimize the chemical reaction that creates ozone.

Economics

The economic effects of global warming in San Diego could threaten some of our most important industries, in particular tourism and agriculture, which are among the top 4 industries here.

As previously stated, San Diego is likely to face rather dramatic sea-level rises that may threaten its coastline, a major tourist draw. In 2001, total revenue from visitors topped $5.1 billion.

San Diego County ranks as the 20th largest agriculture producer in the nation. Weather disturbances or water shortages caused by global warming could disrupt water supplies, cause variations in crop quality and yield, or destroy crops. Climate change can also alter the abundance and distribution of pests and pathogens, as well as affect the opportunities for sequestration (sequestration is the process by which GHG emissions are stored; opportunities include forests and underground storage tanks). Higher temperatures could result in increased electricity demand for cooling, adding to troposphere ozone and pollution.

Public Infrastructure: Water and Energy

Currently the San Diego Region meets its regional water demands through costly and distant imported sources from the Colorado River and Northern California, which account for more than 95% of the regional water supply. Approximately 50% of San Diego's fresh water is used for non-drinking purposes such as landscape irrigation, commercial enterprise, and industrial processing.

Given this heavy dependence on imported water, it is not surprising that almost 60% of the energy used by the City of San Diego goes for pumping water and sewage. Multiple pump stations distribute water through hundreds of miles of pipes to homes, businesses, and treatment plants, the majority ending up in the ocean off of Point Loma. According to the City's Water Department, water conservation measures save over 3 million kWh annually, reducing carbon dioxide emissions by over 1700 tons. The use of reclaimed water saves energy that would have been used to bring water from the Colorado River or Northern California. Upgrades to pumping stations, electronic control systems, and public outreach programs that encourage citizens to conserve water will help reduce energy consumption and greenhouse gas emissions.

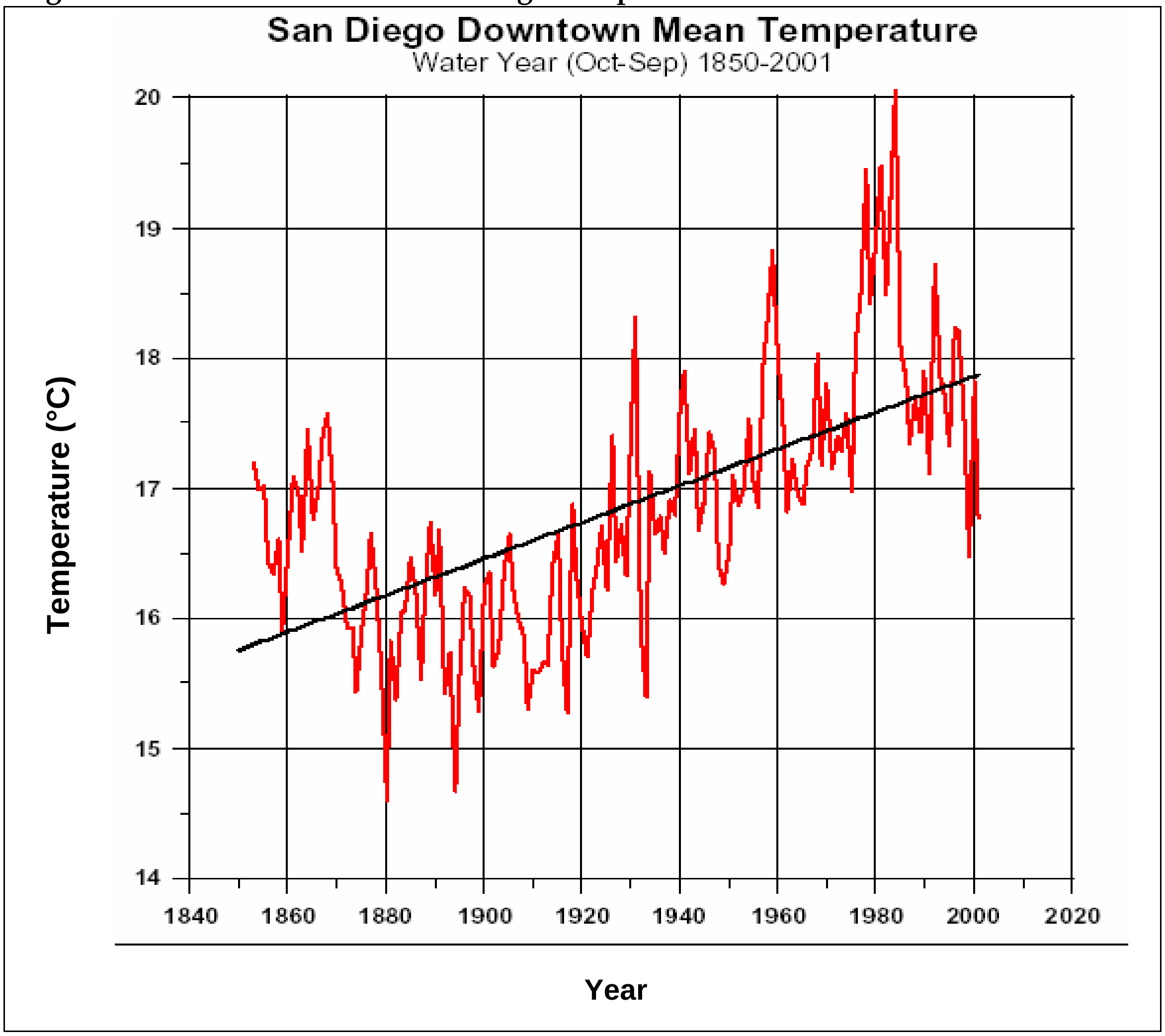
These upgrades are part of the City's comprehensive energy conservation strategy, which will not only improve efficiency and reduce consumption and greenhouse gases, but increase San Diego's energy independence, Mayor Murphy's Goal 9.

As San Diego's population continues to grow, its energy needs will increase accordingly. As with water, San Diego depends on imported power, which is generated primarily from out of state, including hydro plants in Northern California and the Pacific Northwest. Disruptions in water supplies and changes in the snow pack due to global warming could affect the availability of hydro power, forcing San Diego to look to other sources.

Figure 1 illustrates the change in mean temperature for downtown San Diego from 1850 to 2001. The nearly 2 degree increase is misleading, however. The primary reason for the mean average to increase is the "extreme days" that are colder and warmer than usual. In particular, the number of days exceeding 100 degrees has been, and is predicted to continue to increase.

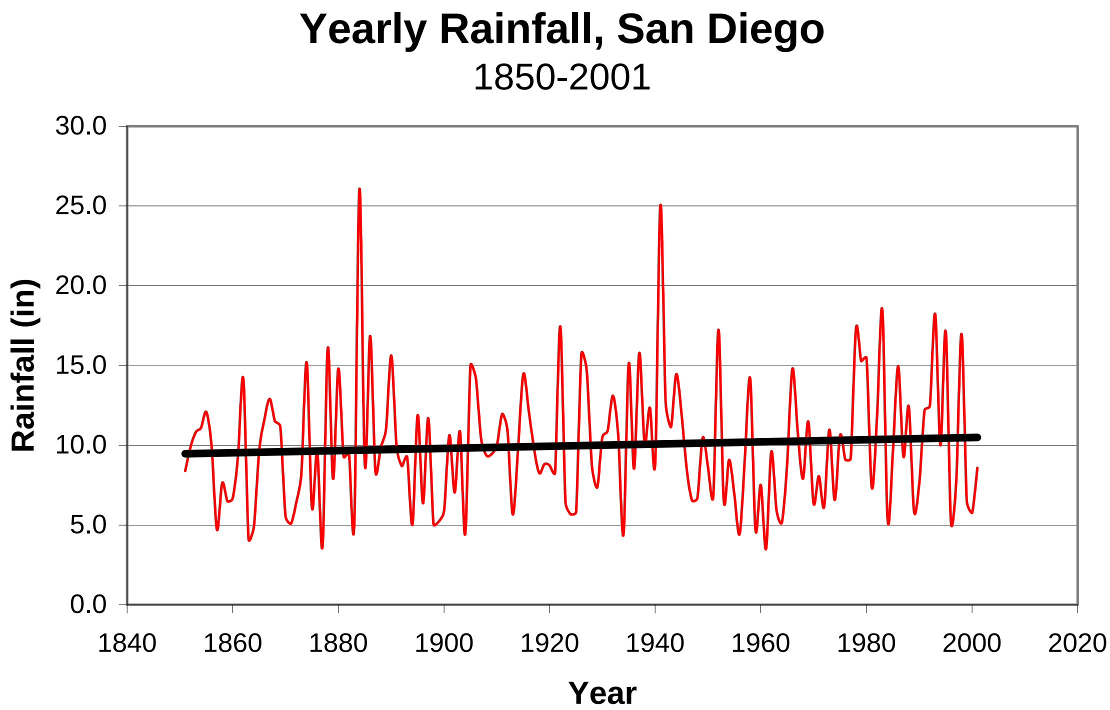
Figure 2 shows that the average trend in yearly rainfall has remained relatively constant, even though individual years are obviously very different. What is predicted are a greater number of storms coupled with longer periods punctuated with little to no rainfall. Once again, this is another indication that the "mean" average is not representing the complete picture for San Diego.

Figure 1. Historical Trend in San Diego Temperature Data



Source: Dr. Larry Riddle, Scripps Institute of Oceanography, Climate Research Div.

Figure 2. Historical Trend in San Diego Rainfall Data



Source: Dr. Larry Riddle, Scripps Institute of Oceanography, Climate Research Div.

Health

San Diego County achieved a milestone in the fight against air pollution on November 15, 2001, when it became the first large urban area in California to meet the federal "one-hour" standard for ozone pollution. The key to progress has been reduced emissions from autos. The federal one-hour standard calls for one or fewer ozone violations per year at all ten air monitoring stations in the County, for a three-year period. Considering that the federal standard had never been met since first being established in 1971, it is a solid accomplishment. Despite this success, San Diego was the 15th worst Metropolitan Area for ozone pollution in 2002. The report grades and ranks counties on how often their air quality reaches "unhealthful" categories of the Environmental Protection Agency's Air Quality Index for ozone, under the 8-hour standard. Research has shown that even low ozone levels can affect breathing, while long-term exposure results in higher risk for respiratory disease. Particulate matter is also a problem – suspended particles of dust, toxins, diesel exhaust, etc. are inhaled and often trapped in the lungs. Additionally, the prevalence rate for asthma increased by 87% among US children between 1982 and 1995. In San Diego County, an estimated 50,000 children and 105,000 adults have asthma.

City of San Diego Actions

On January 29, 2002, the San Diego City Council unanimously approved the San Diego Sustainable Community Program. Included in that program are:

- The City's GHG Emission Reduction Program, which sets a reduction target of 15% by 2010, using 1990 as a baseline
- Establishment of a scientific *Ad Hoc* Advisory Committee to expand the GHG Emission Reduction Action Plan for the City organization and broaden the scope to community actions
- Membership in the International Council for Local Environmental Initiatives (ICLEI) Cities for Climate Protection (CCP) Campaign to reduce GHG emissions (see Appendix A)
- Charter membership in the California Climate Action Registry (see Appendix C)

Participation in the ICLEI CCP campaign and the California Climate Action Registry will not only provide the City with recognition for its efforts, but also ensures that the City is credited with its voluntary emission reductions in the event that mandatory programs are ever adopted. Furthermore, if the international market for greenhouse gases develops as anticipated, the City will be able to participate.

Action Plan Development

Creating an action plan for combating climate change requires four basic steps:

1) Understand the current situation
2) Establish a future goal
3) Develop actions to achieve that goal
4) Devise indicators to measure progress towards the goal

Steps 1, 2, and 4 have been completed through the initial data collection stage. To fill in the remaining puzzle pieces, an *Ad Hoc* committee, which is more closely analyzing the available courses of action, has been appointed. Because the Action Plan must be flexible enough to accommodate changes in technology, environmental issues, and a wide range of community interests, the committee includes a diverse group of citizens, including scientific experts, business leaders, and community members.

Table 5. City Manager's Ad Hoc Committee Members

First Name	Last Name	Organization
Scott	Anders	San Diego Regional Energy Office
Dan	Cayan	Scripps Institution of Oceanography
Bill Ryan	Drumheller Bell	 ICLEI
Nancy	Hughes	Community Forest Advisory Board
Alan	Hurt	United States Navy
Mike	Lewis	Regional Transportation Center
Greg	Newhouse	Miramar Community College
Walter	Oechel	San Diego State University
John	Ruggieri	Project Design Consultants
Fred	Speece	Tetra Tech EM, Inc
Irene	Stillings	San Diego Regional Energy Office
Mark	Thiemens	University of California at San Diego

Step 1

The baseline year used for carbon emissions was 1990. All percent increases or decreases are given relative to 1990 by definition. Future increases in carbon emissions were predicted using a combination of ICLEI software and government reports. Additionally, transportation, energy, and waste were identified as the factors contributing most to GHG emissions. More specific leverage points within each category were also isolated, such as the daily commute, heating and cooling system efficiency, and building material durability. The best ways to reduce GHG emissions are explored in greater detail in Step 3.

Step 2

A 15% reduction target, relative to 1990, has been set and approved by the Mayor and City Council in October, 2002.

Step 3

The formulation of a specific set of actions to reduce GHG emissions in San Diego has been developed and is the basis of this report.

Step 4

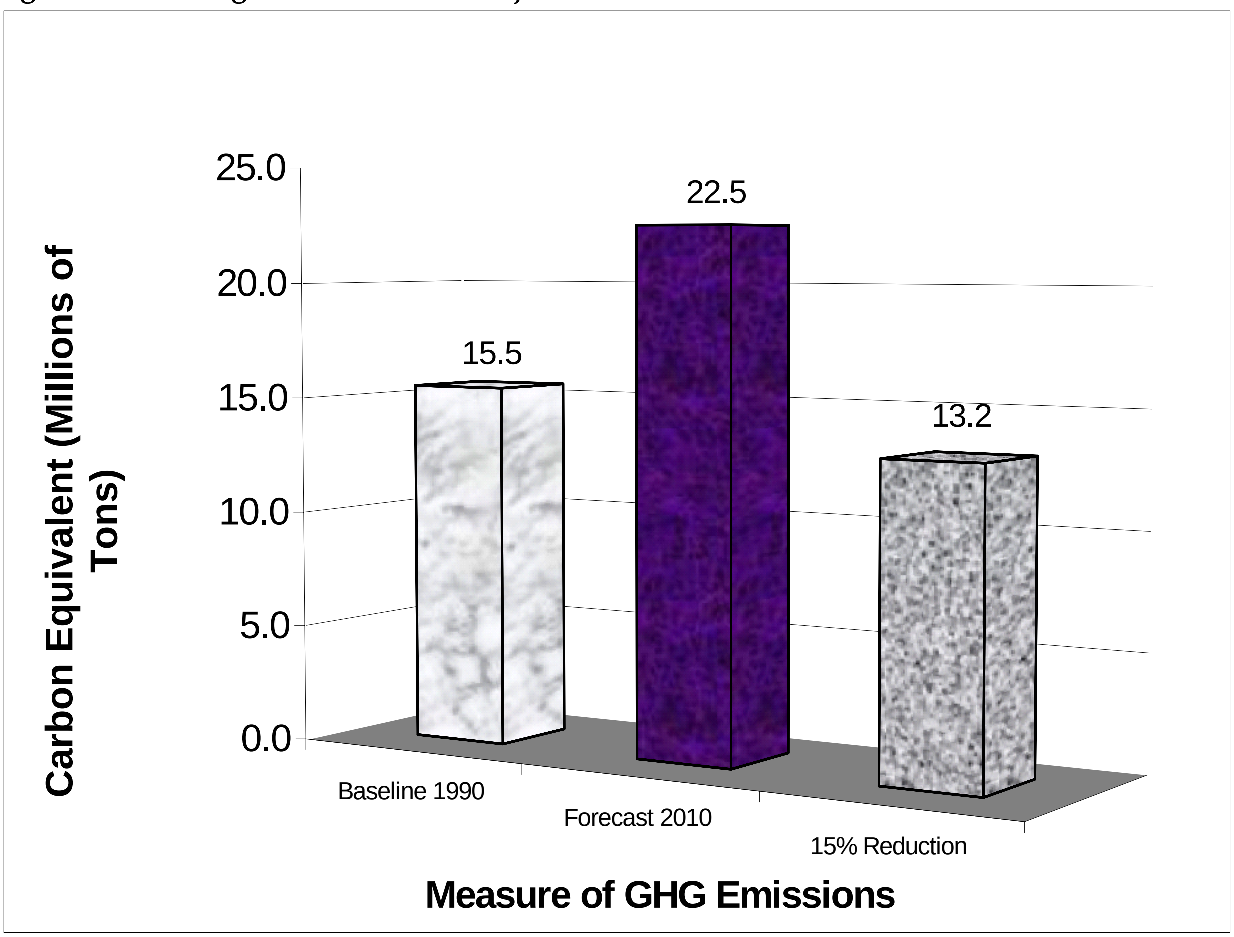
The indicators included in the recently approved San Diego Sustainable Community Program largely fulfill this step. Additional indicators may be necessary to fully measure GHG emission trends.

Emissions Baseline and Forecast

Using a combination of CCP-provided software, San Diego Association of Governments (SANDAG) projected growth rates, and reports from the EPA and California Energy Commission, the City of San Diego has established a baseline 1990 Emissions report and a 2010 forecast based on the status quo. The results are shown in Figure 3.

Next, CCP software and California Energy Commission data were used to determine each of the five sectors' relative contribution to GHG emissions in 1990 and 2010. As Figure 4 and Figure 5 show below, the transportation sector was the largest contributor to GHG in 1990. However, this sector's share of total emissions decreases from 51% in 1990 to 40% in 2010, while energy (electricity and natural gas) increases from 29% in 1990 to 43% in 2010. This is based on SANDAG projections, and is limited to growth within the City of San Diego, which may be different from that of the greater San Diego region.

Figure 3. San Diego Historical and Projected GHG Emissions



City of San Diego Community Baseline and Forecast

(Includes the residential, business and commercial sectors within the City limits)

Figure 4. 1990 City of San Diego Community Baseline GHG Emissions by Sector

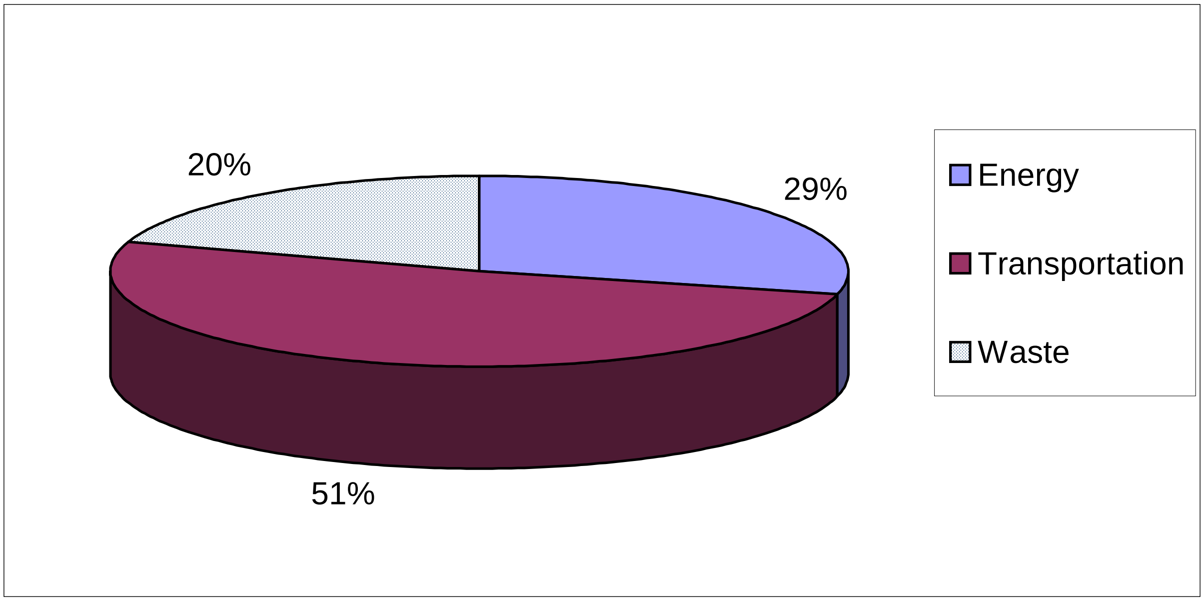
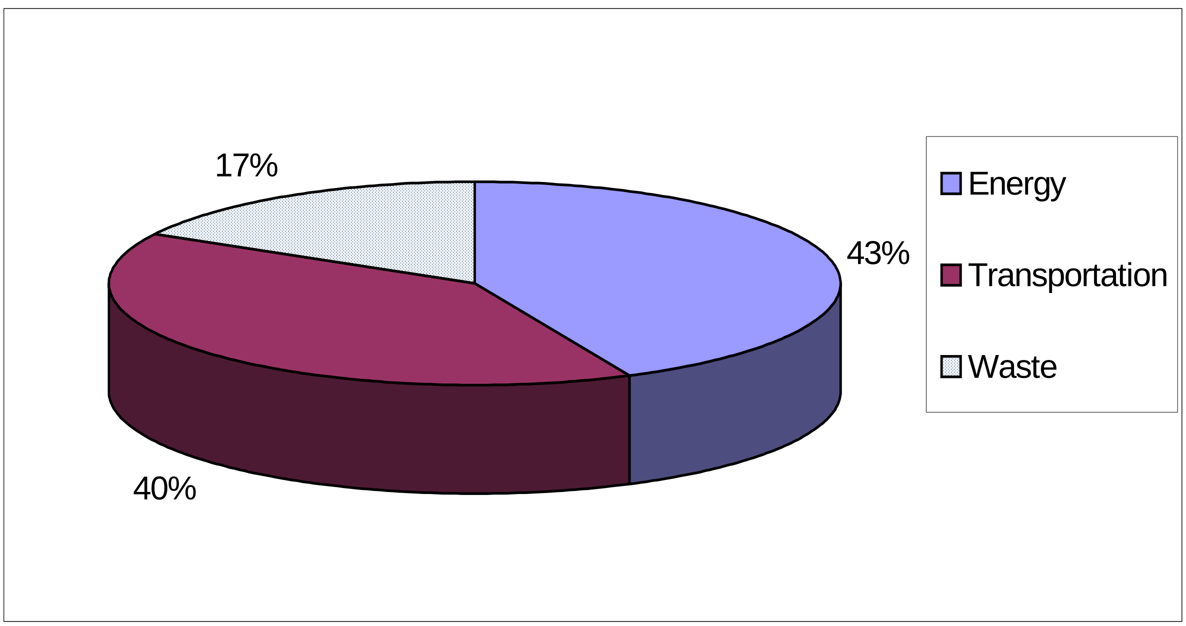


Figure 5. 2010 City of San Diego Community Forecast GHG Emissions by Sector



City of San Diego Organization Baseline and Forecast

(Includes only Municipal Government Operations)

Figure 6. 1990 City of San Diego Organization Baseline GHG Emissions by Sector

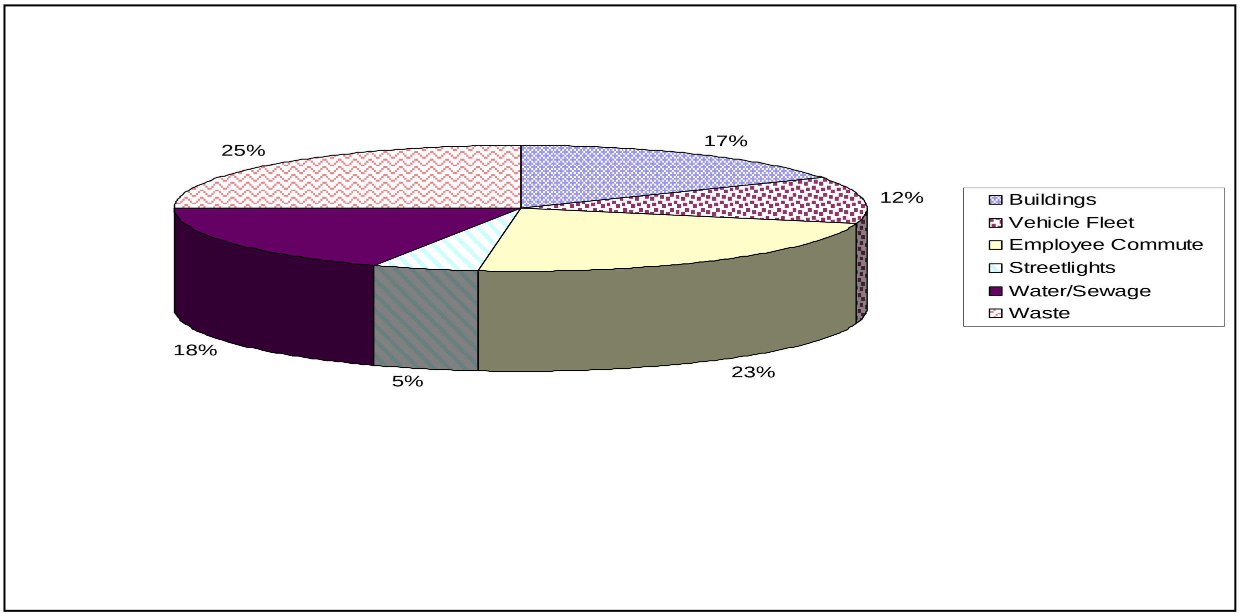
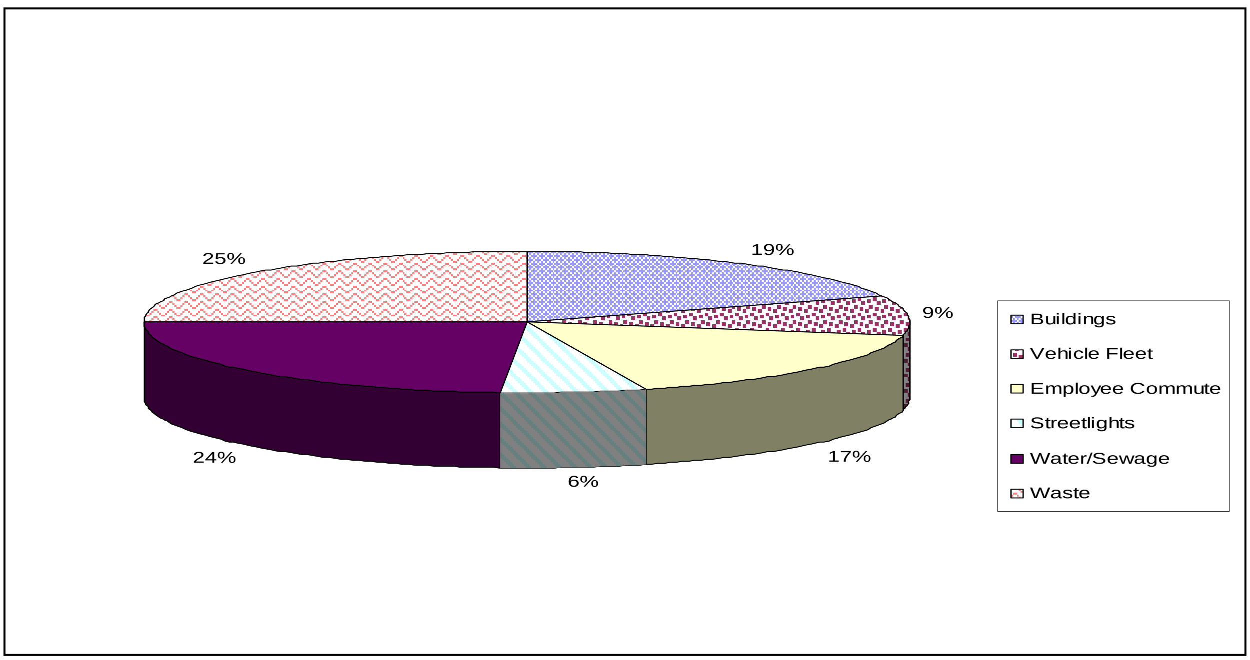


Figure 7. 2010 City of San Diego Organization Forecast GHG Emissions by Sector



Emissions Reduction Strategies

To cut GHG emissions, a two-phase strategy has been initiated:

<u>*Phase One, 1994–2003*</u>

Through a combination of increasing energy efficiency, retrofitting transit infrastructure, recycling, and recovering landfill gas, the City has reduced GHG emissions by more than 800,000 tons per year. This saves the City over $15 million dollars annually.

Table 6. Total City Organization GHG Reductions

Project	**Annual GHG Reduction (Tons CO_2)**
Energy Conservation	**61,833**
Transportation Measures	**12,893**
Solid Waste Measures	**767,193**
City Total	**841,919**

Table 7. Total Community GHG Reductions

Project	**Annual GHG Reduction (Tons CO_2)**
Energy Conservation	65,361
Transportation Measures	42,270
Solid Waste Measures	2,864,375
Community Total	**2,972,006**

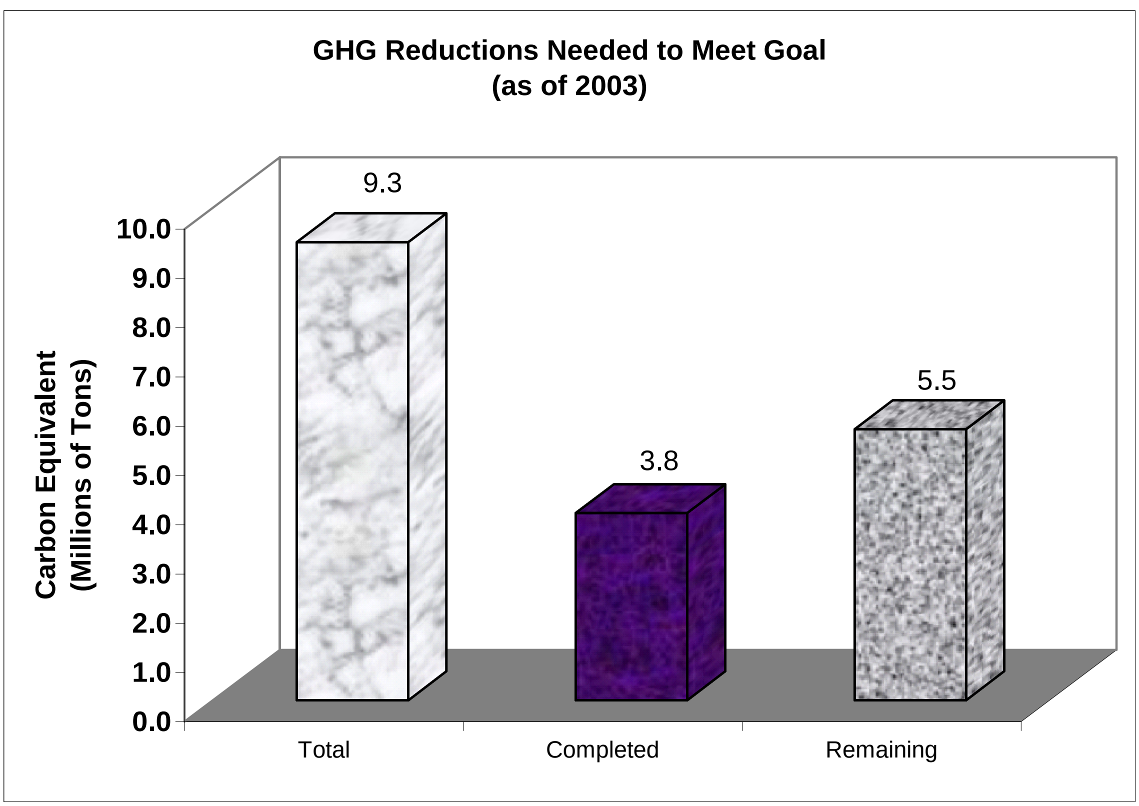
<u>*Phase Two, 2003–2010*</u>

Through actions taken primarily for greater efficiency and cost savings, CO_2 emissions reductions in San Diego are already over one-half the necessary reductions projected for 2010. Greater use of alternative energy sources such as solar photovoltaic panels and landfill gas, along with further improvements in energy efficiency, will continue this process (see Table 8). Figure 8 shows the remaining reduction necessary relative to the cuts already made and the total reductions necessary.

Table 8. Additional Actions

Sectors	City Organization	Community
Transportation	Converting more vehicles to Liquefied Natural Gas (LNG) or Compressed Natural Gas (CNG)	Increasing carpooling and transit ridership
	Telecommuting	Improving bicycle path infrastructure
Energy	Converting more buildings to Green Buildings	Giving incentives for buying more energy-efficient appliances
	Installing solar PV energy systems (e.g., at Miramar Landfill)	Educating the public about energy conservation
Solid Waste	Expand internal recycling programs and enforcement of City goals.	Expanding composting programs
		Expanding recycling programs

Figure 8. Progress Toward 15% Reduction Achievement



Transportation

Transportation is usually one of the largest sources of GHG emissions. Coupled with the challenges of efficient mass transit for a city that is not concentrated in one area, this means that finding effective solutions to transportation emissions is a top priority for San Diego. However, a benefit of finding effective solutions for reducing emissions is an easing of traffic congestion.

Within the City organization, conversion of more vehicles to Liquefied Natural Gas (LNG) or Compressed Natural Gas (CNG), GIS and RouteSmart mapping techniques for more efficient trash collection routes, and telecommuting have assisted in meeting the City of San Diego's GHG reduction goals.

Community solutions include campaigns to increase carpooling and mass transit availability and ridership, including extension of the San Diego Trolley lines; and improving bicycle path infrastructure.

Table 9. City of San Diego Transportation Energy Savings

Year Begun	Project	Annual Energy Savings (Gallons of Fuel)	Estimated Annual Tons CO_2 Reduced
1990	Transportation Alternatives Program: carpool, vanpool, and public transportation incentives for City employees	827,000 gals. Gasoline	6,741
1999	Automated Refuse Collection	280,800 gals. Diesel	2,956
2001	Re-routing of City refuse collection using GIS and RouteSmart software	120,380 gals. Diesel	1,267
2001	EMS at Miramar Landfill: Ticketless Transactions and Idle Time Reduction	110,000 gals. Diesel	1,157
2001	Consolidation of ESD Operations to Single Ops Center (Miramar)	62,235 gals. diesel	659
2003	"Pack at Idle" Program	10, 674 gals. diesel	113
Total Savings for Transportation		**827,000 gals. Gas, 583,289 gals. Diesel**	**12,893**

Energy

Energy consumption may not be the largest source of greenhouse gases, but it is the most recognizable. This is due in part to the costs associated with it, but also because it is an area where government can set the example, while citizens can do tangible things to improve efficiency, such as changing incandescent bulbs with compact fluorescent bulbs.

Table 10 details the City's energy efficiency measures and associated savings from 1994 to the present. Through a mix of equipment and lighting upgrades and use of alternative fuels such as landfill and sewage digester gases, falling water, and photovoltaic panel, the City has not only gained impressive savings, but earned a reputation for innovation and leadership in energy.

This innovation and leadership can be seen in the proposed and planned projects detailed in Table 11. On August 7, 2003 Mayor Dick Murphy announced a goal of 50 megawatts (MW) of renewable energy generation by 2013. The photovoltaic projects listed on the table will add to the 18 MW of generation already present at City facilities.

Table 10. Energy Savings and GHG Reduction

Year Completed	Project	Annual Energy Savings (kWh)	Estimated Annual Tons CO_2 Reduced
1994	Police Southern Division	151,478	54
1994	Mira Mesa Library	9,950	4
1994	RB Community Park/Rec Center	184,034	65
1994	Police HQ Lighting Retrofit	524,963	186
1994	World Trade Center Lighting Retrofit	452,091	160
1994	Concourse Lighting Retrofit	8,190	3
1995	Material Test Lab	28,947	10
1995	Admin 6th & 7th	119,805	42
1995	Central Library	266,784	95
1995	World Trade Center	41,516	15
1995	Climax Pump Station	40,712	14
1995	Montezuma Pumps	463,622	164
1996	Rancho Bernardo Library	52,252	19
1996	Tierrasanta Pool	17,010	6
1996	Balboa Park Club	9,484	3
1996	Material Test Lab	14,185	5
1996	Ridgehaven Court Retrofit	933,446	330
1996	Euclid Community Center	19,021	7
1996	COB Lighting Retrofit	103,601	37
1996	Concourse Lighting Retrofit	517,547	184
1996	20th & B Lighting Retrofit	103,601	37
1996	Chollas Ops Lighting Retrofit	353,401	125
1996	Rose Canyon Lighting Retrofit	73,356	27
1996	LED Exit Signs-Buildings Division	197,339	70
1996	Crabtree Building	61,303	22
1996	Brown Field Lighting Retrofit	21,082	7

Year Completed	Project	Annual Energy Savings (kWh)	Estimated Annual Tons CO_2 Reduced
1996	Crabtree Building	24,148	9
1996	Stadium	42,114	15
1996	Fire Stations 1&2	344,501	122
1996	Police	18,151	6
1996	Conjunctive Billing-Pump Station #64	57,282	20
1996	HVAC/Lighting-Metro Ops 2	107,700	38
1996	Bernardo Heights Pump Station	96,205	34
1996	Carmel Industrial Pump Station	292,839	104
1996	High-Efficiency Motors-Citywide	219,747	78
1996	Balboa Park Fountain	172,390	61
1996	Fire Station Retrofits	344,501	122
1997	High-Efficiency Motors-Citywide	40,519	14
1997	Civic Theater	71,247	25
1997	Stadium Expansion	146,121	52
1997	Carmel Valley Library	12,604	4
1997	Chargers Training Facility	136,680	48
1997	Recreation Center	19,867	7
1997	Scripps/Poway	523,530	186
1997	Police Northern Div Lighting	113,006	40
1997	Police Mid-City Div Lighting	176,734	63
1997	Police Eastern Division Lighting	108,206	38
1997	Police Western Div Lighting	117,892	42
1997	Police Traffic Div Lighting	85,916	30
1997	Kearny Mesa Rec Center	18,687	7
1997	Police Central Division	21,526	8
1997	Police Eastern Division	110,251	39
1997	Hilltop Community Center	12,109	4
1997	Police	185,728	66
1997	Civic Center	50,492	18
1997	North City Water Reclamation Plant Design Efficiencies	17,779,615	6,279
1997	Metro Biosolids Center Design Efficiencies	1,891,098	671
1997	Red LED Traffic Signals	7,134,528	2,531
1997	Water Quality Lab	600,457	213
1997	Scripps Miramar Pump Station	106,700	38
1997	Catalina Pump Station	270,000	96
1997	S. Creek Pump Station	40,408	14

Year Completed	Project	Annual Energy Savings (kWh)	Estimated Annual Tons CO_2 Reduced
1997	Penasquitos Pump Station	2,184,693	775
1997	Herrick Pump Station	600,098	213
1997	Miramar Filter Plant	106,213	38
1997	Alvarado Filter Plant	118,132	42
1997	Otay Filtration Plant	128,588	46
1997	Civic Theater	71,247	25
1998	Point Loma Cogeneration Plant	21,300,000 kWh 1,600,000 therms	17,429
1999	Landfill Gas Cogeneration	56,946,000	20,170
2000	Calle Fortunada Retrofit	511,815	182
2001	Green LED Traffic Signals	4,714,460	1,672
2001	Point Loma Hydro Plant	11,318,000	4,015
2001	CAB Retrofit	2,941,081 kWh 60,429 therms	1,417
2002	Onsite Energy Retrofit Projects • Pump Station #2-lighting • Central Library-equipment • Crabtree Building-lighting • WTC-equipment & lighting	1,178,983 kWh, 42,979 therms	684
2002	Photovoltaic System at Miramar Ops Center-73 kW	91,500	32
2003	Photovoltaic System at ESD Ridgehaven Administrative Center – 65 kW	80,702	29
2003	MOC 3 Photovoltaic Project-30kW	45,000	16
2003	Pt. Loma Admin. Building Retrofit	8,570	3
2003	South Bay WRP New Construction	3,177,275	1,127
Ongoing	Citywide Water Conservation Program	3,058,524	1,085
Total Savings for Energy Conservation 1990-2003		**144,567,631 kWh** **1,703,408 therms**	**61,833**
2004 Projects			
2004	Police HQ Retrofit	1,719,022	610

Impact of the Renewable Portfolio Standard (RPS)

In 2010, it is estimated that electricity use in San Diego will be 12 billion kWh. With a projected population of 1.37 million, that is 8,757 kWh per capita. In 2004, the total electricity consumed in San Diego was 8.6 billion kWh or 6,645 kWh per capita. This 32% projected growth in per capital energy consumption will be accompanied by more emissions of CO2 and other pollutants.

The RPS, which calls for 20% renewable power in 2010, is a valuable tool to offset these emissions. If the goals of the RPS were achieved, 2.4 billion kWh of renewable power would be consumed in 2010. In 2004, 10.6% (912 million kWh) of electricity in San Diego came from renewable sources. The additional 1.48 billion kWh of renewable power from 2004-2010 would reduce greenhouse gas emissions by roughly 528,000 tons annually. This would constitute almost 10% of the remaining GHG reductions to meet the goal of 15% below 1990 levels by 2010.

Table 11. Proposed and Planned Energy Saving Measures: City of San Diego

Project	Estimated Annual Energy Savings	Estimated Annual Tons CO_2 Reduced
Energy Retrofits		
Clairemont Library - Lighting upgrades	 5,419 kWh	 3
University Heights Library - Lighting upgrades	 7,850 kWh	 4
Tierrasanta Library - Lighting upgrades	 9,629 kWh	 5
North Park Library - Lighting & HVAC upgrades	 34,503 kWh	 17
Linda Vista Library - Lighting upgrades - HVAC upgrades	 12,226 kWh 11,750 kWh	 6 6
North Clairemont Library - Lighting upgrades	 9,677 kWh	 5
Fire Communications Center - Vending machine controller	 1,900 kWh	 1
Fire Repair Facility - Skylights - Vending machine controller	 15,330 kWh 1,900 kWh	 8 1
Carmel Valley Pool/Rec - Solar energy heating - Lighting upgrades - Vending machine controller - Pump upgrades	 22, 723 therms 12,760 kWh 7,600 kWh 25,459 kWh	 334 6 4 13
Allied Gardens Pool - Solar energy heating - Vending machine controllers - Pool upgrades	 12,881 therms 3,800 kWh 46,290 kWh	 189 2 26
Colina Del Sol Pool - Vending machine controllers - Pool upgrades	 1,900 kWh 6,535 kWh	 1 3
Benjamin Library - Lighting upgrades - HVAC adjustments	 10,822 kWh 1,481 kWh	 5 1
Pacific Beach Library - Upgrade HVAC	 18,181 kWh	 10
Oak Park Library - Lighting upgrades	 18,184 kWh	 10
Ridgehaven	35,381 kWh	18

Project	Estimated Annual Energy Savings	Estimated Annual Tons CO_2 Reduced
-Lighting upgrade		
Morley Field -manual timers on tennis courts	48,575 kWh	24
Police Departments - Lighting upgrades - HVAC upgrades - Vending machine controllers	195,456 kWh 200,990 kWh 20,752 kWh 1,300 kWh	98 101 10 1
Alvarado Lab - Cogeneration - Lighting - HVAC - Vending machine controllers	 2,063,856 kWh 124,203 kWh 452,320 kWh 1,300 kWh	 1,035 62 227 1
Casa de Balboa - HVAC - Lighting	 152,320 kWh 160,139 kWh	 76 80
Pershing Service Yard - Lighting upgrades - Vending machine controllers	 7,650 kWh 3,800 kWh	 4 2
Photovoltaic Systems		
N. Clairemont Library -15 kW system	 23,000 kWh	 12
Oak Park Library -10kW system	15,000 kWh	8
Carmel Valley Pool/Rec - 30 kW system	 45,000 kWh	 23
Alvarado Lab - 56 kW system	87,000 kWh	44
Projects to Complete Goal of 50MW of renewable generation by 2013-23.1MW ★	46,200,000 kWh	23,171
MWWD Proposal for PV on 40 Pump Stations (average 85,000 kWh per station annual output)	3,400,000 kWh	1,705
Total Possible Savings	**53,501,238 kWh/y** **35,604 therms**	**Approx. 27,000**

★ Figures in this table are estimated, using an average of 3.3 MW of new generation each year from 2003 until 2010, less the proposed PV projects, for a total of 23.1 MW. Also assumes that projects will be a mix of PV, landfill gas, and other renewables, so 1 MW of generation = 2,000,000 kWh per year.

Solid Waste

By far the largest reductions in greenhouse gases come from measures that reduce the amount of solid waste going to landfills through recycling and source reduction. Given the State of California requirement of 50% waste diversion mandated by AB 939, cities in California have multiple motivations for pursuing these measures.

The City of San Diego has once again taken the lead in this area, using landfill gas to generate power, and creating an award-winning composting program. City departments have their own recycling programs, and the Environmental Services Department collects recyclables and green waste from single-family houses throughout the City.

There is still much to be done, however. Encouraging environmentally-preferable purchasing, more strongly advocating recycling among the public and businesses, and finding new uses for landfill gas are possible solutions.

Table 12. Solid Waste Savings and GHG Reduction

Year Begun	Project	Annual Savings	Estimated Annual Tons CO_2 Reduced
1996	Landfill Gas Recovery	n/a	472,139
1990	Curbside Commodity Collection-FY04	72,000 tons of recyclables	231,302
1990	Buyback Center Recycling-FY02	10,430 tons of recyclables	42,300
1990	Internal City Recycling	4,900 tons of recyclables	21,452
Total Savings for Solid Waste Measures		**n/a**	**763,021**

Mitigation Measures

California

Health

Public health and medical professionals are focusing not only on the risks but also adaptive options to mitigate adverse impacts. Adaptive options to minimize health impacts include improved and extended medical care services; enhanced disaster preparedness and relief, increased use of protective technology (air conditioning, water purification, vaccination, etc.), public education directed at personal behaviors, and appropriate professional and research training.

California has the technical potential to meet almost all (96%) of its current electricity needs with the renewable sources listed in Table 13 California's total numbers may have changed slightly since 2002, but the California Energy Commission estimates that 11% of the electricity sold to California consumers in 2002 came from renewable sources. (California Energy Commission, http://www.energy.ca.gov/electricity/gross_system_power.html.)

Table 13. California's Potential to Generate Renewable Energy

Type of Generation	**Electricity Generation (GWh)**
Renewable Technical Potential	
Wind	43,986
Geothermal	37,334
Solar (Thermal and PV)	157,312
Total Biomass	17,758
Small Hydro	6,156
Total Renewable Technical Potential*	**262,546**
Total Electricity Generation, Renewable and Non-Renewable (2002)	**272,509**

Source: California Energy Commission, "Renewable Resources Development Report," November 2003.

* Estimates for California's renewable technical potential vary, sometimes greatly, among studies. The reasons for these variations may include the different time frames in which the studies were conducted, the filtering of data using differing criteria, and in the case of solar, how photovoltaic and central station are counted or characterized.

A June 2002 analysis found that building 5,900 MW of renewable energy capacity in California would lead to 28,000 year-long construction jobs, and 3,000 permanent operations and maintenance jobs. Over thirty years of operation, these new plants would create 120,000 person-years of employment. This is four times as many person-years that would be created by building 5,900 MW of natural gas power plants. In addition to creating jobs, renewable energy development would boost California's economy, according to an analysis by Union of Concerned Scientists. Through 2020, a national standard requiring increased generation from renewable energy would produce:

- $3.1 billion in new capital investment
- $223 million in new property tax revenue for local economies
- $79 million in lease payments to farmers and rural landowners from wind power

Policies

On June 1, 2005 Governor Arnold Schwarzenegger signed Executive Order #S-3-05, establishing ambitious yet achievable greenhouse gas emission targets for the State of California.

Table 14. State Greenhouse Gas Emission Targets

By 2010, Reduce to 2000 Emission Levels*
By 2020, Reduce to 1990 Emission Levels**
By 2050, Reduce to 80% Below 1990 Levels

* Equals 59 Million Tons Emission Reductions, 11% Below Business as Usual
** Equals 145 Million Tons Emission Reductions, 25% Below Business as Usual

Greenhouse gas (GHG) emission reduction strategies that are already underway in California are listed below in Table 15. These strategies, when fully implemented, significantly reduce greenhouse gas emissions in the state. The strategies listed are considered "high-confidence" strategies and were evaluated by the California Climate Action Team established by Governor Schwarzenegger to determine reasonable GHG targets. The targets were established based on the realization that GHG emission reduction technologies and strategies will improve with innovation and continued government leadership. These strategies will bring California half way towards meeting the 2010 target. Included in this list is a regulation (AB 1493) that requires automakers to comply with new, stricter GHG emissions standards set forth by the California Air Resources Board (CARB) beginning with model year 2009.

The next group of strategies to be enacted is expected to be presented to the Governor and Legislature in January 2006. As noted above, it is anticipated that future strategies will rely on technological innovation, but will include a range of policies from voluntary efforts, regulatory programs, and cap-and-trade options.

Table 15. GHG Reduction Strategies Already Underway in California

Lead Agency/Strategy	GHG savings[1] (Million tons CO_2 equivalent)	
	2010	**2020**
Air Resources Board		
GHG Vehicle Standards (AB 1493)	1	30
Diesel Anti-idling	1	2
Energy Commission/Public Utilities Commission		
Accelerated Renewable Portfolio Std (33% by 2020)	5	11
Million Solar Roofs	0.4	3
Integrated Waste Management Board		
Zero Waste/High Recycling Programs	7	10
Energy Commission		
Full cost-effective natural gas efficiency improvements	1	6
Appliance Efficiency Standards[2]	3	5
Fuel-efficient Replacement Tires & Inflation Programs	3	3
Business Transportation and Housing		
Reduced Venting and Leaks in Oil and Gas Systems	1	1
State and Consumer Services		
Green Buildings Initiative	Not Yet Estimated	
Air Resources Board/CalEPA		
Hydrogen Vehicles	Not Yet Estimated	
Total Potential Emission Reductions[3]	**23**	**70**

[1] These are approximations that best reflect our current knowledge given a committed and coordinated effort with strong state leadership in partnership with industry.
[2] Included in the baseline are the 2004 energy efficiency goals which will result in an estimated reduction of 4 million tons of GHG emissions in 2010 and 13 million tons of GHG emissions in 2020.
[3] Rounding may cause this number to be slightly different than the sum of the numbers for each strategy.

City of San Diego

Policies, Initiatives, and Resolutions

The City of San Diego has a number of existing policies, resolutions and initiatives that serve to advance the reduction of greenhouse gas emissions. The list of current policies and initiatives in Table 16 has and will continue to contribute to the success of the Action Plan (for synopses of each policy and initiative, see Appendix C).

Table 16. Existing City of San Diego Policies, Initiatives, and Resolutions

Policy/Resolution Number	Title
100-14	Procurement Policy: Recycled Products
200-05	Planting of Trees on City Streets
200-09	Street Tree Plan-Central Business District
200-17	Alternative Fuels
400-02	Biosolids Beneficial Use
400-09	Action Plan for City's Future Water Supply
400-11	Action Plan for Implementation of Water Conservation Techniques
400-12	Implementation of Water Reclamation/Reuse
600-05	Community Plans
600-14	Development Within Areas of Special Flood Hazard
600-23	Open Space Preservation and Maintenance
600-30	General Plan Amendments to Shift Land from Future Urbanizing to Planned Urbanizing Area
600-34	Transit Planning and Development
600-39	Land Guidance
700-20	San Diego Port Policy
900-01	Economic Development
900-02	Energy Conservation and Management
900-06	Solid Waste Recycling
900-14	Green Building
900-18	Purchase of Energy Efficient Products
n/a	Community Forest Initiative
R-298412	50 MW Additional Renewable Power by 2013

Recommended Policies and Initiatives

The following recommendations are a first step in increasing the ability of the City of San Diego and its residents to continue with more sustainable practices that will reduce greenhouse gas emissions and conserve resources:

- Environmentally Preferable Purchasing Policy
- Fuel Efficiency Policy

Education

Perhaps the most important measure to reduce greenhouse gases is education. The majority of the population is simply unaware of the nature of global warming, the urgency of the matter, and the actions they can take to reduce the amount of greenhouse gases in the atmosphere. Knowledge of the problem is the first step toward a solution. Knowledge can also be passed on through generations, which would help curb global warming for years to come.

In 1999, the Environmental Services Department's Ridgehaven office building was given the U.S. Department of Energy and the U.S. Environmental Protection Agency's first Energy Star Label for energy efficiency. This building now serves as a model of a "green" building and is open for touring throughout the year. The building has educated hundreds of students, businesses and the public on the benefits and materials associated with an environmentally sustainable building that minimizes energy use and in turn reduces the amount of greenhouse gases.

The City of San Diego has developed several programs that focus on the education of all ages:

Environmental Services Department:

Climate Wise-Energy Star® Alliance

Fifteen local companies (called Partners) from various industries and academia, participate in this program. Information exchanges, positive publicity, and access to resources are provided free of charge to Partners, with the goal of not only reducing greenhouse gases, but also fostering public-private partnerships and proving that environmental and business goals can be the same.

Green Action

This countywide program is aimed at educating high school students and currently involves over 1300 students from fifteen different high schools annually. Interactive lectures teach students about global warming and then ask them to think about solutions to the problem, the consequences of taking no action, and how they could live more sustainably. Included in this program is a community service project, an energy audit of their high school, and a field trip to the Ridgehaven "Green Building."

Master Composters of San Diego

This program trains volunteers how to compost, so they in turn can teach others their skills and show them the benefits of composting. Participants attend thirty hours of training, as well as thirty hours of volunteer work for the program.

Public Forums

Through the Sustainable Community Program, regular forums are held on various topics that promote sustainable behavior among the public. Water conservation, the greenhouse effect, and environmentally-preferable purchasing are recent examples.

Enviroschool

Since 1998, the City has hosted workshops for over 3,000 students in San Diego. Activities in this program include: the Splash Van, a mobile laboratory where kids learn about the connection between humans and the environment; the Green Machine, hands-on activities that teach agricultural awareness; and the Recycling Relay, which follows a presentation on the importance of recycling and waste management. Also included in this program is a trip to the Ridgehaven "Green Building."

Water Department

Water Conservation Program

This program seeks to educate the public on water conservation efforts by providing the Residential Water Survey Program. This citywide program is free of charge to single-family and multi-family units who pay their water bills to the City of San Diego. A Water Conservation Representative tours the property and points out leaks and water-saving opportunities and provides water-saving equipment and information. The program not only reduces the property's water usage, but also educates the tenants on the importance of water conservation.

Conclusion

This report addresses the following issues:

1) Clarify the challenges for San Diego in an environment with increased global warming;
2) Quantify the CO_2 baseline for 1990 using standardized software and the *status quo* projections for 2010;
3) Identify a set of actions that will reduce CO_2 emissions from the City of San Diego organization 15% in 2010, using 1990 as the baseline; and
4) Provide decision tools that lead to greater reduction of CO_2 in the community.

The potential state, national, and international impacts of global climate change discussed in this report emphasize the importance of implementing these recommended actions. As a community leader, the City of San Diego has an obligation to set an example and meet the environmental challenges of increased global warming. However, the City cannot do this alone. Partnerships with, and cooperation from, the community are necessary for moving towards a more sustainable future.

Appendix A. International and National Impacts and Involvement

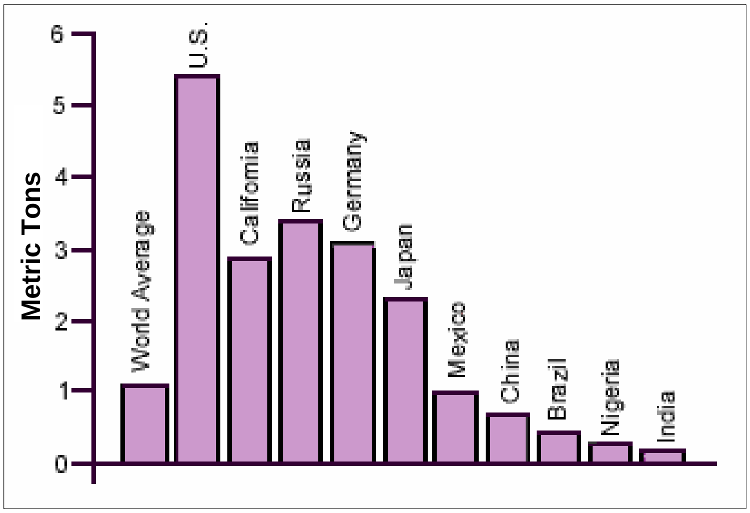
Defining Climate Change

Global climate change, also known as global warming, is identified by many credible scientists around the world as the most pervasive environmental problem facing us today, and will remain so for many generations to come. Rising GHG emissions, primarily carbon dioxide from fossil fuel consumption, are leading to significant changes in climate, including more severe storms, unprecedented heat waves, and drought.

Recent studies have shown how higher CO_2 levels and warmer global temperatures have affected the biosphere, and offer clues about what may lie ahead. The Intergovernmental Panel on Climate Change (IPCC) is determining what constitutes "dangerous anthropogenic interference", and has concluded that it will vary among regions—depending both on the local nature and consequences of climate change impacts, and also on the adaptive capacity available to cope with climate change. It also depends upon mitigative capacity, since the magnitude and the rate of change are both important. There is no universally applicable best set of policies; rather, it is important to consider both the robustness of different policy measures against a range of possible future worlds, and the degree to which such climate-specific policies can be integrated with broader sustainable development policies.

Although comprising only one-twentieth of the world's population, the United States produces about one-quarter of the world's GHG emissions, which is indicated in Figure 9.

Figure 9. Annual Per Capita Carbon Emissions



Note: Data applies to the late 1990s. (1 metric ton is about 1.1 English tons)

Human activities have increased the atmospheric concentrations of greenhouse gases and aerosols since the pre-industrial era. The atmospheric concentrations of key anthropogenic greenhouse gases (i.e., carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and troposphere ozone (O_3)) reached their highest recorded levels in the 1990s, primarily due to the combustion of fossil fuels, agriculture, and land-use changes.

Table 17. National Global Climate Change Impacts

Area	Impact
Natural Infrastructure	• extreme stress to fragile ecosystems • inability of natural ecosystems to rapidly adapt to change • change in species composition • loss of coastal wetlands if sea level rises • change in timing and amount of water supplies due to reduction in snow pack
Economy	• loss of bounty from the nation's lands, waters, and native plant and animal communities • loss of coastal property
Weather	• large increases in heat index (temperature + humidity) • increased frequency of heat waves • greater risk of storm surges
Social	• increased discomfort, especially in cities • loss of national treasures of American landscape

Human Health

Exactly how much risk is posed to human health by climate change is difficult to quantify in terms of numbers of increased deaths or illnesses. Population growth and diminished air and water quality are key factors. The demographic trend toward an aging population in San Diego raises the health risks. The region will also be impacted by the future development in northern Baja California.

Direct health effects include increases in heat-related mortality and illness resulting from expected increases in the intensity and duration of heat waves (although temperature increases should also result in fewer cold-related deaths). Deaths, injuries, and psychological disorders could increase if extreme weather events, such as storms and floods, become more frequent. One study indicates that an increase in ambient air temperatures by 3 °F could almost double the heat-related deaths in Los Angeles, from about 70 today to 125 annually (*US Environmental Protection Agency*, 1997). Cities such as San Diego that experience occasional very hot, dry weather may be especially susceptible. The elderly, particularly those living alone, are at greatest risk.

There is concern that climate change could increase concentrations of ground-level ozone. For example, high temperatures, strong sunlight, and stable air masses tend to increase urban ozone levels. Air pollution also is made worse by increases in natural hydrocarbons emissions during hot weather. This has a direct effect on asthma and respiratory illness, as well as potentially increasing heart related illnesses.

Indirect effects include increases in the potential transmission of vector-borne infectious diseases caused by the extensions of ranges and seasons of some vector organisms and acceleration of the maturation of certain infectious parasites. Climate-induced changes in pollens and spores and temperature increases that enhance the formation and persistence of certain air pollutants could result in increases in respiratory illnesses. Finally, sea level rise could result in physical and demographic disruptions, with consequences for public health.

Summary of Impacts on Human Health

- increased heat mortality and illness
- more respiratory illness caused by higher concentrations of smog
- increased transmission of vector-borne infectious diseases

Natural Infrastructure

The ranges of many species of plants and animals are restricted and fragmented because of both natural and human causes. Many invading species have colonized large areas and displaced native species in the wake of environmental changes in recent centuries. Without natural corridors to allow migration, isolated species could be limited in their ability to adapt to climate change. Plant and animal species near the borders of their ranges are likely to be most affected. Climate change could create more opportunity for the establishment and spread of weeds and pests. Increased fire from climate change could further threaten species.

Trees and forests are adapted to specific climate conditions, and as climate warms, forests will change. These changes could include changes in species, geographic extent, and health and productivity. If conditions also become drier, the current range and density of forests could be reduced and replaced by grasslands and pasture. Even a warmer and wetter climate would lead to changes; trees that are better adapted to these conditions, such as oaks and redwoods, would thrive. Under these conditions, forests could become denser. These changes could occur during the lifetimes of today's children.

Summary of Impacts on Natural Infrastructure

- restricted ranges of plants and animals
- regional extinction due to inability to adapt
- change in species, geographic extent and health of forests

Economics

When discussing climate change, conventional wisdom often assumes that making a profit and reducing GHG emissions are incompatible. One of the most frequently-used justifications for withdrawing from the Kyoto Treaty has been that it would be "too expensive" and "harm the economy".

Summary of Impacts on Economics

- decreased revenue from tourism
- loss of profitable coastline
- destruction of crops
- shift in location of agricultural and industrial centers

Public Infrastructure

Water is vital to all life, and every drought has serious implications for the lifestyles and survival of every person, plant and animal. With fresh water constituting less than 1% of all water on the earth, changes in climate would have drastic effects on the location and abundance of this precious resource. Temperature increases would increase the frequency of droughts, therefore causing rapid consumption of fresh water before it could be replenished. Areas dependent on agriculture would be especially hurt by drought, as a lack of water would begin the process of desertification, rendering the land useless. Too much water elsewhere caused by increased storm activity would result in the loss of lives and property.

Concerning energy, the United States continues to show an upward trend in consumption, using a total of 3,836 billion kWh of energy in 2002, which accounts for 25% of the world's total energy consumption. As a result, 1,565 million metric tons of carbon is created per year, with oil and coal as the leading producers of the carbon. Current projections indicate that U.S. emissions of carbon (mainly in the form of carbon dioxide) will reach 1,624 million metric tons in 2005, an increase of 287 million metric tons since 1990.

With energy production and consumption continually rising, global warming becomes an ever impending threat. Problems associated with acid rain, decreased air quality, and rising temperatures will result in the use of even more energy as air conditioners and other appliances are used. The increase in the population will also contribute to increased energy needs, as well as the addition of more carbon to the atmosphere. Additionally, carbon emissions have leveled off in recent years as a result of the weaker economy, causing energy consumption to stagnate. When the economy becomes stronger, however, the consumption will once again increase.

Summary of Impacts on Public Infrastructure

- inability of reservoirs to hold increased runoff
- evaporation of groundwater supplies
- increased duration of droughts
- reduced availability of hydro power
- water and energy shortages

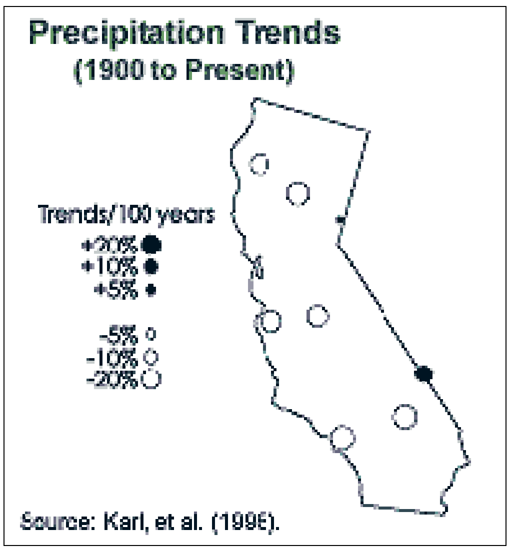
Cities for Climate Protection (CCP) Campaign

From Buenos Aires to Calcutta to Zurich, the International Council for Local Environmental Initiatives (ICLEI) assists the 550 members of the Cities for Climate Protection (CCP) Campaign to reduce GHG emissions. Usually focusing on urban design, transit networks, and energy conservation, the program helps member communities develop individualized plans for reducing GHG emissions in ways that work best for their city. As one of the world's leading cities, it is only fitting that San Diego expand its efforts to mitigate global climate change by formulating an action plan to reduce GHG emissions. In 1997, the City of San Diego chose to participate with this progressive coalition.

Appendix B. State Impacts from Climate Change

On a per capita basis, Californians emit less GHG than the average American, but we are still far above the world average, as was noted in Figure 9. Over the last century, the average temperature in Fresno, California, has increased from 61.9° F (1899-1928 average) to 63° F (1966-1995 average), and precipitation has decreased by up to 20% in many parts of the state.

Figure 10. Precipitation Trends (1900 to Present)



Over the next century, California's climate may change even more. Based on projections given by the Intergovernmental Panel on Climate Change and results from the United Kingdom Hadley Center's climate model (HadCM2), by 2100 temperatures in California could increase by about 5° F (with a range of 2–9° F) in the winter and summer and slightly less in the spring and fall. The amount of precipitation on extreme wet days most likely would increase, especially in the winter and fall, and there could be a decrease in the number of long dry spells and an increase in the number of long wet spells.

In the Bay Area and the Central Valley, with no other changes in weather or emissions, a 7.2°F warming would increase ozone concentrations by 20% and almost double the size of the area not meeting national health standards for air quality. Currently, the national standards for ozone are not attained throughout much of the state. Ground-level ozone has been shown to aggravate existing respiratory illnesses such as asthma, reduce lung function, and induce respiratory inflammation. In addition, ambient ozone reduces agricultural crop yields and impairs ecosystem health.

In California, agriculture is about a $19 billion annual industry, one-third of which comes from livestock. About 3% of total U.S. farm acres are in California. The principal crops are cotton, wheat, hay, tomatoes, and oranges, as well as many other vegetables and fruits. About 87% of the acres farmed are irrigated. As climate warms, production patterns will shift northward. Increases in climate variability could make adaptation by farmers more difficult. Warmer climates and less soil moisture due to increased evaporation may increase the need for irrigation. However, these same conditions could decrease water supplies, which also may be needed by natural ecosystems, urban populations, and other economic sectors.

The seasonal pattern of runoff into California's reservoirs could be susceptible to climatic warming. Winter runoff most likely would increase, while spring and summer runoff would decrease. This shift could be problematic, because the existing reservoirs are not large enough to store the increased winter flows for release in the summer.

California is an ecologically diverse state, with 134 endangered and threatened species, including the sea otter, the California condor, and the American bald eagle. California's unique ecosystems include 25,000 square miles of desert (such as the Mojave and Colorado deserts). California's mountain ecosystems in the Sierra Nevada, including Yosemite National Park's 1,200 square miles, contain alpine wilderness areas with large numbers of sequoia trees. All of these animals and ecosystems would be seriously threatened by an increase in temperature, which would force mass migrations and extinctions as habitats shift northward or disappear altogether.

Table 18, below, provided by the U. S. EPA's State GHG Inventories, identifies 1990 emissions in California by sector: energy; waste; agriculture; industry; and land use.

Table 18. California 1990 GHG Emissions

By Sector	CO_2 (MMTCE)	Methane (MMTCE)	Nitrous Oxide (MMTCE)	NFCs, PFCs, and SPs (MMTCE)	Total GHG Emissions (MMTCE)
Energy – Residential	8.3	*	*	*	8.3
Energy – Commercial	4.2	*	*	*	4.2
Energy – Industrial	24.4	*	*	*	24.4
Energy – Transport	58.4	*	*	*	58.4
Energy – Utility	12.2	*	*	*	12.2
Energy – Exported Electricity	*	*	*	*	*
Energy – Other	*	1.5	1.1	*	2.6
Total Energy	107.5	1.5	1.1	*	110.1
Waste	0.1	4.9	0.0	*	5.0
Agriculture	*	3.9	0.7	*	4.6
Industry	3.6	*	0.1	*	3.7
Land Use	-7.5	*	*	*	-7.5
Total	103.7	10.3	2.0	*	115.9

- All emissions are reported in million metric tons of carbon equivalent (MMTCE).
- An asterisk (*) indicates that emissions of the gas from this sector were zero, insignificant, or not reported.
- Emissions due to coal mining and extraction of natural gas and oil are included in the total energy figures, and emissions from biofuel combustion are excluded.
- The major source of carbon dioxide emissions was fossil fuel combustion (97%), with minor emissions from limestone use (2%), cement production (1%), carbon dioxide manufacture (<1%), waste combustion (<1%), and lime manufacture (<1%). Carbon dioxide sinks (i.e., an increase in forest carbon storage) offset approximately 7% of total carbon dioxide emissions. Contributors to methane emissions include landfills (46%), domesticated animals (21%), manure management (15%), natural gas and oil systems (13%), rice cultivation (2%), fossil fuel combustion (2%), wastewater treatment (1%), agricultural burning (<1%), and coal mining (<1%). The major sources of nitrous oxide emissions were fossil fuel combustion (56%), agricultural soils (38%), and nitric acid production (5%), with minor emissions from waste combustion (<1%), and agricultural burning (<1%).

California emissions in 1990 were 3.9 MTCE per capita, compared to 1990 U.S. emissions of 6.4 MTCE per capita.

In 2002, California generated 11% of its electricity from renewable sources, such as geothermal power, solar and wind. Table 13 (p. 31) highlighted the tremendous technical capacity to generate electricity from renewable sources such as wind, clean biomass, geothermal energy and landfill gas. In fact, California has the best geothermal capacity in the country; it also ranks first for its potential to generate electricity from landfill gas.

Table 19. California's Potential to Generate Renewable Energy

Type of Generation	Electricity Generation (GWh)
Renewable Technical Potential	
Wind	43,986
Geothermal	37,334
Solar (Thermal and PV)	157,312
Total Biomass	17,758
Small Hydro	6,156
Total Renewable Technical Potential*	**262,546**
Total Electricity Generation, Renewable and Non-Renewable (2002)	**272,509**

Source: California Energy Commission, "Renewable Resources Development Report," November 2003.

*Estimates for California's renewable technical potential vary, sometimes greatly, among studies. The reasons for these variations may include the different time frames in which the studies were conducted, the filtering of data using differing criteria, and in the case of solar, how photovoltaic and central station are counted or characterized.

Summary of State Global Warming Impacts

- increased ozone levels
- difficulty for farmers and their crops
- decreased water supplies
- increase in number of endangered animals and extinctions
- ecosystem destruction

Appendix C. Existing City of San Diego Policies, Initiatives and Resolutions

100-14 Procurement Policy: Recycled Products
The City of San Diego shall recycle waste products and purchase recycled products for use in the delivery of City services. Purchase of products which cannot be recycled is strongly discouraged. All paper used in copy machines must be made of post-consumer recycled content.

200-17 Alternative Fuels
California Air Resource Board aims to reduce pollutant emissions by using reformulated gasoline, introducing low emissions vehicles, and implementing transportation control measures. The City plans to improve air quality by using alternative fuels, forming partnerships with other agencies promoting clean air activities, providing incentives to fuel efficient manufacturers, converting city fleet vehicles to cleaner alternative fuel and developing local fuel resources.

200-05 Planting of Trees on City Streets.
This policy establishes guidelines for the planting and removal of trees from City street rights-of-way. Trees will be planted when funds are available in order to improve the City environment. The Park and Recreation Department shall choose species and locations of trees planted and trim trees when necessary. Owner of property adjacent to trees shall be responsible for watering and fertilizing. Trees shall be removed at public expense if they are dead, hazardous, or damaging public improvements.

200-09 Street Tree Plan – Central Business District
Continuity and uniformity of street tree planting in The Central Business District shall be established under this policy. Trees must be deep-rooted, adaptable to controlled pruning and planting in restricted space, evergreen and non-fruiting, hardy and resistant to fungus diseases and insects. Trees that meet such criteria are the Jacaranda Acutifolia, Podocarpus Elongata, Cupania Anacardioides, and the Washingonia Robusta.

400-02 <u>Biosolids Beneficial Use</u>

This policy aims to diversify biosolid management in order to avoid high costs of emergency operations. Biosolids are no longer deposited on Fiesta Island and will presently be hauled, processed and recycled by multiple contractors.

400-09 <u>Action Plan for City's Future Water Supply</u>

In order to assure adequate water supply, the City of San Diego must develop water sources beyond imported Colorado River water. The City Council shall support communication and cooperation among water policy groups, development of future water supply, and cost effective environmentally sound importation activities. The City shall implement conservation, reclamation, re-use, desalinization, surface runoff and groundwater development practices. Water provided by the City must meet all regulatory health standards.

400-11 <u>Action Plan for Implementation of Water Conservation Techniques</u>

The City will identify and implement effective water conservation techniques. City buildings will be retrofitted with faucet flow restrictions. Landscape and irrigation practices that encourage low water demand in both private and City owned sectors shall be promoted. City will encourage efficient water softener usage, low water demand demonstration gardens and water conservation home design awards.

400-12 <u>Implementation of Water Reclamation/Reuse</u>

Policies that encourage water reclamation and reuse are to be set up. The City aims to use a minimum of 70,000 acre feet per year of reclaimed water by the year 2010. A mandatory ordinance shall be drafted which will require the use of reclaimed water instead of potable water wherever available. Water quality management and public education plans will be determined.

600-05 <u>Community Plans</u>

The City Council encourages the formation of formal community plans in large sub-areas of the City. Such plans shall function cooperatively between property owners, residents, local business owners, other community interests, and City staff forces. The City Council and the Planning Commission shall authorize community planning and development programs and provide comprehensive planning services.

600-14 Development Within Areas of Special Flood Hazard

The City Council plans to regulate development in areas prone to flooding in accordance with the Land Development Code. This policy is intended to protect against excessive environmental damage, harm to human life or health, damage to public facilities and depletion of public funds.

600-23 Open Space Preservation and Maintenance

The City will preserve open space by retention of City-owned lands, acquisition of fee titles, and/or acquisition of easements. Current inventory as well as oversight of finances and maintenance of open spaces shall be the responsibility of the City.

600-30 General Plan Amendments to Shift Land from Future Urbanizing to Planned Urbanizing Area

The purpose of this policy is to establish a guideline determining when lands reserved for future urbanization are to be made available for development. Proposed development shall not induce or encourage urban sprawl or prematurely urbanize available land.

600-34 Transit Planning and Development

The City Council and the Metropolitan Transit Development Board shall plan for and implement development of improved public transit in the San Diego area. The City plans to pursue implementing measures for right-of-way protection, planning, and funding.

600-39 Land Guidance

The City aims to direct growth into compact patterns of development, where living and working environments are within walkable distances. The City shall apply the "Transit Oriented Development Design Guidelines" which are designed to reduce auto trips to work, roadway expansion and air pollution. These guidelines will maximize availability of open spaces, diversify housing and populations, as well as improve upon new and existing public transit, convenience and availability.

700-20 San Diego Port Policy

The City of San Diego aims to provide a comprehensive guideline for the City Council concerning Port policy matters. These guidelines shall support the State of California Policy and Port Act Purposes. Policy goals consider sustainable land and economic development for the Bay. Current usage of the Bay should not hinder the ability of future generations to use the Bay. Long-term strategic plans which protect water quality and wildlife assets of the Bay shall be implemented.

900-01 Economic Development

This policy provides an economic development program which encourages sustainable economic prosperity. It addresses business attraction, assistance, and retention and expansions, as well as international trade, tourism, redevelopment, neighborhood revitalization and promotion of well managed, environmentally sensitive growth.

900-02 Energy Conservation and Management

San Diego has established guidelines to conserve energy for optimum use of available supplies. City operations include purchasing of energy efficient products, utilizing current energy conservation techniques in construction and building maintenance and operations, and maximizing off-peak hour electricity usage. City regulated activities such as, urban development and transportation methods, which minimize vehicular travel directly conserve energy. Indirect influences including, public education and legislation for tax incentives offer further conservation solutions

900-06 Solid Waste Recycling

City's solid waste management system shall include a recycling component intended to reuse recoverable resources. Public education, convenient recycling collection operations, and legislation supporting State and Federal recycling programs were set up to assist with goal to recycle a minimum of 25% of all solid waste by 1992.

900-14 Green Building

City buildings should be designed to minimize waste, provide healthy indoor air quality, support innovative, environmentally sustainable technologies, utilize native plants, and ensure long-term health of natural environment. Energy efficiency, conservation, public education and private sector incentives are necessary to promote, facilitate and implement Green Buildings in the community.

900-18 Purchase of Energy Efficient Products

San Diego will purchase energy efficient products in order to lower green house gas emissions, utility bills and energy usage. Products must meet Energy Star specifications or be in upper 25% of energy efficiency standards. Employees will be educated in energy efficient practices in order to use appliances and equipment correctly.

n/a Community Forest Initiative

Planting of 5,000 shade trees per year on public property for twenty years, for a total of 100,000 trees by the year 2020 (see Appendix F).

R-298412 50 MW Additional Renewable Power by 2013

In 2003 the City adopted a resolution to install 50 Megawatts of additional renewable power at City facilities by 2013. Renewable energy includes: photovoltaic solar panels, solar thermal panels, solar thermal water heating panels, wind generators, landfill gas generation, small hydroelectric generators, geothermal energy systems, and other renewable energy technologies. This resolution is part of Mayor Murphy's Goal #9 to Pursue Energy Independence.

Appendix D. Scientific Aspects of Global Warming

(Taken from *Historical and Forecasted Emissions Inventories of Greenhouse Gases in California*, California Energy Commission, 1998, http://www.energy.ca.gov/global_climate_change/documents/97GLOBALVOL3.PDF)

Causes of Global Warming

The temperature of the Earth's atmosphere is the result of the balance of different factors, such as the amount of solar radiation reaching our planet, the capability of different surfaces on the earth and clouds to reflect incoming solar radiation (Albedo effect), the amount of thermal energy radiated to outer space by the Earth, the presence of aerosols in the atmosphere, and the atmospheric concentration of greenhouse gases. Greenhouse gases, such as water vapor and carbon dioxide, are transparent to the radiation coming from the sun (shortwave radiation), allowing it to pass through the atmosphere, heating the Earth's surface. Thermal energy is then radiated in the long-wave spectrum back into the atmosphere. The greenhouse gases, which are not transparent to the outgoing long-wave radiation, partially block it, resulting in a heating of the atmosphere. The energy balance established between incoming and outgoing radiation determines the ambient atmospheric temperatures.

Different greenhouse gases, some of which are shown in Table 1, have different effects on the Earth's radiative energy balance. The IPCC developed the concept of Global Warming Potential (GWP) to compare the radiative forcing effect of different greenhouse gases. The GWP is the ratio of the global warming capability, or radiative forcing of a gas, relative to carbon dioxide. The GWP most frequently used is the 100-year GWP, which is calculated by integrating all the greenhouse effects of a gas over a 100-year period. This particular GWP is used in this report to compare the emissions of different greenhouse gases in California. Table 17 contains a list of the GWPs used in this inventory. Note that gases can contribute to the greenhouse effect either directly or indirectly. Indirect effects occur when a gas, through chemical transformation in the atmosphere, produces a GHG, or when it influences the atmospheric lifetime of greenhouse gases.

Table 20. Global Warming Potential for Greenhouse Gases

Gas	GWP (100 years)
Carbone dioxyde	1
Methane[1]	21
Nitrous oxide	310
HFC-143a	1,300
HFC-23	11,700
HFC-152a	140

Source: IPCC

[1]The GWP for methane includes indirect effects of tropospheric ozone production and stratospheric water vapor production.

Many GHGs occur naturally as a result of the Earth's geological, hydrological, and biological cycles. They include water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). Some human-made compounds, including chlorofluorocarbons (CFCs), partially halogenated chlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), and perfluorinated carbons (PFCs), also function as GHGs. In addition, other photochemically important gases, such as carbon monoxide (CO), oxides of nitrogen (NO_x), and non-methane volatile organic compounds (NMVOCs), while they do not function as GHGs per se, contribute indirectly to the greenhouse effect. NO_x and NMVOC react in the atmosphere in the presence of sunlight to produce tropospheric ozone, which is a GHG. Carbon monoxide reacts in the atmosphere with certain compounds, such as the hydroxyl radical, that otherwise would react with and destroy methane and ozone. In addition, carbon monoxide is oxidized in the atmosphere to CO_2.

Assessing the Impacts of Climate Change

When assessing climate change, the most fundamental issue is whether it is even happening. Over the past century, global temperatures have trended upward, rising about 0.6° C overall.[2] This is likely[3] the largest temperature increase in any of the past ten centuries in the Northern Hemisphere.[4] Further, "it is likely that the 1990s have been the warmest decade and 1998 the warmest year of the millennium" in the Northern Hemisphere.[5] Additionally, snow cover very likely has receded about 10% since the late 1960s, "Northern Hemisphere spring and summer sea-ice extent has decreased by about 10–15% since the 1950s," and global average sea level has risen between 10–20 cm.[6] Atmospheric concentrations of major greenhouse gases (GHG), which trap solar radiation and warm the earth, have also been increasing. Since 1750, carbon dioxide (CO_2) has risen 31%, methane (CH_4) has seen a 151% increase, and nitrous oxide (N_2O) has increased by 17%.[7] GHG concentrations have been increasing, and so has the earth's temperature. Essentially all scientists will agree to these statements.

Due to the somewhat incomplete knowledge of all the factors, both natural and anthropogenic, that influence temperature change, some disagreement does exist over the relationship between the earth's warming and the rise in GHG. However, most scientists will agree that the rise in GHG has at least some causal relationship to the rise in temperature. The IPCC believes that "in the light of new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in GHG concentrations."[8] Thus the issue is not whether rising GHG concentrations have any effect on the climate, but rather what the extent of that effect will be in the future.

Scientists develop computer simulations of weather patterns to predict the potential effects of climate change. Although weather can never be predicted to 100% certainty, the accuracy of these models, as measured by their ability to predict current meteorological events, has become quite good. Present models predict temperature increases of 1.5 to 4.5° C over the next century[9]: the IPCC, for example expects a warming of 1.4 to 5.8° C by 2100.[10] The wide range of estimates arises mainly from differing views on the role of clouds. Higher global temperatures would lead to

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[2] Intergovernmental Panel on Climate Change (IPCC). "Summary for Policymakers: A Report of Working Group I of the Intergovernmental Panel on Climate Change." 2001. www.ipcc.ch page 2

[3] Using the following guidelines formulated by the IPCC:
"In this Summary for Policymakers and in the Technical Summary, the following words have been used where appropriate to indicate judgmental estimates of confidence: *virtually certain* (greater than 99% chance that a result is true); *very likely* (90-99% chance); *likely* (66-90% chance); *medium likelihood* (33-66% chance); *unlikely* (10-33% chance); *very unlikely* (1-10% chance); *exceptionally unlikely* (less than 1% chance). The reader is referred to individual chapters for more details."

[4] *Ibid.*, pg 2.

[5] *Ibid.*, pg 3. The figures are given for the Northern Hemisphere because weather data is more well-known for it than for the Southern Hemisphere.

[6] *Ibid.*, pg 4.

[7] *Ibid.*, pg 7.

[8] *Ibid.*, pg 10.

[9] Charles, Chris. Environmental Systems 102 lecture. March 20, 2001.

[10] *Supra* note 1, pg 13.

increased evaporation and likely more clouds. However, some clouds trap more heat than they reflect, and others reflect more than they trap. Much of the range in temperatures arises because there is no definitive way to predict which effect will predominate.

An increase in global temperature will have a variety of effects. Sea level is expected to rise 30 cm by 2050, and perhaps by 2025.[11] The IPCC predicts an increase of 9–88 cm by 2100. [12] These changes are highly temperature-dependant: most of the sea level rise comes from thermal expansion of ocean water, along with some melting of ice sheets and glaciers. The EPA estimates that approximately 10,000 square miles of land in the US would be lost if sea level rose two feet.[13] In addition to sea level change, higher average temperatures would likely dry mid-latitude continental interiors, shifting precipitation to higher latitudes.[14] Air holds significantly more moisture at temperatures in excess of 15^{o} C, which is the approximate average summertime temperature in mid-latitudes.[15] Even a small temperature rise would lead to a large increase in evaporation rates; the greater rate of evaporation would outstrip any increase in precipitation. The end result would be more severe and more frequent droughts. Increased intensity of monsoons and cyclones is also likely.[16] Further, warmer temperatures would cause shifts in ecosystems, leading to migrations of species and changes in disease vectors.

Health Impacts of Climate Change

As the climate changes, natural systems may be destabilized, which could pose a number of risks to human health. In general, these risks affect whole populations rather than individuals or groups of people. Exactly how much risk is posed to human health by climate change is difficult to quantify in terms of numbers of increased deaths or illnesses. For one thing, human populations differ in vulnerability. Factors such as crowding, food scarcity, poverty, and local environmental decline make populations in some developing countries especially vulnerable. Likewise, in industrialized countries, the demographic trend toward an aging population raises the health risks.

Climatic changes may have wide-ranging effects on human health, via both direct and indirect pathways. Direct health effects include increases in heat-related mortality and illness resulting from expected increases in the intensity and duration of heat waves (although temperature increases should also result in fewer cold-related deaths). Deaths, injuries, psychological disorders, and exposure to chemical pollutants

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[11] Global Warming Impacts: Coastal Zones. http://www.epa.gov/globalwarming/impacts/coastal/index.html
[12] *Supra* note 1, pg 16.
[13] *Supra* note 8
[14] *Supra* note 1, pg 15
[15] *Supra* note 11
[16] *Supra* note 1, pg 15-16

in water supplies could increase if extreme weather events, such as storms and floods, become more frequent.

Indirect effects include increases in the potential transmission of vector-borne infectious diseases caused by the extensions of ranges and seasons of some vector organisms and acceleration of the maturation of certain infectious parasites. Some increases in non-vector-borne infectious diseases could occur (especially in tropical and subtropical regions) because of climate impacts on water distribution, temperature, and microorganism proliferation. Climate-induced changes in pollens and spores and temperature increases that enhance the formation and persistence of certain air pollutants could result in increases in respiratory illnesses. Though still uncertain, the regional effects of climate change on agricultural, animal, and fisheries productivity could increase the local prevalence of hunger and malnutrition (particularly in developing countries). Finally, sea level rise could result in physical and demographic disruptions, with consequences for public health.

Public health and medical professionals are focusing not only on the risks but also adaptive options to mitigate adverse impacts. Adaptive options to minimize health impacts include improved and extended medical care services; enhanced disaster preparedness and relief, increased use of protective technology (air conditioning, water purification, vaccination, etc.), public education directed at personal behaviors, and appropriate professional and research training. However, any technological adaptations such as use of pesticides to control disease-transmitting insects should also be assessed for potential health risks. In addition, improved and internationalize monitoring of health-risk indicators in relation to climate change are needed.

Appendix E. Transportation System Greenhouse Gas Emission Reduction Strategies

Background

Emissions from the transportation system have become one of the most significant in regards to greenhouse gas emissions. The average miles traveled per vehicle per year have generally increased from 12,000 to 15,000. Also, the overall fuel economy has remained the same or slightly lessened with the substantial influx of sport utility vehicles. Finally, it is more likely that idling time is substantially greater than in the past. As a result, emissions are produced with no or limited resultant value in fuel consumed as one sits on a congested freeway, going nowhere.

As noted by the California Energy Commission, "Traffic congestion costs Californians millions of dollars each year in wasted time and fuel, delivery delays, pollution and stress. According to a study by the Texas Transportation Institute, which looked at the nation's largest cities, Los Angeles topped the list for annual congestion costs. Based on the value of time delay as perceived by motorists and the cost of fuel wasted in traffic, congestion costs L.A. residents $8.6 billion a year!"

However the cost of congestion is not limited to Los Angeles. "California is home to four of the nation's 10-most congested urban areas -- Los Angeles, San Francisco Bay Area, San Diego and the San Bernardino-Riverside area." The San Diego region's north/south freeway system turns into a parking lot for most of the commuter traffic during the weekdays. East/west freeways also experience growing congestion. Traffic accidents, even fender-benders, result in quick and lengthy congestion on nearby community thoroughfares.

"The public, however, has been reticent to leave their private vehicles," as Jeff Jacoby, a columnist with the Boston Globe, wrote in an "Op-Ed" piece in the Sacramento Bee:

> Americans are not being obstinate. It makes sense to prefer private cars to public trains and buses. Cars and highways are available 24 hours a day. They go virtually everywhere...They sharply reduce travel time -- nationwide, the average mass transit commute takes 42 minutes, while the average commuter driving to work makes it in only 20 minutes...It isn't a 'love affair' with cars that keeps Americans behind the wheel. It is the freedom, flexibility and efficiency that automobiles provide.

His observations are quite telling. Even where congestion cannot be avoided, people seem more likely to purchase a CD player for their vehicle and more CDs to listen to, rather change driving patterns.

Even from a fleet perspective, many fleet managers have considered or even implemented the use of alternative fuels over the past 30 years with variable economic and operational success. Success stories and horror stories abound. Administrators have jumped on alternative fuels when prices appeared to be lower than gasoline or diesel fuel, only to have those prices change quickly over following years. Others have acquired alternative fuel vehicles when incentives have reduced their cost to at or below gasoline or diesel vehicles, only to find hidden costs in facility redesign, technician training and the like.

With the variability of choices and potential outcomes, coupled with the present and near-term national and state economy, addressing greenhouse gas emissions from the transportation sector poses quite a challenge. Options do exist, however, and can be addressed from a number of perspectives as noted below.

Options

"Transit First" is a choice that the City and County of San Francisco has chosen. It is essentially described as focusing on the value of developing and preserving alternative transit assets. A key component is to integrate land use policy with the goal of promoting the effectiveness of transit options – including light-rail or trolley, bus, and rail systems.

Environmental audit programs – where governmental organizations have recycling and/or environmental audit programs, include the transportation sector. Where departments can demonstrate increased transportation efficiencies, and hence reduced fuel costs, provide a means for them to use budget savings to further improve their transportation options/services/vehicles with set criteria that includes greenhouse gas emission reduction.

Providing greenhouse gas emission reduction "credits" is a practice in governmental contracting. In its most basic form any company bidding on a government contract, particularly in construction, demonstrates their actions to reduce/limit greenhouse gas emissions in exchange for additional "points" during the contractor selection process.

A variation of the above would involve certain government authorities, such as airports, in the awarding of contracts to shuttle, taxi and related services. In these circumstances companies committed to using fuels or vehicles that would produce fewer greenhouse gas emissions would receive greater likelihood of receiving contract approval.

In Portland, Oregon, the Businesses for an Environmentally Sustainable Tomorrow (BEST) program is a public-supported business services brokerage that provides educational, technical, and financial assistance to local businesses. BEST currently focuses its assistance on the efficient use of energy and water, the reduction of waste, and the utilization of clean and efficient transportation. It assists businesses with questions on new product options, utility incentives, and state assistance programs. BEST also partners with private organizations, businesses, and other levels of government to offer state-of-the-art assistance on water conservation, waste reduction, and transportation alternatives. Among other things, BEST publishes a series of fact sheets on energy, water, waste, and transportation, and a series of BEST Service Matrices. The matrices provide a listing of no-cost information and assistance services available to local businesses.

Many have referred to Curitiba, Brazil as an excellent example of integrating land use and transportation. They started from a perspective that the environmental quality and economic efficiency of cities are highly dependent upon transportation systems that are well integrated with urban form. Integrated transport systems consist of a variety of modes of transport within the city, applying each where it is most efficient, appropriate, and environmentally suitable. Even in the San Diego region the key to solving a number of urban problems, not just greenhouse gas emissions, is to re-integrate transportation with land-use planning so that the land-use pattern can support more sustainable and environmentally acceptable transport modes.

Green fleets programs pose another option toward reducing greenhouse gas emissions. While this federal program is limited in incentives, it can provide direction and implementation guidance. Cooperative, and even competitive, implementation between and amongst jurisdictions that is well publicized can also work to produce results as communities, or even businesses, want to be seen as the most environmentally responsive within the region.

While it does not relate to a specific program, the overall marketing or public relations in regard to reducing alternative fuels in the San Diego region can go a long way to fostering an overall spirit of making changes. More organizations are implementing large or small choices that result in emission reductions that we do not even know about. How to capture these and publicize them can be critical to instill a spirit of change. The San Diego Regional Clean Fuels Coalition, Air Pollution Control District, SANDAG and others could play a key role here.

Appendix F. Community Forest Initiative

One way the adverse affects of an accumulation of greenhouse gases can be mitigated is by planting trees. A recent Urban Ecosystem Analysis, conducted by American Forests, revealed that 27% of San Diego's tree cover has been lost in the last seventeen years. Impervious surfaces, such as roads and buildings, have replaced the trees and have added to the increasing volume of greenhouse gases in the atmosphere. The study estimates that the total amount of pollution and greenhouse gases removed from the air by San Diego's trees can be valued at 10.8 million dollars annually, showing how significantly trees impact the environmental health and climate of San Diego.

A recent cost-benefit analysis conducted at the University of California, Davis shows that every $1 invested in tree planting returns approximately $2.37 in avoided costs for energy consumption and air pollution control. Additional benefits include increased property value, enhanced scenic quality, and improved human health and well being. (McPherson, E. Gregory, 1997)

Trees have the ability to absorb atmospheric carbon, the major GHG, as well as store it. The City of San Diego's trees sequester about 9,000 tons per year and store a total of 1.2 million tons. These trees also remove 4.2 million pounds of pollutants, such as carbon monoxide and ozone, from the air each year. Additionally, trees help curb the "Urban Heat Island Effect" by providing shade to buildings and surrounding areas, and reducing the need to use air conditioners, which consume a great deal of energy. Reducing energy use is critical as energy production is one of the largest producers of greenhouse gases. Trees also help the infrastructure of cities by reducing stormwater runoff, preserving soil, and increasing the beauty of an area.

In 1995 the City of San Diego recognized the value of developing additional regulations for the community forest when it adopted Resolution No. R-286098 creating the Tree Advisory Board. The main duties of the Tree Advisory Board include advocating and formulating proactive urban forestry policies, ordinances and guidelines to promote the planting of more new trees and to protect existing trees. In 1999 the City Council adopted Municipal Code Sections 26.0501 through 26.0503 additionally charging the Board with providing advice and recommendations directly to the Mayor, City Council and the City Manager on all policy issues relating to urban forestry.

In 2002, the Tree Advisory Board, now referred to as the Community Forest Advisory Board, began working with City staff to draft an ordinance that would protect community trees, specifically ones that have historical value, by allowing for the designation of these trees as heritage and landmark trees. The draft ordinance also attempted to set guidelines for replacement of existing public trees and a procedure for saving existing trees. Also in 2002, Mayor Murphy recognized the benefits trees provide for the city and announced the Community Forest Initiative. This program calls for the planting of 5,000 shade trees per year on public property for twenty years, for a total of 100,000 trees by the year 2020. These trees would absorb 33,333 tons of CO_2 annually.

The first year after the tree planting goal was announced, a total of 5,175 trees were planted on public property within the City of San Diego, excluding trees planted as a result of a development permit requirement. In the calendar year ending December 31, 2004, a total of 5,909 trees were planted. Another tree planting effort which is enhancing the community forest region-wide is the San Diego Regional Energy Office's "Cool Communities Shade Tree Program." Throughout the County of San Diego, the program planted 4,981 shade trees from January through December 2004, primarily on private property. The Program has enough funding to continue through March 2006 with a county-wide goal of planting 17,000 trees.

Appendix G. CCP Data Compilation Information and Rationale

(Source: ICLEI Community Analysis module Help File)

Much of the data for developing base year and target emissions for the *Action Plan* was compiled using the *Community Analysis* module of the Clean Air and Climate Protection Software (CACPS), developed by Torrie Smith Associates for ICLEI. The following information is provided for any questions concerning data origination or formulas used.

Carbon Dioxide

The main source for carbon dioxide (CO2) emission coefficients was the 1605 Voluntary GHG Emissions Reporting Guidelines produced by the DOE (http://www.eia.doe.gov/oiaf/1605/ggrpt/ , 2001). Here, emission coefficients were given in million metric tons of carbon per quadrillion BTU. This was converted into kilograms of pollutant per Gigajoules (GJ) of energy.

Table 21. Data Information

Data Type	Data From	Data Originator
Fuel consumption (by sector)	City of San Diego	SANDAG
Electricity consumption (by sector)	City of San Diego	SDGE
Landfill Waste	City of San Diego	City of San Diego
Methane Recovered	City of San Diego	City of San Diego
Vehicle Miles Traveled (VMT)	City of San Diego	SANDAG
Fuel economy default values	CCP provided	U.S. EPA
Indicators*	City of San Diego	SANDAG

* Indicators include: total number of households, total commercial sector employment, total commercial building floor area, total industrial sector employment, and total industrial sector building floor area. These indicator inputs are optional and do not affect the calculation of GHG emissions and emission reductions.

Residential, Commercial, and Industrial Sectors Data

CO_2 emissions are calculated on the basis of information the City of San Diego provides about total use of fuels and electricity in these sectors. This information is combined with emission coefficients to determine GHG emissions. The default coefficients provided are based on the Energy Information Administration (DOE) database, but use a slightly different method than the one used for the 1605(b) reporting guidelines. Default emission factors for average and marginal grid electricity are based on the thirteen North American Electricity Reliability Council (NERC) regions. For San Diego, emission factors were based on Region 13 WECC/CNV -- Western Electricity Coordinating Council, California and Southern Nevada Subregion.

The use of state-based electricity coefficients has become increasingly anachronistic over time because electricity grids have become increasingly integrated along regional, national and even international lines, rather than state lines. NERC regions more closely approximate existing electricity-producing regions of the country than do state boundaries. NERC-based emission coefficients will therefore more accurately reflect emissions generated from the use of electricity in any state within a NERC region than will state-based coefficients.

Transportation Sector Data

The ICLEI software calculates transportation energy and CO_2 emissions on the basis of the VMT and fuel economy (miles per US gallon) information entered. For the criteria pollutant emission coefficients for gasoline and diesel, emission factors were extracted from EPA's Mobile 5. These emission factors specify both the average vehicle fuel efficiency and average emissions per mile of criteria air pollutants for particular classes of vehicles when using particular fuels (e.g. gasoline powered mid-size autos). Values are provided for each year from 1990 through 2020, based on historical and simulated future evolution of the on-road fleet in the U.S.

Waste Sector Data

GHG emissions from waste and emission reductions and recycling measures are based on US EPA research. Essentially, GHG emissions and emission reductions from waste and waste diversion measures are now computed according to a simple equation:

Equivalent CO_2 (e CO_2)Emissions = (Quantity of Waste of Particular Type) * [(1-R)*A + B]

A is a coefficient, with units of tons of eCO_2 per ton of waste, specifying the landfill methane emissions from the waste (or the avoided methane emissions in the case of waste diversion measures).

B is a coefficient, with units of tons of eCO_2 per ton of waste reflecting the non-methane greenhouse gas emissions or emission reductions associated with the waste or waste measure (mainly CO_2 emissions but some other gases in the case of aluminum recycling, for example).

R is the rate of landfill gas recovery to be applied. Inventories are computed using the landfill gas recovery rate that was already extant in the base year of the local action plan, with any landfill gas recovery introduced subsequent to the base year entered as a measure in the appropriate module. Thus, target year inventories in business-as-usual forecasts are computed with the base year landfill gas recovery factor. A separate value of R can be specified to be used when computing the impact of waste reduction measures, thus avoiding double counting any methane that has already been recovered as part of a landfill gas recovery measure implemented since the base year of the plan.

The software assumes a default Base Year Methane Recovery Rate of zero.

Future landfill methane emissions are computed using the information the City of San Diego provides about the amount of waste in our community hauled to landfills, the composition of that waste, and the rate of methane recovery at the landfills.

Appendix H. Emission Sources: 1990 Baseline

Waste Sector

Table 22. Waste Amounts and Emissions 1990 Baseline

Source	Tons of Waste	Tons of CO_2 emissions
Waste to Landfill	1,950,079	742,064
Waste in Place	37,719,758	2,405,941
Total	**39,669,837**	**3,148,005**

Table 23. Waste Composition 1990 Baseline

Waste Type	Percentage
Paper Products	25.9%
Food Waste	9.9%
Plant Debris	10.5%
Wood/Textiles	11.5%
All Other Waste	42.2%

Energy Sector

Table 24. Electricity 1990 Baseline

Source	kWh	Tons of CO_2
Residential Energy Use	1,986,345,685	687,766
Commercial Energy Use	2,794,408,791	967,556
Industrial Sector	2,229,150,676	771,837
Total	**7,009,905,152**	**2,427,159**

Table 25. Natural Gas 1990 Baseline

Source	Therms	Tons of CO_2
Residential Energy Use	155,857,306	962,921
Commercial Energy Use	66,076,804	408,237
Industrial Energy Use	114,728,133	708,816
Total	**336,662,243**	**2,079,974**

- **Total Energy Emissions: 4,507,133 tons of CO_2**

Transportation Sector

Table 26. Transportation Energy Usage and Emissions 1990 Baseline

Type	**Fuel**	**Usage**	**Tons of CO_2**
Road	Gasoline	611, 563,404 gallons	6,616,008
Road	Diesel	116,186,863 gallons	1,229,857
Road	Propane	297,873 gallons	2,077
Road	CNG	182,912 therms	1,159
Rail	Electricity	123,446,431 kWh	42,743
Total			**7,891,844**

- **Total CO_2 Emissions: 15,546,981 tons**

Appendix I. Emission Sources: 2010 Forecast

Waste Sector

Table 27. Waste Amounts and Emissions 2010 Forecast

Source	Tons of Waste	Tons of CO_2 emissions
Waste to Landfill	4,272,863	1,625,953
Waste in Place	37,719,758	2,109,709
Total	**41,992,621**	**3,735,662**

Table 28. Waste Composition 2010 Forecast

Waste Type	Percentage
Paper Products	25.9%
Food Waste	9.9%
Plant Debris	10.5%
Wood/Textiles	11.5%
All Other Waste	42.2%

Energy Sector

Table 29. Electricity 2010 Forecast

Source	KWh	Tons of CO_2
Residential Energy Use	3,587,561,258	1,799,292
Commercial Energy Use	5,047,013,112	2,531,260
Industrial Energy Use	3,312,400,642	1,661,289
Total	**11,946,975,012**	**5,991,841**

Table 30. Natural Gas 2010 Forecast

Source	Therms	Tons of CO_2
Residential Energy Use	281,495,631	1,739,142
Commercial Energy Use	119,342,058	737,322
Industrial Energy Use	207,211,734	1,280,200
Total	**608,049,423**	**3,756,664**

- **Total Energy Emissions: 9,748,505 tons of CO_2**

Transportation Sector

Table 31. Transportation Energy Usage and Emissions 2010 Forecast

Type	**Fuel**	**Usage**	**Tons of CO_2**
Road	Gasoline	680,264,908 gallons	7,297,662
Road	Diesel	147,709,061 gallons	1,564,211
Road	Propane	409,171 gallons	2,853
Road	CNG	251,256 therms	1,592
Rail	Electricity	169,571,435 kWh	85,046
Total			**8,951,364**

- **Total CO_2 Emissions: 22,516,532 tons**

Appendix J. Factors and Assumptions used for 2010 Emissions Forecast

Energy Sector

Projected Growth in Demand from 1990-2010:

Table 32. Annual Growth by Energy Sector

Sector	Electricity	Natural Gas
Residential	3%	3%
Commercial	3%	3%
Industrial	2%	3%

(source: San Diego Regional Infrastructure Study)

Transportation Sector

Projected Growth in Fuel Use from 1990-2010:
Based on VMT in San Diego growth from 1990-2000. (source: SANDAG)

Daily VMT in 1990: 30,583,000 x 330 days/yr. =10,092,390,000 Annual VMT
Daily VMT in 2000: 35,450,000 x 330 days/yr. =11,698,500,000 Annual VMT

Projected growth in VMT is assumed to follow previous trends for the region. If so, then from 2000-2010 the overall increase is 16% , which equates to 1.6% annually.

Waste Sector

Includes waste to Miramar and Sycamore landfills.

Waste generated in 1990: 2,375,911 tons
Waste generated in 2000: 3,337,867 tons

Projected growth in waste generated from 1990-2010 is assumed to follow the actual growth from 1990 to 2000. If so, then the 2000-2010 the overall increase is 80%, which equates to 4% per year.

Waste Reduction Measures

Source for data on 1990-2003 measures is the City of San Diego Environmental Services Department, Waste Reduction and Enforcement Division (WRED).

Waste Diverted in 1990: 692,426 tons
Waste Diverted in 1996: 1,194,805tons

Waste Diverted in 2003: 1,549,033 tons
Estimate Waste Diversion in 2004(assumes a 50% diversion rate): 1,783,737 tons
Estimate Waste Diversion in 2010(assumes a 50% diversion rate): 2,256,996 tons

Average annual growth rate for diversion between 1996-2003: 6%.
Estimated average annual growth rate for diversion between 2004-2010: 4.4%

Amounts in waste reduction measures from 1990-1996 were based on actual data for amounts of various types of waste (paper, aluminum cans, steel, wood, plastic) diverted between 1990-1996.

Amounts in waste reduction measures from 1996-2003 were assumed to follow the annual 6% growth in overall waste diversion. Specific data regarding types of waste diverted was not available.

Projected amounts in waste reduction measures from 2004-2010 are assumed to follow a projected 4.4% growth in waste diverted, based on a 50% diversion rate.

Appendix K. Community Greenhouse Gas Reduction Measures 1990-2003

Energy Sector

Table 33. Energy Measures 1990-2003

Year Completed	Project	Annual Energy Savings	Estimated Annual Tons CO_2 Reduced
1994-1997	Misc. SDG&E Energy Efficiency Projects	4,115,344 kWh	1,459
1998	SDG&E New Construction-Electric	17,638,200 kWh	6,257
1998	SDG&E New Construction-Gas	403,800 therms	2,495
1998	SDG&E Residential-Electric	20,949,600 kWh	7,431
1998	SDG&E Residential-Gas	141,408 therms	874
1998	SDG&E Non-Residential-Electric	22,390,200 kWh	7,942
1998	SDG&E Non-Residential-Gas	1,251,000 therms	7,729
1999	SDG&E New Construction-Electric	13,239,000 kWh	4,691
1999	SDG&E New Construction-Gas	22,200 therms	137
1999	SDG&E Residential-Electric	10,449,000 kWh	3,707
1999	SDG&E Residential-Gas	304,200 therms	1,879
1999	SDG&E Non-Residential-Electric	48,841,800 kWh	17,326
1999	SDG&E Non-Residential-Gas	552,600 therms	3,414
1999	Naval Air Station PV Array	40,000 kWh	20
Total Savings for Energy Conservation		**137,663,144 kWh** **2,675, 208 therms**	**65,361**

Transportation Sector

Table 34. Transportation Measures 1990-2003

Year Begun	Project	Annual Energy Savings (Gallons of Fuel)	Estimated Annual Tons CO_2 Reduced
1994	SANDAG's Ridelink Program: includes carpooling, vanpooling, bike lockers, and incentives for bus and trolley transportation	2,328,077 gals. Gasoline	24,212
1999	MTDB Use of CNG-powered buses	2,866,000 gals. Diesel	18,479
1999	Bike-to-Work Day	2,700 gals. Gas	29
Total Savings for Transportation		**2,330,777 gals. Gas, 2,866,000 gals. Diesel**	**42,270**

Waste Sector

The amounts listed in the table below for private sector recycling measures are approximations based on the projected amount of waste diverted within the City limits in 2003. This figure is calculated by estimating waste generation for a year (based on population, number of households, economic growth, and other factors) and subtracting the actual amount of waste disposed. The remainder is assumed to be diverted, i.e. reduced or recycled.

Private sector amounts are calculated by subtracting the waste diverted by the City of San Diego from the total waste diverted. It is assumed that this waste is recycled by the private sector, i.e. businesses and individuals.

Table 35. Private Sector Recycling Measures 1990-2003

Year Begun	Material	Estimated 2003 Annual Tons Waste Recycled	Estimated 2003 Annual Tons CO_2 Reduced
1990	Aluminum	8,196	145,497
1990	cardboard	209,323	810,727
1990	Mixed	30,486	118,813
1990	Newsprint	167,707	575,118
1990	Office paper	152,423	774,829
1990	Steel	103,639	209,063
1990	Wood	129,090	218,741
1990	Plastic	4,787	11,587
Total Savings for Waste		**805,651 tons of recyclables**	**2,864,375 tons CO2**

Appendix L. City of San Diego Organization Baseline and Forecast

City of San Diego Organization 1990 Baseline

Table 36. City Organization Buildings Sector 1990 Baseline

Source	**Usage**	**Tons of CO_2**
Electricity	56,696,939 kWh	19,621
Natural Gas	2,827,201 therms	19,834
Total		**39,465 tons**

Table 37. City Organization Streetlights Sector 1990 Baseline

Source	**Electricity Usage**	**Tons of CO_2**
Streetlights	15,481,458 kWh	5,360
Traffic Signals	16,845,567 kWh	5,833
Total	**32,327,025 kWh**	**11,193 tons**

Table 38. City Organization Water and Sewage Sector 1990 Baseline

Source	**Usage**	**Tons of CO_2**
Sewage Facilities	92,179,790	31,917
Water Facilities	29,035,307	10,053
Total	121,215,097	41,970

Table 39. City Organization Vehicle Fleet Sector 1990 Baseline

Type	**Fuel**	**Usage**	**Tons of CO_2**
Automobiles	Gasoline	1,726,823 gallons	17,422
Trucks and Heavy Equipment	Diesel	987,090 gallons	11,088
Sedans	Ethanol	3,134 gallons	18
Total			**28,528**

Table 40. City Organization Employee Commute Sector 1990 Baseline

Type	Fuel	Usage	Tons of CO_2
Automobiles	Gasoline	5,121,700	53,566

Table 41. City Organization Waste Sector 1990 Baseline

Tons of Waste	Tons of CO_2 emissions
150,000	**63,967**

Table 42. City Organization Waste Sector Breakdown 1990 Baseline

Waste Type	Percentage
Paper Products	25.9
Food Waste	9.9
Plant Debris	10.5
Wood/Textiles	11.5
Other Waste	42.2

City of San Diego Organization 2010 Forecast

Table 43. City Organization Buildings Sector 2010 Forecast

Source	Usage	Tons of CO_2
Electricity	90,715,102 kWh	45,497
Natural Gas	4,523,522 therms	31,374
Total		**76,871(19%)**

Table 44. City Organization Streetlights Sector 2010 Forecast

Source	Electricity Usage	Tons of CO_2
Streetlights	24,770,332 kWh	12,423
Traffic Signals	26,952,907 kWh	13,518
Total		**25,941(6%)**

Table 45. City Organization Water and Sewage 2010 Forecast

Source	Usage	Tons of CO_2
Sewage Facilities	147,487,664	73,970
Water Facilities	46,456,491	23,300
Total		**97,720(24%)**

Table 46. City Organization Vehicle Fleet Sector 2010 Forecast

Type	Fuel	Usage	Tons of CO_2
Automobiles	Gasoline	2,279,406 gallons	23,706
Trucks and Heavy Equipment	Diesel	1,302,959 gallons	13,551
Sedans	Ethanol	4,137 gallons	54
Total			**37,311(9%)**

Table 47. City Organization Employee Commute Sector 2010 Forecast

Type	Fuel	Usage	Tons of CO_2
Automobiles	Gasoline	6,760,644	**70,707 (17%)**

Table 48. City Organization Waste Sector 2010 Forecast

Tons of Waste	**Tons of CO_2 emissions**
270,000	**102,743 (25%)**

Table 49. City Organization Waste Sector Breakdown 2010 Forecast

Waste Type	**Percentage**
Paper Products	25.9
Food Waste	9.9
Plant Debris	10.5
Wood/Textiles	11.5
Other Waste	42.2