CHULA VISTA
CO_2 REDUCTION PLAN

Adopted November 14, 2000

CITY OF
CHULA VISTA

The U.S. Environmental Protection Agency
recognizes the leadership of

The City of *Chula Vista, California*

for its efforts to reduce global warming
and its participation in the
Cities for Climate Protection Campaign

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100% RECYCLED
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CO_2 REDUCTION TASK FORCE

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ABBREVIATIONS USED THROUGHOUT DOCUMENT

APCD	Air Pollution Control District
Btu	British thermal unit
CEC	California Energy Commission
CH_4	Methane
CO_2	Carbon dioxide
CPUC	California Public Utility Commission
EPA	U.S. Environmental Protection Agency
FCCC	Framework Convention Climate Change
ICLEI	International Council for Local Environmental Initiatives
IPCC	Intergovernmental Panel on Climate Change
KWh	Kilowatt-hour
Lbs	Pounds
MM	Million
MMBtu	Million Btu
mpg	Miles per gallon
MW	Megawatt
MWh	Megawatt-hour
SANDAG	San Diego Association of Governments
SDG&E	San Diego Gas & Electric
VMT	Vehicle miles traveled

CARBON-CARBON DIOXIDE CONVERSION

Because the primary audience of this plan is non-technical, global warming emissions are expressed in pounds or tons of carbon dioxide (CO_2) rather than carbon (C). The conversion is 44 pounds of CO_2 for 12 pounds of C, or 3.666667 pounds of CO_2 per one pound of C.

EXECUTIVE SUMMARY

The Problem

The world's population is burning carbon-based fossil fuels faster then the earth's natural systems can absorb the resulting uncombusted CO_2 gas. Increased CO_2 emissions are being trapped in the atmospheric "greenhouse" that keeps the planet warm, raising concern about elevated temperatures and global warming. Although the scientific evidence of global warming is still inconclusive, there is broad international agreement that reducing CO_2 emissions is a sensible precaution until more is known about the greenhouse effect.

What is Chula Vista's Contribution?

Each person's share of Chula Vista's CO_2 emissions is about eight tons per capita every year. About half of this comes from automobile driving and gasoline; another quarter comes from energy use in homes, much of that in electricity; and the remainder comes from energy use in stores, offices, industries, and municipal government. This adds up to a total of about one million tons of emissions annually, or about eight tons per person as shown in Figure ES-1.

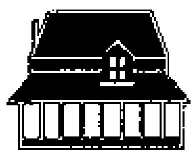
What Can One City Do?

One city alone cannot resolve the issue of climate change. However, cities are now recognized internationally for their role in contributing to, and conversely, their potential to reduce carbon dioxide emissions by addressing how cities are built, what materials are used in building our cities, where cities place roads, and how local decisions effect the way citizens live, where they work, how they play and the interaction between these elements.

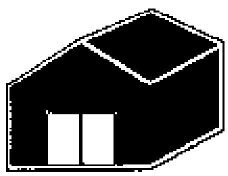
Half of the world's population will live in urban areas by the year 2000. Further, such areas are major centers of carbon dioxide emissions. Local energy use varies significantly - stemming from differences in urban form, land use, transportation, and utilization of energy, all of which are matters that cities exercise decisions over.

Figure ES-1
EXAMPLES OF CHULA VISTA CO_2 EMISSIONS
(1990)

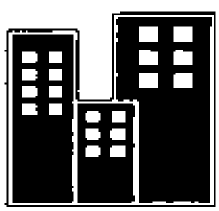
CO_2 Tons/yr


Single-family home

5


10,000 sq.ft. store

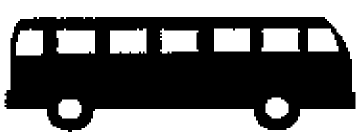
41


20,000 sq.ft. office

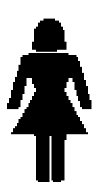
109


Auto with 1.1 passengers

5½ per passenger


Bus with 30 passengers

3½ per passenger


Total per capita

8

Chula Vista's International Link

In 1992, Chula Vista was asked to participate with a select group of cities throughout the world in a model program aimed at developing municipal action plans for the reduction of greenhouse gases. This project recognizes that municipalities are the level of government closest to the people, and that the success of global action depends on the support of people at the community level everywhere. Municipal participation fulfills one part of the International Framework Convention on Climate Change, signed by over 159 countries, including the United States. The International Framework on Climate Change is an international agreement to achieve carbon dioxide reduction through global cooperation and collective decision making. Municipalities have been incorporated into this process because of the recognition that all local planning and development have direct consequence to energy consumption, and these decisions, at their source, are made at a local level.

Cities are important partners in climate protection because they exercise key powers over urban infrastructure, including neighborhood design; transportation infrastructure such as roads, streets, pedestrian areas, bicycle lanes and public transport; waste management; parks, local building and facilities. These items all relate directly to the contribution of greenhouse emissions and correlated energy use.

This project was sponsored by the International Council of Local Environmental Initiatives (ICLEI) and the United Nations Environment Programme. ICLEI is an international association of local authorities with over 180 members worldwide. ICLEI's purpose is to improve the capacity of local authorities to prevent environmental problems, to respond effectively to problems when they arise, and to enhance their naturel and built environments at the local level.

Other local agencies in the program include: Dade County, Florida; Portland, Oregon; Minneapolis/Saint Paul, Minnesota; Toronto, Canada; Denver, Colorado; Bologna, Italy, Copenhagen, Denmark; Ankara, Turkey; Saarbrukken, Germany; Hannover, Germany; Helsinki, Finland. Each city in the program was asked to develop a local action plan, to be reviewed and approved by the respective legislative body of that municipality. Each participant was to create local policy measures which have multiple benefits to the city involved and at the same time identify a carbon reduction goal through the implementation of those measures. The carbon dioxide reduction goal was to fit within the realm of international climate treaty reduction targets. Each policy measure has multiple benefits to the city, none stand alone. In other words, even without the benefits of carbon dioxide reduction, these policies reduce energy consumption and aim toward a more pedestrian friendly and integrated city.

The local action plans are being used as models for cities across the country. Chula Vista, once again, is at the forefront of future planning. Although greenhouse gases are not regulated as a pollutant under the Clean Air Act at this time, federal governments are required to meet CO_2 reduction targets; thus it may be in the future. The local action plans provide a bottom-up approach to a complex and vexing problem. As the international climate and science community come closer to a consensus on climate change, as is evolving slowly through the United Nations International Climate Panel, federal governments will turn their attention toward cities.

How Much Worse Could It Get?

If no municipal action is taken, CO_2 emissions are projected to increase as much as 25% by 2010. This increase is being driven by an expected 23% growth in population, and more notably for CO_2, by a projected 44% increase in vehicles miles traveled (VMT). Figure 1.6 in (Sec. 1, pg. 25) illustrates a range of emission forecasts which, in the worst case, project 2010 emissions as high as 1.5 million tons/yr. At this rate, each person's share of emissions could reach 10 tons every year.

What Can be Done?

Chula Vista can lower its CO_2 emissions by diversifying its transportation system and using energy more efficiently in all sectors. These strategies not only save energy and CO_2, but they also increase personal and business savings, and create jobs. To focus City efforts in this direction, it is proposed that Chula Vista adopt the international CO_2 reduction goal of returning to pre-1990 levels by 2010. In order to achieve this goal, the plan proposes a reduction strategy composed of the following eights elements:

1. To spur action, increase the public's awareness of the problem. Focus in particular on the next generation of Chula Vistans through continuous implementation of the Global Warming Teachers kit and guide, developed by the City, and coordinate with the Chula Vista Elementary School District to make CO_2 reduction an everyday practice by 2010.

2. Reduce the long-term need for travel in the community through efficient land-use/transportation coordination and telecommunications technology. Focus in particular on shaping areas east of Interstate 805 to be as CO_2 friendly as possible.

3. Of the travel that does occur, provide for multi-modal choices.

4. Of the automobile driving that remains, work to make it as clean as possible.

5. Capture cost-effective building efficiency improvements in both new construction and remodeling through a mix of implementation approaches.

6. Lead the effort with municipal energy programs that can be showcased. Focus on encouraging personal and organizetional (business, government, school districts, residential) actions.

7. Interlock the City's efforts with other regional programs in order to strengthen region-wide progress on climate protection (Air Pollution Control District, SANDAG programs). Examples include: the Telecenter effort, BECA, etc.

8. Focus initially on a few short-range actions to build visibility and results, and then periodically update and fine tune the strategy over time.

This strategy is to be implemented primarily through voluntary efforts with encouragement from a strong public information and advocacy effort. Specifically, 20 action measures are recommended for initial implementation as summarized in Table ES-1, and explained in detail in Chapter 7. These action measures are intended to promote clean fuel vehicles; alternatives to driving; transportation-efficient land-use planning; and energy efficient building construction. Several of the action measures are to be implemented by municipal government to demonstrate leadership in CO_2 reduction, and thereby encourage personal and organizational action throughout the community.

When fully implemented in 2021, the action measures will save approximately 100,000 tons/yr of CO_2 emissions, which is roughly one quarter of the savings needed to achieve the international reduction goal. The international goal is to reduce CO_2 emissions 20% below 1990 levels by 2010. Implementing the 20 action measures will require roughly $25 million in capital costs and about $5 million/yr in operation and maintenance costs over the next 14 years (all costs are expressed in 1995 dollars). The capital and O&M costs represent a total outlay of roughly $95 million, which will be shared by municipal government, businesses, homeowners, and other regional agencies. This outlay, however, is estimated to produce approximately $130 million in savings to the community. These savings include $16 million in reduced energy expenses; $5 million in avoided CO_2 damage; and $109 million in reduced auto/truck driving expenses.

An additional 70 CO_2 reduction measures have been identified by the Task Force as suitable for further implementation as the community strives to achieve the international CO_2 reduction goal (see Appendix F). An important component of the overall effort will be periodic evaluation of the community's progress and fine tuning of implementation measures.

Table ES-1
ACTION MEASURES

		2010 CO_2 Savings (tons/yr)
1.	Municipal clean fuel vehicle purchases.	251
2.	Private fleet clean fuel vehicle purchases.	3,471
3.	Municipal clean fuel demonstration projects.	2,722
4.	Telecommuting and telecenters.	367
5.	Municipal building upgrades and employee trip reduction.	799
6.	Enhanced pedestrian connections to transit.	6,328
7.	Increased housing density near transit.	8,744
8.	Site design with transit orientation.	4,372
9.	Increased land-use mix.	8,744
10.	Reduced commercial parking requirements.	6,328
11.	Site design with pedestrian/bicycle orientation.	4,372
12.	Bicycle integration with transit and employment.	2,417
13.	Bicycle lanes, paths, and routes.	1,447
14.	Energy efficient landscaping.	1,279
15.	Solar pool heating.	2,462
16.	Traffic signal and system upgrades.	1,640
17.	Student transit subsidy.	3,878
18.	Greenstar building efficiency program.	15,591
19.	Municipal life-cycle purchasing standards.	10,151
20.	Increased employment density near transit.	13,355
TOTAL		98,379

1. INTRODUCTION

CITY OF
CHULA VISTA

WHY A CO_2 PLAN?

Significance for Chula Vista

Based on 1990 data, each person in Chula Vista creates about eight tons of carbon dioxide (CO_2) emissions every year. CO_2 is the gaseous product of incomplete combustion of fossil fuels, such as gasoline and natural gas. Of the seven major greenhouse gases, the highly heat absorbing character of CO_2 causes it to have the most direct impact on global climate. Research has estimated that approximately 75% of the global greenhouse effect is attributable to CO_2 emissions, and over 90% of Chula Vista's greenhouse gas emissions are CO_2. This section describes potential impacts and assumes no mitigation measures, beyond those currently practiced, to reduce carbon dioxide emissions.

The development of this plan is the culmination of 2 years by the City's task force and 3 years of participation in the International Council of Local Environmental Initiatives cities project. Each city selected for the program was responsible for developing a plan for implementation.

Global climate change is not just another environmental issue. Since the 1980s, virtually all international investigations have confirmed that human activity is changing the atmosphere at an unprecedented rate, and that these changes constitute major threats to the economic and environmental health of communities worldwide, including Chula Vista. If allowed to continue, global warming could potentially impact Chula Vista in several significant ways: rising ocean level and flooding of coastal areas; higher prices for water, electricity, and farm products; adverse changes in fragile ecological systems; poorer air quality; increases in certain illnesses; and jeopardized economic health.

The Scientific Debate

Until recently, the scientific community debated whether global warming was a natural phenomena or not, and if so, what were the effects. The uncertainty has provided skeptics with ammunition to argue against taking steps to reduce the 'potential' impacts. But now, the United Nations International Scientific Panel on Climate Change (IPCC), a respected U.N.-sponsored body made up of more than 1,500 leading climate experts from 60 nations, came out with an unprecedented report that for the first time ever, presents that global warming can be blamed, at least partially, on human activity. This report is critical in that the IPCC had been reluctant to make such a connection until consistent and agreed-upon scientific evidence demonstrated this to be true. This shift in scientific consensus is not so much based on new data but on improvements in the complex computer models climatologists use to test these theories. Additionally, a number of studies have also added to the scientists' confidence that they can generally predict what may happen if greenhouse gases continue to be released into the atmosphere unchecked (excerpt from Time Magazine October 2, 1995). Of course, the issue has proponents on all sides, since it is not a clearly visible issue yet in the United States.

Why pick on cities? Most of the world's 500 million vehicles are in cities. Cars produce about 60% of smog forming emissions. City planning results in either more or less utilization of cars. How long it takes to get from point A to point B results from where residential versus commercial areas are designated. The proposed plan attempts to take these principles into account throughout the document and its policy measures.

It is important to note that the City's plan does not predict these impacts with certainty. It instead examines them as potential impacts resulting from a hypothetical set of climate circumstances if current trends continue. The City's plan to reduce Chula Vista's CO_2 emissions is based largely on energy efficiency improvements. Chula Vista gains valuable economic, environmental, and social benefits from the energy savings that come with CO_2 reductions.

Global Economic Impacts

Studies of the economic impact of climate change by the Intergovernmental Panel on Climate Change (IPCC) are being carefully examined by the international insurance and banking industries. The insurance industry believes that an unprecedented series of hurricanes, floods and fires may ba the first real effects of human-induced climate change. These companies are spending millions of dollars on climate studies because of the millions of dollars in insurance claims paid, resulting from weather-related disasters. The insurance industry is interested in climate change because in the last 100 years, the worst natural disasters and largest insurance claims occurred in just the last six years. 1995 was the hottest global year on record and it follows a string of record breaking years that built to a crescendo just before the dust of the Mt. Penatubo volcanic eruptions blocked accumulation for several years. Even the record breaking cold weather is potentially a result of more solar energy trapped in the earth's atmosphere by greenhouse gases.

The Washington Post reported January 21, 1996 a mood shift in the international businesses coming about by nothing less than the brute strength of the marketplace. Recent major disasters caused by extreme climate events could literally bankrupt the insurance industry in the next decade. U.S. business interests are just beginning to see their stake in the debate. The Post reported on a memorandum prepared by the Assistant Director of the British Bankers' Association, intended for the Bankers' annual meeting of chief executive officers. The memo warned that more than half of all current bank lending is "affected by environmental factors" and that within the 20-40 year "life-time of loans granted today, climate change is forecasted to have dramatic impacts". By the same token, Blackman drew his collegues attention to the profitable silver lining, stating "there are enormous opportunities available to finance new environmental developments and the development of alternative energies" extending well beyond spacific technologies like solar collectors and electric cars. Broadly defined "the environment could become the biggest market of the 21st century."

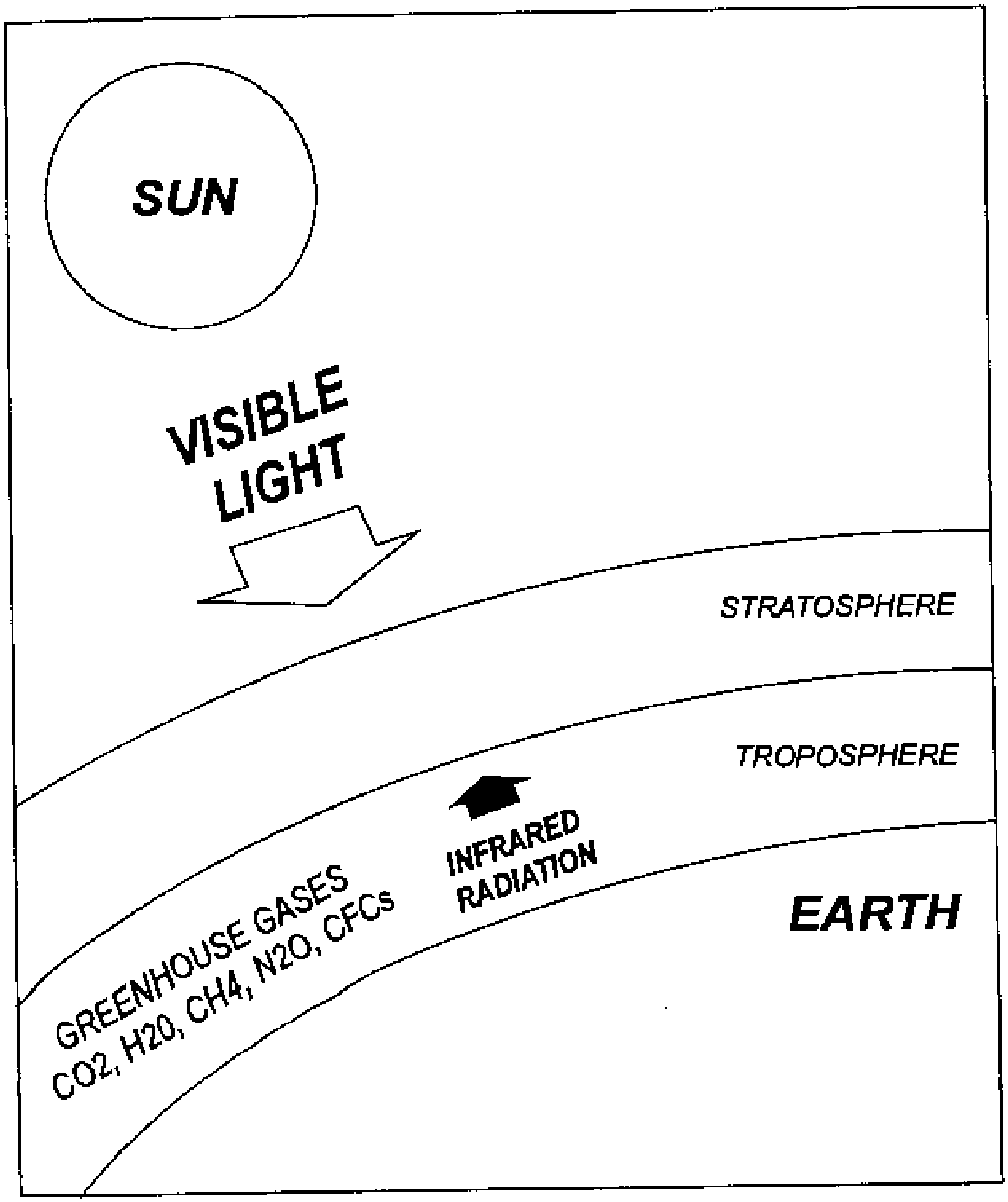
The Greenhouse Effect

The greenhouse effect keeps Chula Vista (and the earth) warm. Sunlight passes through the atmosphere and warms the earth's surface, and the earth then radiates infrared energy. Trace gases and water vapor absorb part of the infrared radiation and emit some back, further warming the atmosphere. The problem is that concentrations of these gases are increasing at higher than natural rates, and most scientists agree that these increases could significantly affect the global climate.

Naturally occurring gases in the atmosphere trap heat in the physical process termed the greenhouse effect. As shown in Figure 1.1, surface temperatures on earth are determined by radiation from the sun and the physical properties of atmospheric gases. These gases, known as greenhouse gases, allow solar radiation to pass through the earth's atmosphere to heat the earth's surface. This heat is then re-radiated from the earth in the form of infrared energy. Greenhouse gases absorb part of this radiation in the process known as the greenhouse effect.

Five naturally occurring atmospheric gases are responsible for the greenhouse effect: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), tropospheric ozone, and water vapor. These gases are naturally transferred between the land, atmosphere and ocean. For example, plants absorb carbon dioxide through photosynthesis as they grow, store it in solid form during the life of the plant, and release it again as a gas when they die and decompose. Carbon can be stored for longer periods of time, sometimes for millions of years, in the form of coal, oil, and natural gas.

Figure 1.1
THE GREENHOUSE EFFECT



Source: CEC, 1991.

The greenhouse problem arises with human activity upsetting the equilibrium of gas concentrations by releasing carbon, methane, and other gases faster than oceans, plant matter, and soils can absorb them. For example, the carbon in oil would be released very slowly under natural circumstances, but because we are driving gasoline-powered automobiles in ever increasing amounts, the release of carbon occurs more quickly. This rising build-up of greenhouse gases is leading to warmer global temperatures, or the effect known as global warming.

Potential Impacts of Global Warming

It is not possible to predict with certainty what will happen to Chula Vista as a result of global warming, but research has enabled the California Energy Commission (CEC) to assemble a hypothetical set of impacts for the state. This scenario assumes a doubling of CO_2 emissions by 2050 with a 5.4° F (or 3° C) temperature rise as a result. These increased CO_2 emissions could impact water, energy, agriculture, forestry, ocean level, natural habitat, outdoor recreation, air quality, health, and the economy. Of these impact areas, the following seven subsections describe those that may potentially apply to Chula Vista. These seven subsections have been excerpted from the CEC 1991 report entitled Global Climate Change Potential Impacts and Policy Recommendations:

Potential Energy Impacts

Temperature increases projected from global warming may increase electricity demand while reducing electricity supply. The primary temperature-sensitive electric end-uses in California are the heating and cooling of residential and commercial buildings. Considering only changes in heating and air conditioning, a 3° C temperature rise could increase net annual electricity use as much as 2.5%. Decreases in wintertime space heating demand would not offset the much larger increase in summertime air conditioning demand. Because California's electric utilities experience their peak demands in the summer, warming-induced increases in air conditioning load could lead to peak demand increases of as much as 6%. As demand for electricity increases, associated carbon emissions from electric generation could also increase, depending on the fuel mix used to generate the additional electricity. At the same time, warming could change the amount and timing of hydroelectric supplies, since warming may reduce the volume of winter snowpack.

Potential Ocean Level Impacts

Sea level rise is expected to occur as a result of thermal expansion of the ocean surface, melting of the earth's glaciers and polar ice fields, and mixing of now stratified ocean waters. The current rate-of-rise would cause ocean levels in San Francisco Bay to rise as much as 5 inches in the next 50 years. A recent EPA study estimates that if temperatures rise 3° C by 2050, a one-meter (or approximately 3 foot) sea level rise could result by 2100. Coastal erosion also is expected to increase due to sea level rise. Higher seas provide a higher base for storm surges and have the potential for more destructive storm activity.

Potential Water Impacts

Global warming may decrease water supplies from surface sources, increase water demand, increase the occurrence of winter flooding, and make water pollution more severe. Since the amount of water stored in mountain snowpack is primarily a function of winter snowfall, a 3° C temperature rise could raise California's historical snowlines by approximately 1,500 feet, which would reduce the average snowpack area 52%. Global warming may also magnify water quality problems by reducing spring and summer flow in rivers and their ability to dilute existing and anticipated pollutant loading.

Potential Air Quality Impacts

Changes in temperature, atmospheric ventilation, solar radiation, and precipitation may affect air quality in California both adversely and positively. However, since the impact of global warming on local climate cannot be confidently predicted, the magnitude of these effects is unknown. Climate change may adversely affect regional air pollution levels because of higher temperatures, increased ultraviolet radiation, and possible increases in precipitation. However, changes in wind patterns could worsen pollution problems, or they could help flush pollutants from urban areas. The potential impacts of global warming on the state's major air pollutants are:

- *Ozone*—Higher temperatures and increased ultraviolet radiation accelerate the chemical rates of reaction in the atmosphere, leading to higher ozone concentrations. Higher temperatures also cause increases in emissions of oxides of nitrogen (NO_x) and hydrocarbons, the two precursors for ozone. More electricity demand in summer months could lead to higher NO_x

emissions from utilities. Evaporative emissions of hydrocarbons from motor vehicles, refueling, and deciduous trees also increase with temperature.

- *PM_{10}*—Increased chemical rates of production due to higher temperature and increased ultraviolet radiation lead to higher PM_{10} concentrations. Precursor emissions of NO_x, sulfur oxides (SO_x), and soot and ash from stationary and transportation sources may rise in summer because of increased energy demand for air conditioning. Nitrate may increase or decrease depending on both temperature and relative humidity. In winter, changes in the frequency and intensity of inversions may work to reduce trapping of vehicle exhaust. Since human outdoor activity is greater in summer than in winter, longer warm seasons and less intense winters may increase the comparative importance of summer-type aerosol exposure in major urban areas.

- *Acid Disposition*—Possible increases in acid deposition due to more electricity demand (higher NO_x and SO_x emissions), higher temperatures and drier, warmer conditions

- *Carbon Monoxide*—CO is a product of incomplete combustion, and is primarily a winter problem in California. Air pollution levels may benefit from warming induced increased atmospheric ventilation at night. A shorter winter season and possible reduced frequency of inversions may reduce frequency, but not necessarily severity, of CO "hot spots" due to motor vehicles.

Potential Economic Impacts

Global warming could have a dramatic impact on California's economy. Most of the impacts discussed above would ultimately have economic consequences. Changes in water supplies and air quality, for example, have direct and indirect economic consequences. The California economy and its relationship to the global economy is also extremely complex and the ways in which climatic change could affect it are similarly complex. Some of the basic impacts could include:

- *Higher prices*—for water, electricity, fuels, farm products, and for goods requiring the input of these primary goods.

- *Changes in trade*—resulting from changes in the availability and prices of some goods, changes in the economies of trading partners, and changes in the overall global economy. Some researchers estimate that the climate changes resulting from an effective CO_2 doubling will reduce global economic growth by three percent per year.

- *Changes in demographics*—as a result of increased "economic and environmental refugees" from areas in the world that experience significant climate drying, warming, or economic disruption. This may be of particular significance for North America, where immigration to California may be easy. The possibility of immigration out of California as a result of these trends must also be recognized. A larger difference between income levels and economic strata within California may result.

- *Shift of investments*—from normal investments in the economy to investments necessary for accommodating a warming, thereby reducing available capital necessary for maintaining a robust and growing economy.

- *Changes in the riskiness of investments*—as a result of climate circumstances outside the experience of most investors. This could cause upward pressure on interest rates and cost of capital, further constricting the availability of discretionary capital.

Potential Natural Habitat Impacts

Warmer temperatures, sea level rise, and changes in water availability could result in substantial impacts to threatened and endangered species, particularly coastal wetlands and wetlands species. Changes in temperature, rainfall, or other significant climatic effects could have devastating effects on sensitive species. Global warming could effect estuaries and low-lying wetlands through sea level rise by greater variation in seasonal freshwater in-flow and salt-water intrusion. A 3° C warming could also cause land-based vegetation belts to shift northward by as much as 200 miles. A climatic change of this magnitude would require that species shift distribution several miles each year or physiologically adapt to the warming. The mobility of some wildlife species may enable them to achieve this rate, but most plant species could not shift this quickly. Marine habitats could also be affected if global warming shifts ocean upwelling patterns and associated nutrient transport. The shift could precipitate a change in the location of productive fisheries along the coast.

Potential Human Health Impacts

Increased warming may endanger the health of thousands of citizens. Each of the state's major air pollutants is associated with a set of health problems. These are discussed below in relation to global warming:

- *Ozone*—Ozone exposures of several hours, at levels currently experienced in California, cause airway constriction in as many as 20% of healthy exercising adults and children. Other lung changes indicative of actual lung injury also occur. Increased duration and level of ozone exposure increases both the severity of the response and the number of individuals who respond. Years of ozone exposure can result in structural alterations in the lung and contribute to a cumulative lifetime decrease in lung function. Increased frequency and severity of ozone exposure will most likely increase the rate at which long-term changes occur and also increase the total ozone contribution to lifetime lung injury.

- *PM_{10}*—Adverse health effects of fine particles include chronic reduction of lung function and specific toxic effects of various components of the aerosol mass. Clinical and epidemiologic studies indicate PM_{10} contributes to increased incidence of emphysema, aggravation of asthma, and transmission of airborne pathogens.

- *Carbon Monoxide*—CO is a toxic gas that acts by blocking transport of oxygen by the blood. Exposure has been shown to aggravate chest pain in patients with coronary heart disease. Both individuals with chronic heart disease and respiratory problems are at greater risk.

Global warming could increase concentrations of these pollutants, and the CO_2 increase presently projected would likely result in both increased morbidity (illness) and mortality (death) among citizens. The elderly and the very young would be most severely affected. More than 70% of the increased mortality in adults would occur in persons above the age of 65; most of these would result from exacerbation of coronary heart disease and stroke. Global warming may also indirectly lead to an increase in the number of premature births and perinatal deaths (deaths occurring before, during, or just after birth). Increase in the number of preterm births and perinatal deaths are generally associated with warmer summer months. Preterm birth increases the risk of both morbidity and mortality in developing infants, and therefore increased morbidity and mortality should be expected among these infants."

In addition to these potential impacts of increased global warming, City staff have requested information on criteria pollutant impacts from CO_2 emission reductions. In other words, while CO_2 increases could potentially degrade air quality as described above, what are the potential air quality impacts of CO_2 reductions? The answer to this question depends upon the type and magnitude of CO_2 reduction measures implemented. In the buildings sector, measures that reduce energy consumption will produce criteria pollutant reductions proportionate to CO_2 reductions. Measures involving fuel switching from fossil fuels to renewable energy resources will completely eliminate criteria pollutant emissions along with CO_2 emissions. In the transportation sector, measures that eliminate or reduce driving will produce criteria pollutant emission reductions proportionate to CO_2 reductions. However, measures that create mode or fuel switching may increase certain criteria pollutant emissions depending upon site-specific circumstances. For example, shifting passengers from autos to transit may not result in a net criteria pollutant improvement if the average transit vehicle occupancy is relatively low and transit vehicle fuel is more polluting than auto fuel, e.g. diesel versus gasoline. The CEC has sponsored research on the air quality impacts of various transportation modes and fuels, and has concluded that the large number of variables makes it impossible to generalize about the criteria pollutant effects of CO_2 reduction (Delucchi, 1995). This wide range of potential impacts is shown in Table 1.1 where percentage changes in emissions per passenger trip are compared for transit versus autos in four California regions. Based on these results, the CEC has determined that the air quality effects of CO_2 reduction measures must be analyzed on a case-by-case basis.

International CO_2 Reduction

Chula Vista has undertaken this CO_2 reduction effort as part of the international, multi-city Urban CO_2 Reduction Project. Sponsored by the International Council for Local Environmental Initiatives (ICLEI), the Urban CO_2 Project includes a group of 14 cities worldwide who are committed to demonstrating local leadership on climate change. Table 1.2 provides a sample of the CO_2 reduction actions being taken by these cities. The Urban CO_2 Project was initiated in 1991, and Chula Vista joined the effort in 1993.

Starting with the Toronto Conference on the Changing Atmosphere in 1988, the international scientific community proposed that a global reduction of 1988 CO_2 emissions of 20% by the year 2005 should be a target if a 50% reduction of 1988 emissions is to be achieved by 2050. The United Nations Environment Program and the World Meteorological Organization established the Intergovernmental Panel on Climate Change (IPCC) to develop further understanding of the problem and formulate policy options for the international community. In 1990, the Second World Climate Conference in Geneva

Table 1.1
PERCENTAGE CHANGE IN EMISSIONS PER PASSENGER TRIP USING TRANSIT IN PLACE OF AUTOS

	Sacramento	San Francisco	Los Angeles	San Diego
NMHC	-97.5%	301.3%	-44.4%	-7.2%
CO	-91.3%	87.3%	48.6%	-83.7%
NO_x	-70.5%	39.9%	148.4%	-71.2%
SO_x	84.7%	-5.4%	-89.5%	66.0%
PM_{10}	-91.5%	-93.1%	-12.0%	-92.3%
C_6H_6	-99.0%	87.5%	1013.2%	93.1%
HCHO	-87.9%	111.1%	1845.7%	-67.8%
CH_3CHO	-88.4%	4490.4%	-82.5%	-91.4%
$CH_2CHCHCH_2$	-98.6%	infinite	375.9%	infinite
CH_2CH_2	-93.6%	infinite	25.2%	-94.2%
Fuelcycle GHG	-87.5%	19.1%	52.8%	-59.4%

NMHC = nonmethane hydrocarbons; CO = carbon monoxide; NO_x = nitrogen oxides; SO_x = sulfur oxides; PM_{10} = particulate matter of less than 10 microns; C_6H_6 = benzene; HCHO = formaldehyde; CH_3CHO = acetaldehyde; $CH_2CHCHCH_2$ = 1.3 butadiene; CH_2CH_2 = ethelyne (ethene).

Source: Delucchi, M.A., Emissions of Criteria Pollutants, Toxic Air Pollutants, and Greenhouse Gases From the Use of Alternative Transportation Modes and Fuels, CEC, 1995

Table 1.2

LOCAL CO_2 REDUCTION EFFORTS WORLDWIDE

City	Sector	Program	Voluntary/ Mandatory	Implementation	Instituted	Cost	Impact/Goal
Portland	Commercial	Sustainable Tomorrow (BEST)	V	Brokerage service by City that provides educational, technical, financial assistance to local businesses.	1992	$40-70,000 annually	Local economic development and environmental protection; more than 140 businesses have participated.
Dade County	Land-Use	Neighborhood Development	M	Integration of homes with work, commerce, leisure.			Projected 30-40% fewer daily auto trips.
St. Paul	Municipal	Environmental-Economic Partnership Project	N/A	Survey of 48 environmental-related activities of city government, with economic implications. Report presents range of options for each activity.	1994		Impact varies by department: Public Works saves $250,000 annually; Parks and Recreation saves $500,000; other departments enjoy reduced energy consumption and CO_2 emissions.
Phoenix	Municipal	Energy Conservation Reinvestment Plan	M	City reinvests half of energy savings each year to finance new energy efficiency projects.	1984	$10,000,000 initial investment	Yielding $18,000,000 savings by 1992.
Toronto	Municipal	Energy Efficiency Office	N/A	Developing a plan to retrofit city-owned buildings with high-efficiency lighting and to upgrade communal housing.	1990	$23,000,000 endowed fund	Goal of reducing CO_2 emissions by 20% from 1988 levels by 2005.
Denver	Municipal	Green Lights Project	M	Covert 90% of city's lighting to efficient technologies.		$5,000,000 over five years	
Austin	Residential	Energy Star and Green Builder Programs	V	Incentive programs rewarding low-impact environmental behaviors/ components in residential construction.	1986, 1991	$150,000/yr	More than 90% of the houses built since 1986 have been rated; more than 50 separate builders have participated in the program.
Saarbrucken	Residential	Saarbrucken Participation Program	V	Low-interest loans (subsidized by municipal utility) for residential retrofits of energy conservation investments.	1980	3-5 million DM/yr	Related energy education program has reduced CO_2 emissions 15%.
Saarbrucken	Residential	Solar Rooftop Program	V	Local bank set up loan program for residential retrofits of photovoltaics; residents can sell this solar power to utilities.		as above	Goal of one megawatt of generating capacity on rooftops.
Ankara	Residential	Residential Fuel Conversion	M	Conversion from coal/fuel oil to natural gas for residences.			
Copenhagen	Residential	District Heating	M	Mandatory expansion of district heating.			From current 65% rate to 95% by 2002.
Seattle	Municipal/ Transport	City Employee Commute Trip Reduction Program	M	Provides public transportation subsidies, parking subsidies for carpools, telecommuting, etc. to reduce number of drive-alone trips.	1993		Goal to reduce single-occupancy vehicle rate.

Source: ICLEI

reviewed the work of the IPCC, the result of which was a commitment to prepare an international convention on climate change for the Earth Summit in 1992.

The resulting Framework Convention on Climate Change (FCCC) was signed by more than 150 countries at the Earth Summit. The Convention stops short of a firm target and schedule for greenhouse gas emission reductions. A number of countries, including the United States, have since made unilateral commitments to bring greenhouse gas emissions to their 1990 levels by the year 2000.

In April 1995, the signatories to the FCCC met in Berlin to re-evaluate emission targets. At this meeting, the countries made a new commitment, known as the Berlin Mandate, under which they will try to set new emission targets for the years after 2000 by 1997. Though the scientific evidence for global warming is still inconclusive, the decision reflects broad agreement that reducing the output of greenhouse gases is a sensible precaution until more is known about their effect on the global climate.

At ICLEI's recommendation, this initial Chula Vista plan is interpreting the international goal to be 80% of 1990 emissions in 2010. Chula Vista can respond to subsequent FCCC targets during future updates of the CO_2 plan.

Developing the Plan

The process used to prepare Chula Vista's plan is illustrated in Figure 1.2. A 25-member Task Force of interested stakeholders was assembled in May 1994 to oversee the plan's preparation. Using staff and consultant assistance, the Task Force inventoried existing CO_2 emissions; projected emissions growth to 2010; and evaluated a wide range of CO_2 reduction measures to identify those most suitable for Chula Vista. This process culminated in the reduction stretegy, policies, and implementation measures described in the plan's concluding chapters. The geographic scope of the plan is shown in Figure 1.3, which illustrates the City's general planning area in relation to the San Diego region.

Measuring CO_2 and Energy

Planning for CO_2 emission reductions and related energy efficiency improvements requires the measurement of CO_2 and various energy quantities. In this plan, CO_2 is expressed as a function of fuel type by weight, in either pounds or tons (short tons of 2,000 lbs.). For example, 87 gallons of gasoline is equivalent to about one ton of CO_2. As shown in Figures 1.4, 1.5 and 1.6, about half of this comes from automobile driving and gasoline; another quarter comes from energy use in homes, much of that in electricity; and the remainder comes from energy use in stores, offices, industries, and municipal government.

Figure 1.2

CHULA VISTA CO_2 REDUCTION PLANNING PROCESS

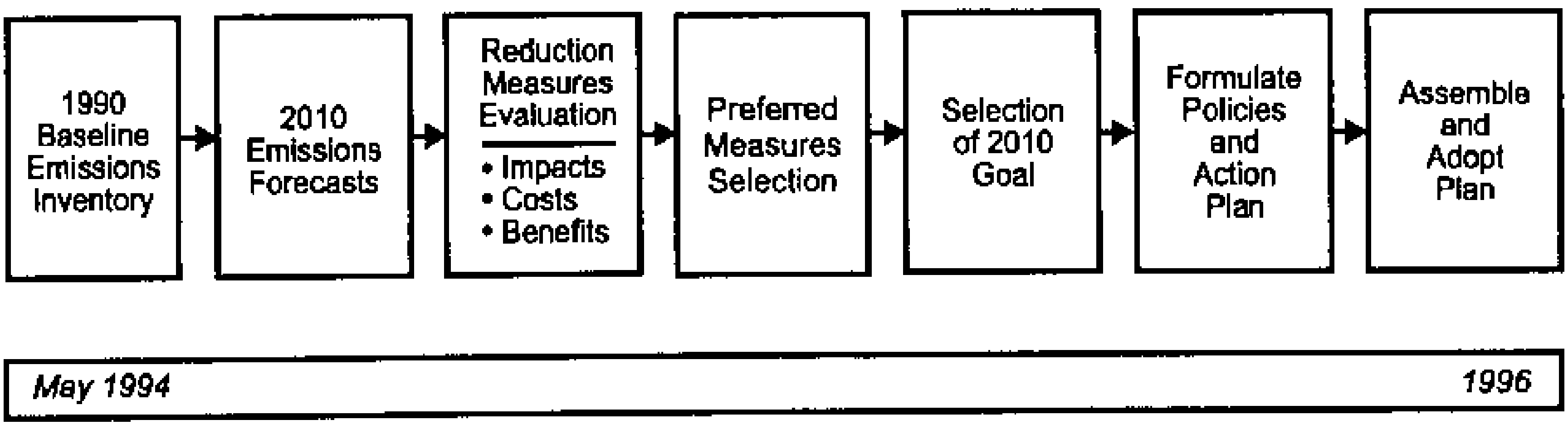


Figure 1.3
CHULA VISTA PLANNING AREA & VICINITY

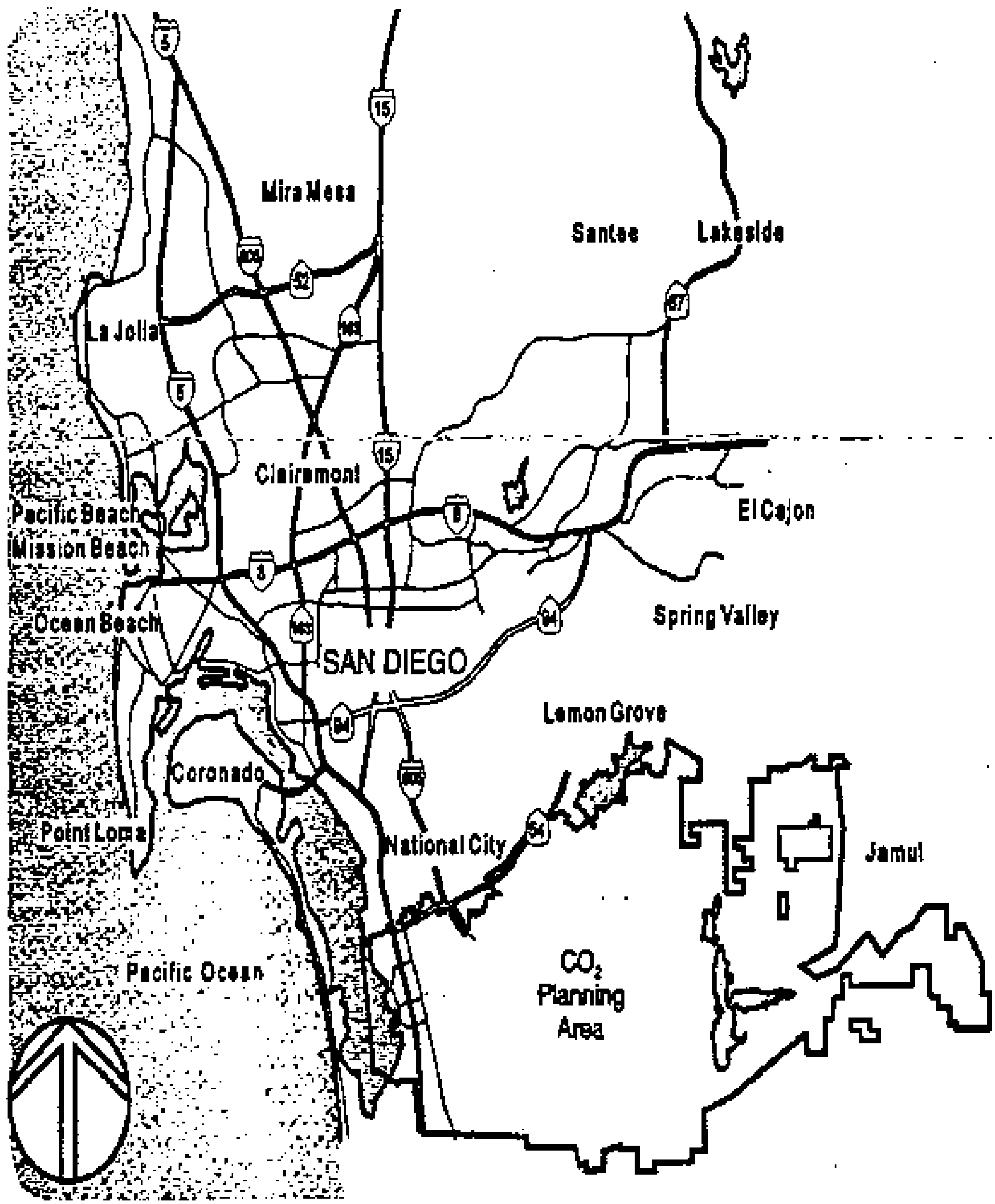
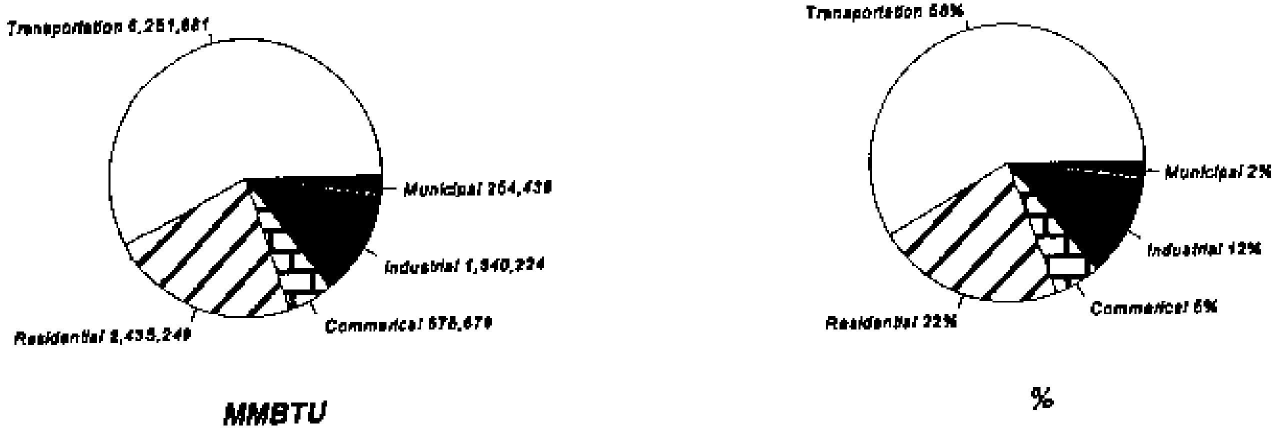


Figure 1.4

1990 TOTAL
ENERGY CONSUMPTION BY END-USE SECTOR



1990 TOTAL
CO2 EMISSIONS BY END-USE SECTOR

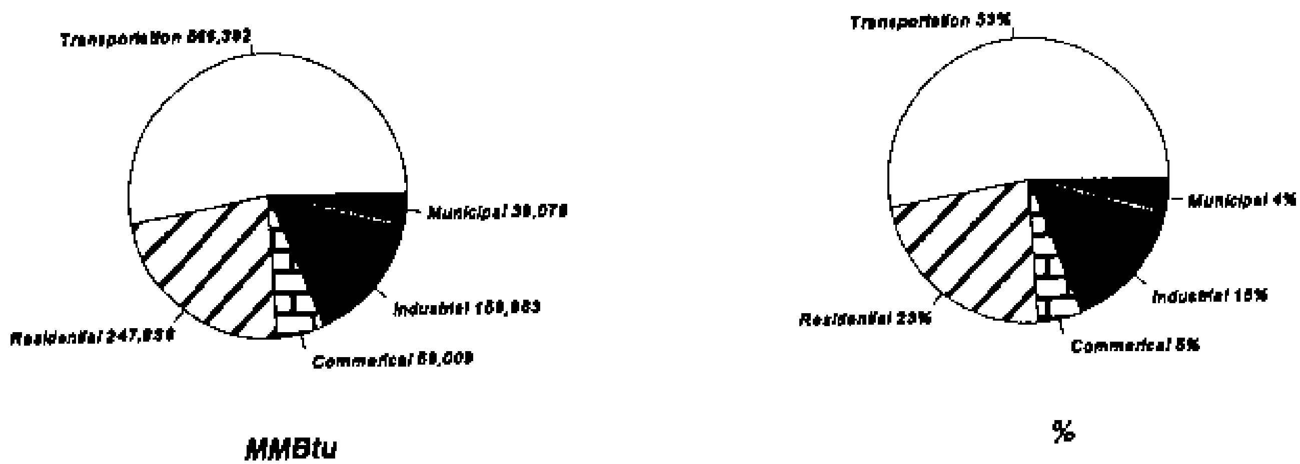
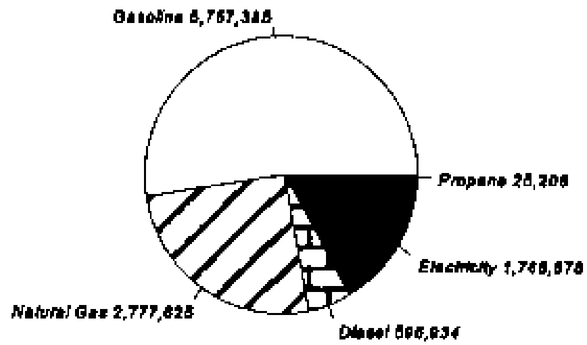
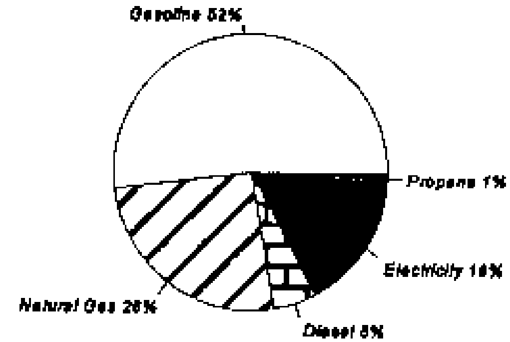


Figure 1.5

1990 TOTAL
ENERGY CONSUMPTION BY FUEL TYPE

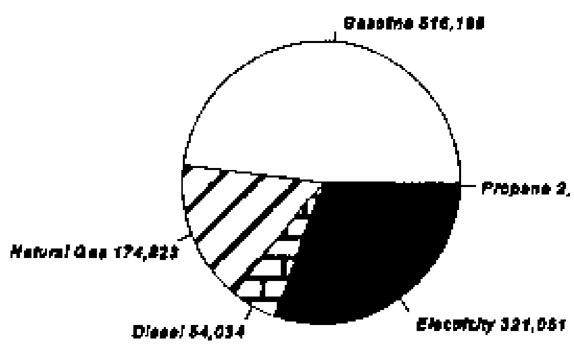


MMBtu

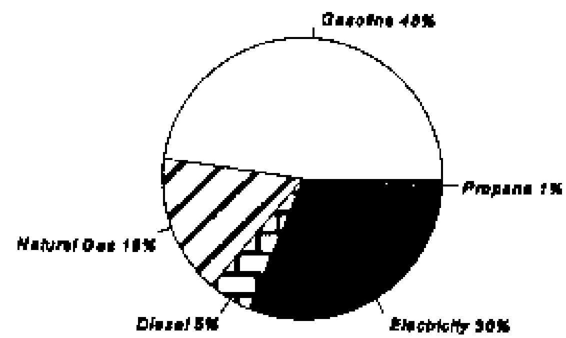


%

1990 TOTAL
CO2 EMISSIONS BY FUEL TYPE



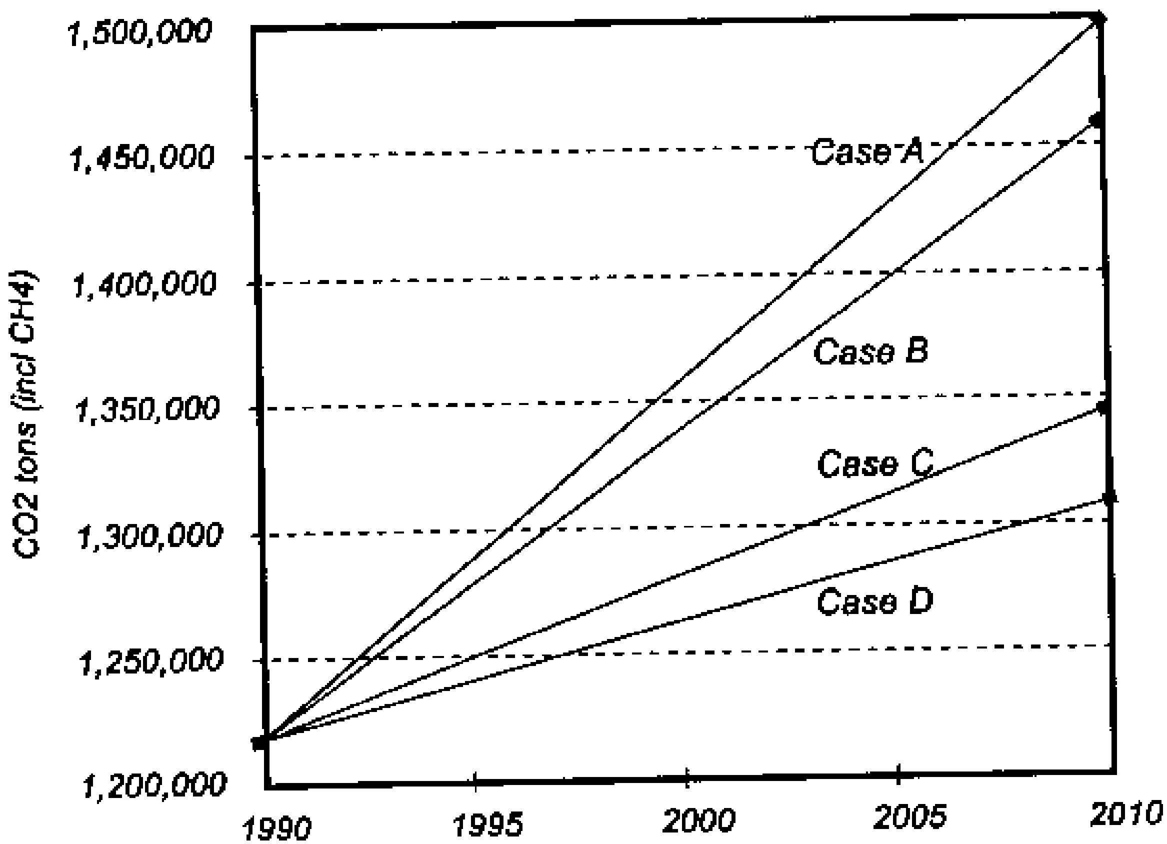
MMBtu



%

Figure 1.6

2010 CO_2 FORECASTS WITHOUT MUNICIPAL ACTIONS



Case:

A: Population and VMT growth only.

B: Electric resource mix improvement. Due to utility deregulations, this scenario is no longer valid, according to SDGE.

C: Vehicle efficiency improvement.

D: Electric resource mix and vehicle efficiency improvements.

Energy use involves a variety of fuels that are measured in their own unique units. Electricity, for example, is normally expressed in kilowatt/hours while gasoline is measured in gallons. To simplify tabulations, all energy values are converted into British thermal units (Btu). One Btu is the amount of thermal energy required to raise the temperature of one pound (one pint) of water 1° F at sea level. Because a single Btu is a relatively small amount of energy, one million Btu (MMBTU) is used as a standard unit throughout the plan. Table 1.3 presents conversions of various fuels into Btu equivalents according to energy and CO_2 content.

Two other statistical notes: 1) methane (CH_4) is addressed intermittently throughout the plan, and in those instances it is measured in equivalent CO_2 units; and 2) CO_2 emissions are often expressed in pounds or tons per capita, which is the total amount of CO_2 from a given source divided by Chula Vista's total population. This latter expression is intended to give citizens better insight into how their personal actions contribute to the community's global warming emissions.

Table 1.3
ENERGY AND CO_2 CONVERSIONS

		CO_2	
	MMBtu	Lbs	Lbs/MMBtu
One gallon of gasoline	0.1250	19.37	152
One gallon of diesel	0.1390	23.57	169
One therm of natural gas	0.1000	12.58	116
One kilowatt-hour (kWh) of electricity (based on SDG&E's 1990 resource mix)	0.0034	1.24	364

One ton of CO_2 = 87.02 gallons of gasoline

One ton of CO_2 = 159 therms of natural gas

One ton of CO_2 = 1,610 KWh of electricity

2. EMISSIONS INVENTORY

CITY OF
CHULA VISTA

1990 BASELINE INVENTORY

CO_2 Emission Sources

The first step in Chula Vista's CO_2 reduction planning is the establishment of a baseline to measure reductions against: how much CO_2 is Chula Vista currently emitting, and what are the sources of those emissions? 1990 was selected as the plan's baseline year because that was the most recent year of complete data, and it is also consistent with the baselines used by most ICLEI cities. The sources of Chula Vista's emissions are categorized as follows:

Energy consumption

- Petroleum use in autos, trucks, and other equipment.
- Electricity and natural gas use in homes and businesses.

Energy production

- Petroleum refining
- Electric power generation
- Natural gas distribution

Each of these components are summarized below and detailed in Appendices A and B.

Energy Consumption

Emissions are directly created by energy consumption when fuel is combusted by end-users, such as motorists using gasoline and homes and businesses using natural gas. Emissions are indirectly created by electrical use, i.e., using electricity in a home requires generation at a power plant that, in turn, emits CO_2. Chula Vista's energy consumption is organized into five end-use sectors: municipal government, transportation, residential, commercial, and industrial.

Municipal Government

Chula Vista's municipal government uses energy in three ways: fueling municipal-owned vehicles; space conditioning and powering municipal-owned buildings; and powering certain public services, such as street lighting and park irrigation. Municipal energy use accounts for only 2% of total community energy use. This energy consumption generates about 39,000 tons of CO_2 emissions annually, and 80% of that comes from electric use. Although municipal government energy consumption is the smallest end-use sector, it nonetheless is most directly subject to public policy and can therefore be used to set a leadership example for other sectors. It also represents a $4.4 million annual expense in the municipal budget. Using energy more efficiently not only reduces CO_2 emissions, but also saves money that can be redirected to other critical public service needs.

Transportation

As a suburban community, based upon 1990 census data, a total of 54,200 Chula Vista residents commute to work outside of Chula Vista. As a bedroom community to San Diego, the inventory identified Chula Vista's largest energy end-use sector and CO_2 emitter as transportation. Because of Chula Vista's suburban nature, it is understandable that the largest identified contributor to CO2 emissions reflects the community's dependence on automobiles for a large majority of its travel needs. Chula Vistans use approximately 106,000 automobiles and trucks to travel over one billion miles annually, emitting nearly 600,000 tons of CO2 in the process. This includes travel both within Chula Vista and for commute trips to other parts of the San Diego region. This sector represents slightly over 50% of the community's annual CO_2 emissions, indicating heavy dependence on low occupancy automobiles that are the City's single highest contributors to CO_2.

Residential

After transportation, the second largest energy user is Chula Vista's residential sector. This sector included 49,849 dwelling units in 1990, 46% of which were detached single-family homes, and 24% of which were apartment buildings with ten or more units. Chula Vista's residences are relatively young; 23% were built since 1980, and another 60% between 1950 and 1980. In total, this sector accounts for 22% of the community's total energy use. About one-third of the residential energy used is electrical, and two-thirds is natural gas. This energy consumption creates approximately 248,000 tons of CO_2 annually, or 23% of total emissions.

Commercial

The community's commercial sector is dominated by retail and service trades. These are estimated to consume about 5% of total community energy, and to produce approximately 91,000 tons of CO_2 emissions every year. It should be noted that SDG&E has provided electric and natural gas end-use data for commercial and industrial sectors combined, making it necessary to estimate the commercial share. This estimate can be refined if and when actual commercial sector data become available.

Industrial

Chula Vista's industrial sector includes aerospace manufacturing and other light industries. This sector is estimated to consume about 12% of total community energy and to emit about 157,000 tons of CO_2 annually. Again, SDG&E only provided combined commercial and industrial data, making it necessary to estimate the industrial share. This can be refined if and when actual industrial data are made available.

Energy Production

The second portion of the 1990 inventory are those emissions created during energy production and distribution. For example, electric power plants and petroleum refineries emit CO_2 when producing their output, and large pipelines may emit CO_2 or CH_4 through venting or flaring during product distribution. These sources are organized by energy type, and further by their location either in Chula Vista or elsewhere but serving Chula Vista.

Electricity

Electricity is provided in Chula Vista solely by SDG&E (excepting for a small number of "self-generators," which are facilities that operate small power plants for their internal use). SDG&E generates electricity from power plants that it owns and operates throughout San Diego County, including the 700 MW South Bay plant in Chula Vista. It also purchases power from independent producers throughout the County, including several in Chula Vista, and from other utilities outside the region. Chula Vista experiences power plant CO_2 emissions far in excess of its own electric needs, with about 2.8 million tons of CO_2 coming from local power plants alone every year. In contrast, the community's electric end-use creates only about 300,000 tons/year of CO_2 emissions.

It is also worth noting that what is normally a community's largest source of methane emissions, the solid waste landfill, is being put to beneficial use in Chula Vista by methane recovery for fueling power generation.

Natural Gas

SDG&E also provides natural gas service in Chula Vista. There is no wellhead natural gas produced in San Diego County; all of SDG&E's supplies are purchased from out-of-region sources and piped into the County. Estimates of CO_2 from pipeline flaring (and equivalent units of methane venting associated with pipeline operation), including deliveries to power plants and direct-use consumers, totals about 146,000 tons/yr. As with previous estimates, this value is an approximation. Actual values were not available from SDG&E at the time of plan preparation.

Transportation Fuels

All petroleum transportation fuels used in Chula Vista are produced and refined outside of the region. Most gasoline and diesel supplies are refined at facilities in the Los Angeles area, and either piped or shipped by truck or rail into San Diego County. For the purposes of emission calculations for this section, staff only included emissions that the city has direct control over. Because freeway traffic does not originate or end with Chula Vista residents, the City cannot greatly effect a reduction in those emissions. Thus freeway traffic on I-5 and I-805 through the City was not included in the calculations because the city has no direct relationship with those individuals driving north to south that do not live in Chula Vista. Staff did include trips originating in Chula Vista, trips ending in Chula Vista, and internal trips. Incorporating all freeway traffic (including through-put traffic) would increase the total, but there would be no way to effect reductions. Therefore, emissions are based upon traffic moving 1) within Chula Vista, 2) originating from Chula Vista, or 3) ending in Chula Vista, approximately 89,000 tons of CO_2 emissions per year is estimated for Chula Vista's share of petroleum refining and distribution.

Summary

The 1990 inventory of consumption and production emissions is summarized by end-use sector and fuel type in Table 2.1. Figures 2.1 and 2.2 provide graphic illustrations of the data contained in Table 2.1, including energy consumption and CO_2 emissions by end-use sector in Figure 2.1, and energy consumption and CO_2 emissions by fuel type in Figure 2.2. The inventory is also fully detailed in Appendices A and B. In total, Chula Vista emits about one million tons of CO_2 annually. About half of

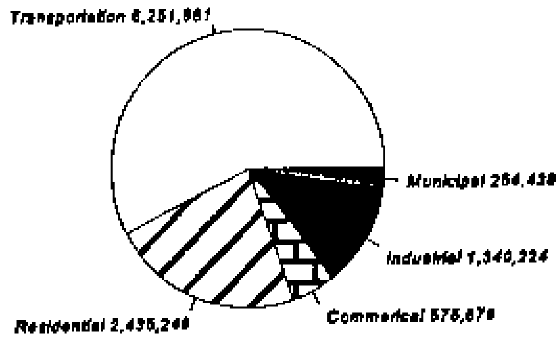
Table 2.1
1990 TOTAL ENERGY CONSUMPTION AND CO_2 EMISSIONS

End-Use Sector	Fuel Type	Energy Consumption		CO_2 Emissions		
		MMBtu	%	Tons	% by Sector	Lbs Per Capita
Residential	Electricity	794,378	33	144,563	58	2,140
	Natural Gas	1,640,871	67	103,273	42	1,528
	Gasoline	0.00	0.00	0.00	0.00	0.00
	Diesel	0.00	0.00	0.00	0.00	0.00
	Propane	0.00	0.00	0.00	0.00	0.00
	Sub-total	2,435,249	100	247,836	100	3,668
Commercial	Electricity	182,933	32	33,291	57	493
	Natural Gas	392,746	68	24,720	43	366
	Gasoline	0.00	0.00	0.00	0.00	0.00
	Diesel	0.00	0.00	0.00	0.00	0.00
	Propane	0.00	0.00	0.00	0.00	0.00
	Sub-total	575,679	100	58,011	100	859
Industrial	Electricity	610,099	46	111,027	71	1,643
	Natural Gas	730,125	54	45,956	29	680
	Gasoline	0.00	0.00	0.00	0.00	0.00
	Diesel	0.00	0.00	0.00	0.00	0.00
	Propane	0.00	0.00	0.00	0.00	0.00
	Sub-total	1,340,224	100	156,983	100	2,323
Municipal	Electricity	176,782	70	32,171	83	476
	Natural Gas	13,883	5	874	2	13
	Gasoline	23,266	9	2,094	5	31
	Diesel	40,508	16	3,936	10	58
	Propane	0.00	0.00	0.00	0.00	0.00
	Sub-total	254,439	100	39,075	100	578
Transportation	Electricity	1,486	0.00	0.00	0.00	0.00
	Natural Gas	100	0.00	0.00	0.00	0.00
	Gasoline	5,734,119	91	514,103	91	7,609
	Diesel	556,126	9	50,098	9	741
	Propane	25,208	0.00	2,180	0.00	33
	Sub-total	6,317,039[a]	100	566,381	100	8,383
	Total	10,922,630		1,068,286		15,811

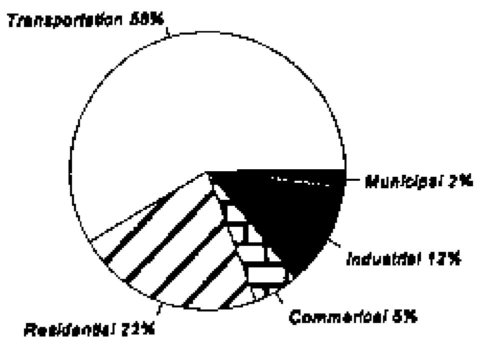
(a) Includes municipal transportation fuel.

Figure 2.1

1990 TOTAL
ENERGY CONSUMPTION BY END-USE SECTOR

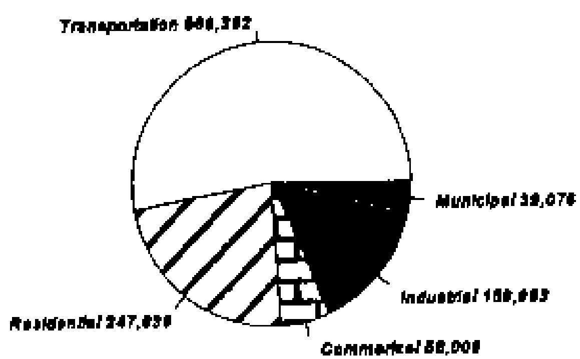


MMBtu

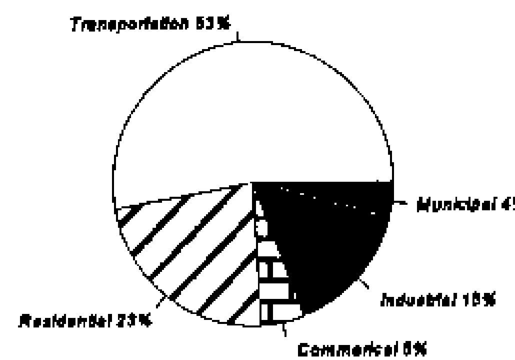


%

1990 TOTAL
CO2 EMISSIONS BY ENO-USE SECTOR



MMbtu

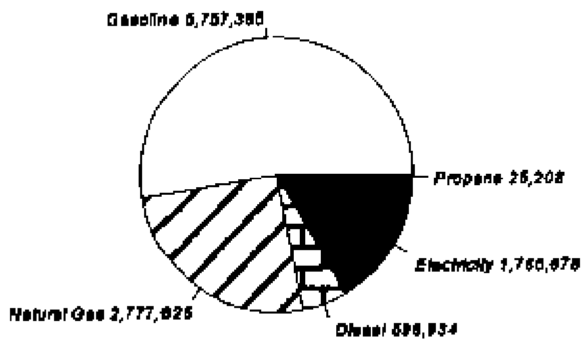


%

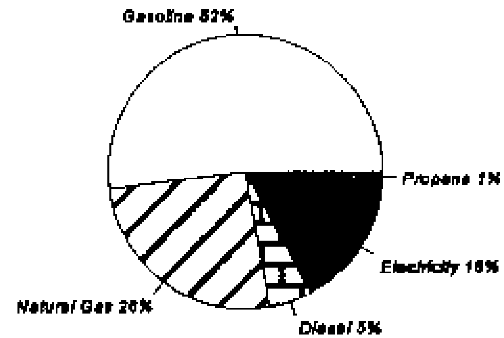
Figure 2.2

1990 TOTAL

ENERGY CONSUMPTION BY FUEL TYPE



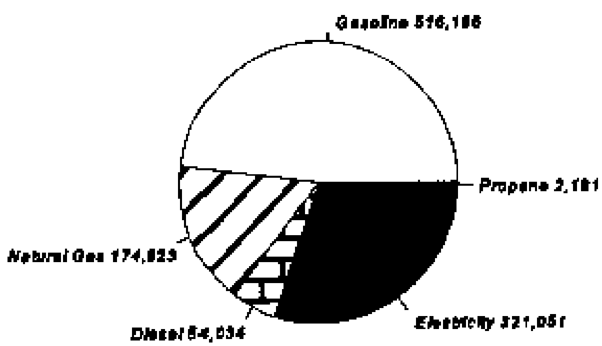
MMBtu



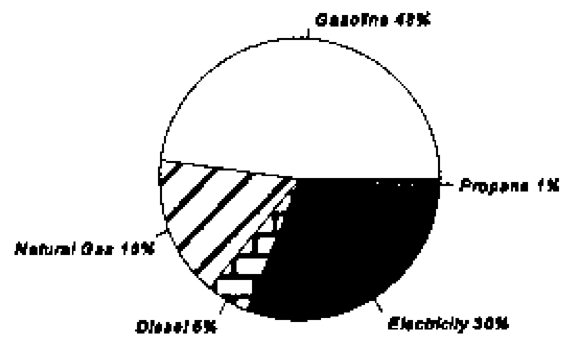
%

1990 TOTAL

CO2 EMISSIONS BY FUEL TYPE



MMBtu



%

the emissions come from the transportation sector, one-quarter come from residences, and the remaining quarter is split between the commercial, industrial, and municipal sectors. Of the fuels used by these sectors, gasoline accounts for nearly half of the CO_2 emissions, and about one-third come from electricity. The remaining 20% is split between natural gas, propane, and diesel.

Figure 2.3 summarizes these emissions on a variety of personal and community levels in order to illustrate the relative magnitude of different end-use contributions to global warming.

Chula Vista conditions are compared to other ICLEI cities in Figure 2.4. Chula Vista appears to compare favorably with these cities in terms of lower per capita CO_2 emissions, but it should be remembered that Chula Vista is much smaller in population than other ICLEI cities, and as a rule energy intensities per capita are markedly greater in cities larger than 250,000 persons.

Chula Vista's per capita CO_2 emissions also compare favorably to other North American cities because of the relatively low carbon intensity of SDG&E's resource mix. Several of the other cities rely on coal and oil-fired power generation versus the natural gas, nuclear, and hydro characteristics of SDG&E's resource mix. Alternatively, Chula Vista does not compare favorably to European cities that are less reliant upon automobile travel.

Figure 2.3

EXAMPLES OF CHULA VISTA CO_2 EMISSIONS

(1990)

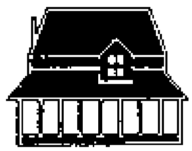
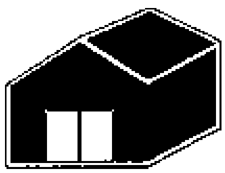
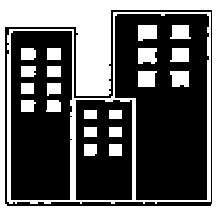
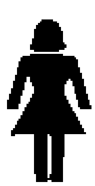
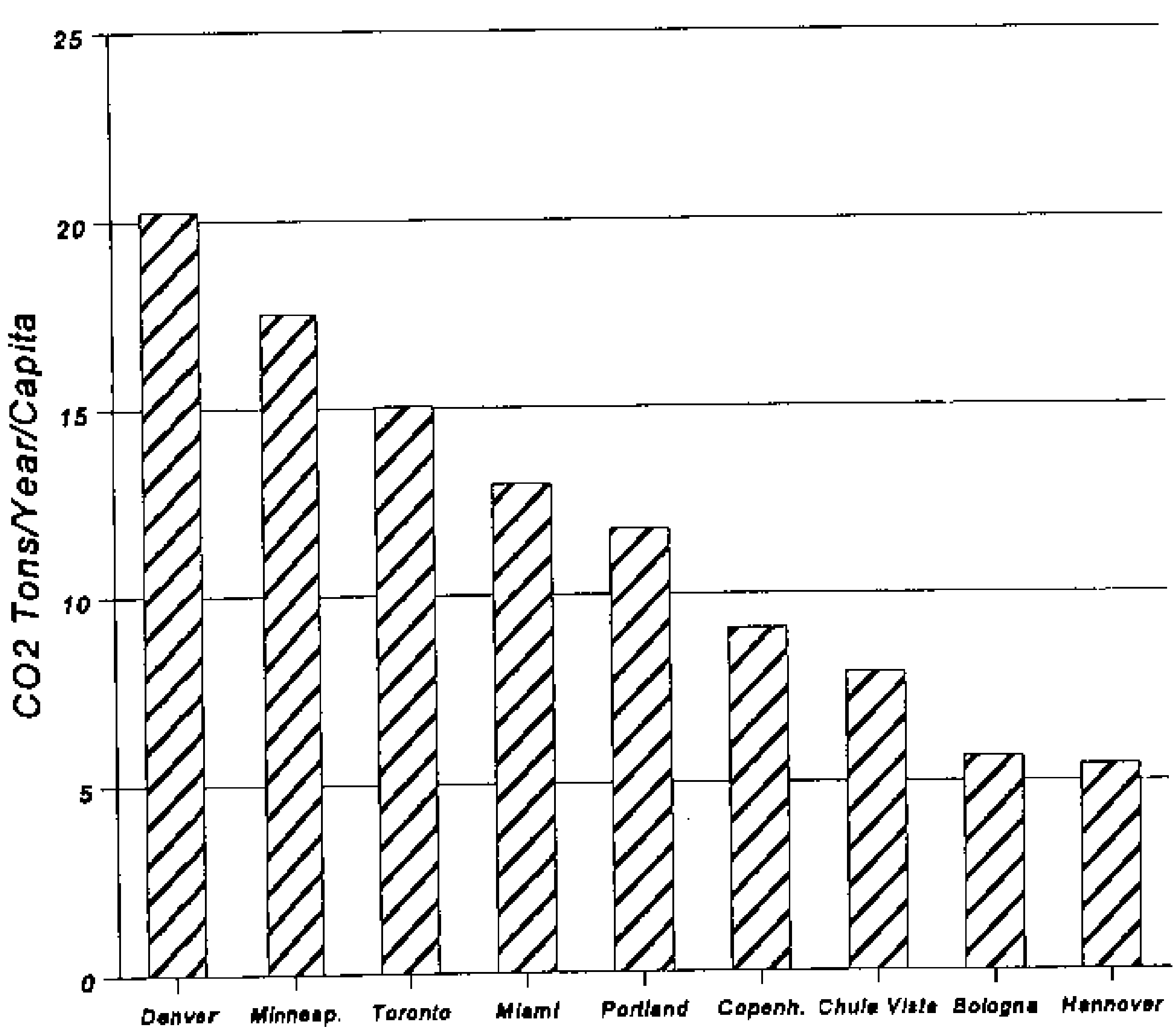
	CO_2 Tons/yr
 Single-family home	5
 10,000 sq.ft. store	41
 20,000 sq.ft. office	109
 Auto with 1.1 passengers	5½ per passenger
 Bus with 30 passengers	3½ per passenger
 Total per capita	8

Figure 2.4

1990 PER CAPITA CO_2 EMISSIONS OF SELECTED ICLEI CITIES



3. EMISSIONS FORECAST

CITY OF
CHULA VISTA

2010 EMISSIONS FORECAST

Having established a baseline inventory of Chula Vista's current CO_2 emissions, the next step in the planning process is a forecast of emissions growth under various future conditions. The purpose of such forecasting is to:

- Illustrate the increased global warming that may be caused by Chula Vista's population growth if CO_2 emission reduction actions are not taken.
- Identify the amount of CO_2 that reduction actions must eliminate in order for Chula Vista to stabilize or possibly reverse its global warming contributions.

The year 2010 is used as a planning horizon consistent with the international CO_2 reduction goal of 80% of 1990 levels in 2010. A set of forecasts have been prepared to simulate differing combinations of community variables that affect emissions, including:

- Population growth as projected by SANDAG Series VII population study for the current incorporated area. This study indicated that by 2010, Chula Vista is expected to grow 23%, adding 32,000 additional residents between 1990-2010. As the City continues to expand its territorial limits, and population expands, the potential CO_2 emissions and savings from the action measures will also increase. This estimate does not include the Otay Ranch area.
- Vehicle miles traveled (VMT) and transit passenger miles traveled as projected by SANDAG. These include all trip origins and destinations inside and outside the City consistent with the 1990 baseline inventory. VMT is increasing at a faster rate than population growth throughout California, and in Chula Vista a significant 44% increase is projected by 2010.
- The average fuel efficiency of vehicles on the road, which is presently 18 mpg in the San Diego region. This variable is influenced by federal fuel efficiency standards for new vehicles and the overall age of the region's vehicle stock. A gradual improvement in baseline fuel efficiency is assumed consistent with CEC projections that reach 21 mpg in 2010.

- The marginal electric generation CO_2 coefficient, or CO_2 intensity of incremental additions to SDG&E's resource mix in the future. This is influenced by the carbon intensity of fuels used in the future to generate the community's electricity, i.e., renewables versus fossil fuels. A gradual reduction in the baseline CO_2 intensity of SDG&E's electric fuel mix is assumed consistent with industry and regulatory trends. However, given the significant changes expected from electric industry restructuring, it is unclear how CO_2 emissions will be impacted. This is an issue, consistent with the City's legislative agenda, that the City will continue to monitor.

The forecasts are shown in Table 3.1 and Figure 3.1 according to four cases: 1) population and VMT growth only; 2) population and VMT growth with less carbon-intensive electric generation fuels; 3) population and VMT growth with vehicle fuel efficiency improvements that exceed the baseline trend; and 4) a combination of all three previous cases. All four forecasts represent scenarios of what could happen without any special municipal action to reduce Chula Vista's CO_2 emissions. Table 3.2 details the assumptions used for the improved electric resource mix scenario. All forecasts include projected methane emissions expressed in equivalent CO_2 units.

As a final step in projecting emissions, the average of the four "no municipal action" forecasts has been used in Figure 3.2 as a basis for comparison to the federal and international reduction goals as follows:

- Expected CO_2 emissions if Chula Vista takes no municipal action to reduce its emissions. The average of the four cases equates to 1,405,650 tons/yr of emissions in 2010.

- CO_2 emissions that would occur if Chula Vista achieves the current federal reduction goal of stabilizing emissions at 1990 levels. This would equate to 1,213,579 tons/yr of emissions in 2010, which would require a reduction of 192,071 tons/year (1,405,650 - 1,213,579 = 192,071).

- CO_2 emissions that would occur if Chula Vista achieves the international goal of 2010 emissions equaling 80% of 1990 levels. This would equate to 970,863 tons/yr of emissions in 2010, which would require a reduction of 434,787 tons/year (1,405,650 - 970,863 = 434,787).

Figure 3.3 expresses the forecasts in terms of CO_2 savings that must be achieved to reach either the federal or international goals. It should be noted again that electricity-related emission estimates in Tables 3.1 and 3.2, and Figures 3.1 through 3.3, are based on previous SDG&E resource planning which may be impacted by the electric industry restructuring currently underway.

Table 3.1

2010 EMISSIONS FORECASTS WITHOUT MUNICIPAL ACTION

(based upon SANDAG Series 7 population study[1] - does not include Rancho San Miguel, Otay Ranch)
(CO_2 and CH_4)

	1990	2000	% Change from 1990	2010	% Change from 1990
Case A: Population and VMT Growth Only					
Population	135,136	151,412	12.04	166,688	23.35
Vehicle miles traveled/year	1,041,083,750	1,273,323,100	22.31	1,505,562,450	44.61
Transit passenger miles traveled/year	59,787,953	73,125,127	22.31	86,462,301	44.61
Marginal elec. CO_2 coef. (lbs/kWh)	1.24	1.24	0.00	1.24	0.00
Vehicle fuel efficiency (mpg)	18	19	5.56	21	16.67
No action (CO_2 tons)	1,213,579	1,381,414	13.83	1,499,489	23.56
Federal reduction goal: 2000 = 1990 (CO_2 tons)		1,213,579	0.00	1,213,579	0.00
ICLEI reduction goal: 2010 = 80% of 1990 (CO_2 tons)		1,092,221	-10.00	970,863	-20.00
Case B[2]: Case A Plus Electric Resource Mix Improvement					
Population	135,136	151,412	12.04	166,688	23.35
Vehicle miles traveled/year	1,041,083,750	1,273,323,100	22.31	1,505,562,450	44.61
Transit passenger miles traveled/year	59,787,953	73,125,127	22.31	86,462,301	44.61
Marginal elec. CO_2 coef. (lbs/KWh)	1.24	1.10	-11.47	1.00	-19.52
Vehicle fuel efficiency (mpg)	18	19	5.56	21	16.67
No action (CO_2 tons)	1,213,579	1,298,249	6.98	1,343,683	10.72
Federal reduction goal: 2000 = 1990 (CO_2 tons)		1,213,579	0.00	1,213,579	0.00
ICLEI reduction goal: 2010 = 80% of 1990 (CO_2 tons)		1,092,221	-10.00	970,863	-20.00
Case C: Case A Plus Vehicle Efficiency Improvement					
Population	135,136	151,412	12.04	166,688	23.35
Vehicle miles traveled/year	1,041,083,750	1,273,323,100	22.31	1,505,562,450	44.61
Transit passenger miles traveled/year	59,787,953	73,125,127	22.31	86,462,301	44.61
Marginal elec. CO_2 coef. (lbs/KWh)	1.24	1.24	0.00	1.24	0.00
Vehicle fuel efficiency (mpg)	18	20	11.11	22	22.22
No action (CO_2 tons)	1,213,579	1	11.13	1,467,617	20.93
Federal reduction goal: 2000 = 1990 (CO_2 tons)		1,213,579	0.00	1,213,579	0.00
ICLEI reduction goal: 2010 = 80% of 1990 (CO_2 tons)		1,092,221	-10.00	970,863	-20.00
Case D: Cases A/B/C Combined					

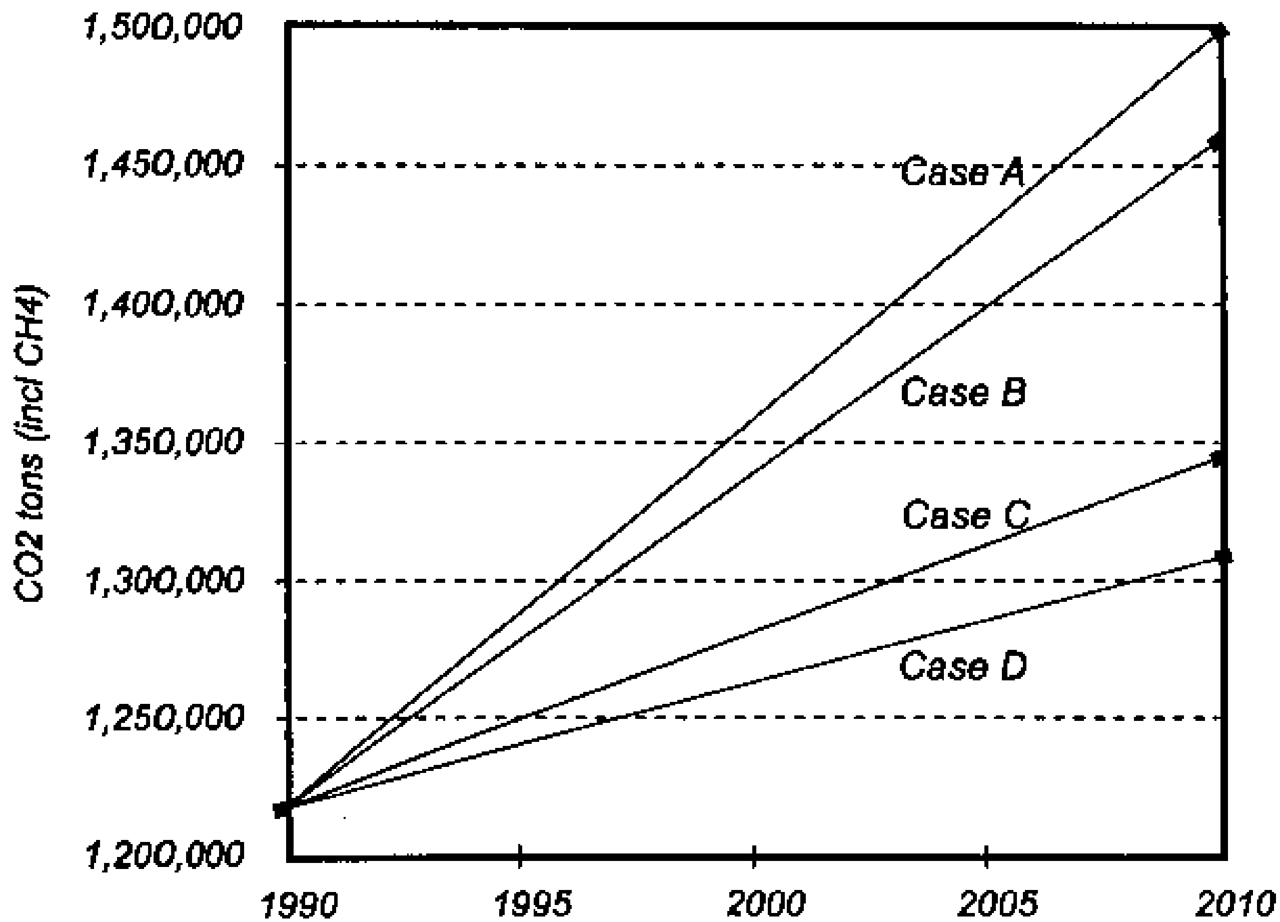
[1]The population estimates are based upon SANDAG Series VII for the current incorporated area. As the City continues to expand its territorial limits, and population expands, the potential CO_2 emissions and potential savings from the action measures will also increase. The previous estimated savings of 100,000 tons/yr of CO_2 emissions could increase to 150,000 to 160,000 tons based on application to expanded territory of the twenty action measures when fully implemented. These measures will offset population impacts.

[2]Due to utility restructuring and deregulation plans, the Case B scenario is no longer valid, according to SDG&E, the PUC and CEC. Because this inventory was done prior to the PUC's decision in 1995 to restructure the utility industry, resource mix improvements will not be pursued at this time by the local utility.

Table 3.1 Continued

	1990	2000	% Change from 1990	2010	% Change from 1990
Population	135,136	151,412	12.04	166,688	23.35
Vehicle miles traveled/year	1,041,083,750	1,273,323,100	22.31	1,505,562,450	44.61
Transit passenger miles traveled/year	59,787,953	73,125,127	22.31	86,462,301	44.61
Marginal elec. CO_2 coef. (lbs/KWh)	1.24	1.10	-11.47	1.00	-19.52
Vehicle fuel efficiency (mpg)	18	20	11	22	22
No action (CO_2 tons)	1,213,579	1,265,435	4.27	1,311,811	8.09
Federal reduction goal: 2000 = 1990 (CO_2 tons)		1,213,579	0.00	1,213,579	0.00
ICLEI reduction goal: 2010 = 80% of 1990 (CO_2 tons)		1,092,221	-10.00	970,863	-20.00

Figure 3.1
2010 CO_2 FORECASTS WITHOUT MUNICIPAL ACTIONS



Case:
A: Population and VMT growth only.
B: Projected electric resource mix improvement. *Due to State of California utility deregulation and restructuring plans, the Case B scenario characterized in this report is no longer valid, according to SDGE, the PUC and CEC. Resource improvement plans is uncertain at this time. Thus Case B is no longer valid.*
C: Vehicle efficiency improvement.
D: Electric resource mix and vehicle efficiency improvements.

Table 3.2

TOTAL SDG&E ELECTRIC GENERATION RESOURCE MIX: 1990 BASELINE AND 2010 SCENARIO[3]

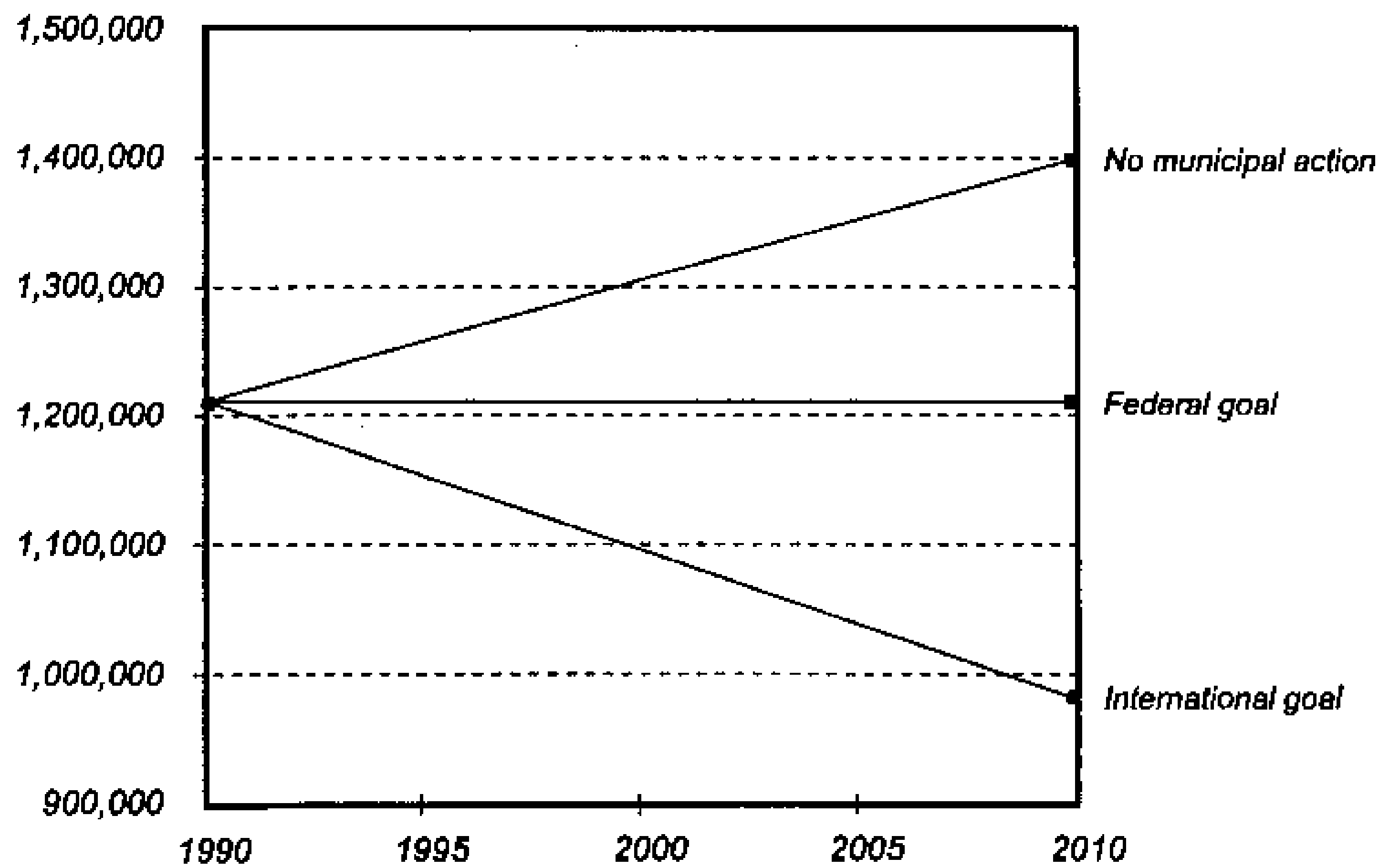
Fuel Type	Case A: 1990 Baseline		Case B: 2010 Improved Mix	
	% Total MWh	CO_2 Lbs/KWh	% Total MWh	CO_2 Lbs/KWh
Nuclear	23.30	0.0000	20.00	0.0000
Natural Gas	36.85	0.5803	47.20	0.7432
Fuel Oil	3.86	0.0887	0.00	0.0000
Coal	19.87	0.5697	9.00	0.2580
Biomass	0.02	0.0006	0.00	0.0000
Biogas	0.20	0.0032	0.30	0.0047
Hydro	7.70	0.0000	7.50	0.0000
Geothermal	8.20	0.0000	9.00	0.0000
Solar	0.00	0.0000	4.00	0.0000
Wind	0.00	0.0000	2.00	0.0000
Ocean	0.00	0.0000	0.50	0.0000
System Efficiency Improvements	0.00	0.0000	0.50	0.0000
Total	100.00	1.2425	100.00	1.0059

Figure 3.2

[3]Again, due to State of California utility restructuring plans, resource mix improvements characterized in this report are no longer valid. SDG&E's resource improvement plans have been placed on hold.

Figure 3.2

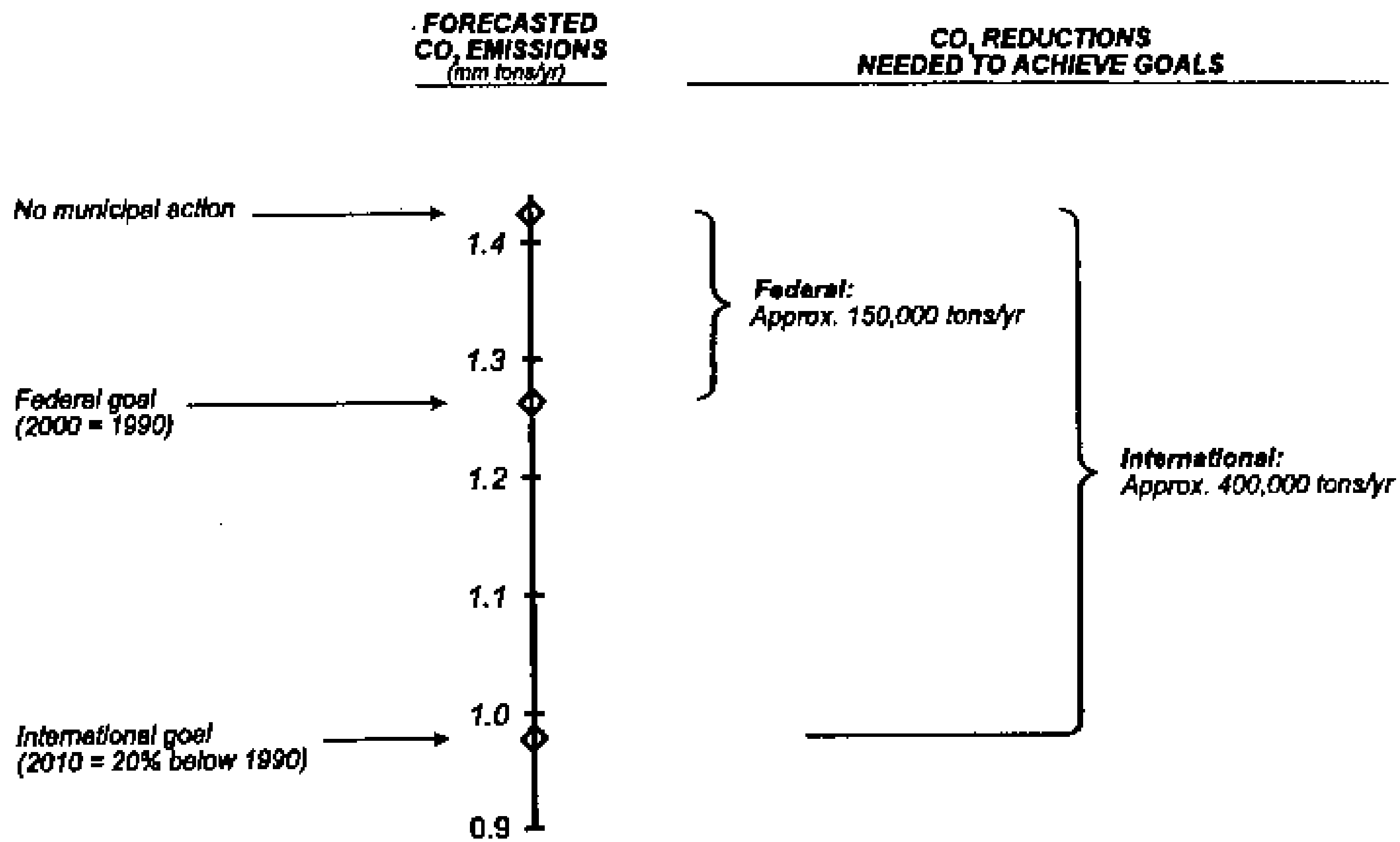
2010 NO ACTION FORECAST COMPARED TO FEDERAL AND INTERNATIONAL REDUCTION GOALS



Federal goal: 2000 = 1990
International goal: 2010 = 80% of 1990

Figure 3.3

SUMMARY OF ALTERNATIVE REDUCTION GOALS



4. REDUCTION STRATEGY

CITY OF
CHULA VISTA

CO_2 EMISSION REDUCTION STRATEGY

Emission Reduction Measures

Having established baseline and future CO_2 emission estimates, the next planning step is an evaluation of CO_2 reduction measures suitable for Chula Vista, how much CO_2 they could save, and how they can be assembled into an effective reduction strategy. For purposes of developing the strategy, emission reduction measures are grouped into the following seven categories:

- Transportation control
- Land-use
- Clean transportation fuels
- Residential/commercial/industrial buildings
- Municipal government
- Electricity and natural gas supply systems
- Regional/state/federal policies

Using these groups of measures, the reduction strategy was formulated in the following manner:

1. The consultant provided a total potential universe of approximately 300 reduction measures compiled from regional, state, national, and international sources.

2. The consultant conducted an initial screening of 300 measures and presented the Task Force with a generic list of 168 "CO_2 Reduction Measure Descriptions" for screening by the Task Force with regard to applicability to Chula Vista and favorable economics. The Task Force reviewed the generic measure descriptions as they were presented in five categories: transportation control; land use; building measures; alternative fuels, municipal measures.

3. The Task Force then reviewed all 168 reduction measures in detail to establish their Chula Vista suitability. Many were eliminated by the Task Force during the screening process. The screening process identified 90 preferred measures using the evaluation criteria in Table 4.1.

Table 4.1

CO_2 REDUCTION MEASURE SELECTION CRITERIA

Preferred Measures

- *Overall appropriateness of the measure to Chula Vista's geography and character.*
- *General acceptability of the measure to the public.*
- *Acceptability of the measure's technology requirements, if applicable.*
- *Feasibility of implementation funding.*
- *Presence of an established and/or growing market for the measure.*
- *Ability to quantifiably gauge results and benefits.*
- *Useful life or durability of a measure's CO_2 savings.*
- *Availability of an organization willing and capable to implement a measure.*

Action Measures

- *Measures already underway.*
- *Diversity of measures.*
- *Magnitude of CO_2 savings.*
- *Cost-effectiveness.*
- *Measurable results.*
- *Adequate implementation resources.*

4. Of the 90 preferred measures, the Task Force then selected 20 "action" measures for implementation following plan adoption. Selection criteria for these 20 measures are also given in Table 4.1.

The remainder of this chapter describes the seven categories of measures in more detail, and summarizes the Task Force's review that lead to the selection of preferred and action measures.

Transportation Control Measures

Transportation control measures (TCMs) are those CO_2 reduction actions that reduce auto dependence and/or increase the efficiency of vehicle use. For example, TCMs include actions that reduce or eliminate auto trips, or that increase auto occupancy levels. TCMs do not include fuel changes; these are addressed in a following section on Clean Fuels.

The Task Force conducted a detailed review of all TCMs in the SANDAG regional TCM plan, as well as numerous TCMs from other jurisdictions, and several suggested by Task Force members. In total, about 75 TCMs were evaluated against the criteria in Table 4.1 in order to arrive at preferred and action measures. TCMs preferred by the Task Force are listed below according to those suitable for direct municipal action, and those requiring implementation by other organizations that can be encouraged by the municipality:

<u>Direct Municipal Action Measures</u>

- Transit
  - Route improvements
  - Terminal/stop improvements

- Parking management
  - Parking cash-out
  - High Occupancy Vehicle preferential parking
  - Limit new parking in areas with transit
  - Improved enforcement
  - Bus stop relocation to parking areas

- Employment travel
  - ☐ Telecommuting and telecenters

- Shopper shuttle
  - ☐ Shopper shuttle service

- Ridesharing
  - ☐ Transportation management associations
  - ☐ Vanpool programs
  - ☐ Carpool matching programs
  - ☐ Guaranteed ride home

- Information distribution
  - ☐ Ridesharing/park and ride signage
  - ☐ Ridesharing matching programs
  - ☐ Transit/paratransit promotion
  - ☐ Traffic condition announcements/signs

- Pedestrian travel
  - ☐ Safety improvement
  - ☐ Direct connections with transit

- Bicycle travel
  - ☐ Education and promotion
  - ☐ Integration at employment/shopping areas
  - ☐ Bikeways/lanes
  - ☐ Integration with transit
  - ☐ Incentives for showers/clothing lockers at employment locations

- Roadway assignment
  - ☐ Reversible-flow bus and car lanes

Other Measures to be Advocated

- Transit
  - Commuter discounts
  - Peak/off-peak transit fares

- Parking management
  - Parking cash-out
  - Parking cost increases

- Employment travel
  - Four-day work week
  - Employment benefits based on HOV/transit use
  - Tax incentives for vanpool or transit
  - Parking disincentives for single occupancy vehicles

- Student travel
  - Parking/carpool incentives
  - Student transit subsidy
  - School mandated cost recovery
  - Reduced minimum distance for bus riders

- Pricing
  - Merchant transportation incentives for shoppers
  - Lower rates/preferential treatment for HOVs

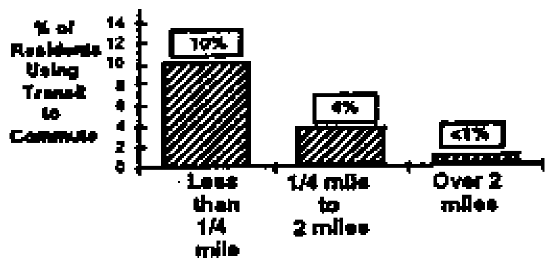
Land-Use

Land-use CO_2 measures are those that reduce auto dependence and increase building energy efficiency through land-use mixes, densities, and siting standards that reduce energy consumption and promote non-auto travel modes. In effect, the shape and content of Chula Vista's land-use plan largely dictates the types and amount of energy needed for the community to function. By purposely shaping its land-uses to be more energy efficient, the community reduces pollutant and global warming emissions, and saves the costs of the fuels that create those emissions. These and other benefits such as reduced infrastructure costs are illustrated in Figure 4.1.

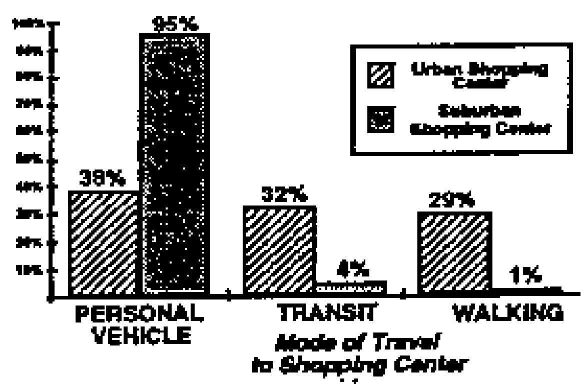
Figure 4.1

EFFECTS OF LAND-USE CO_2 REDUCTION MEASURES

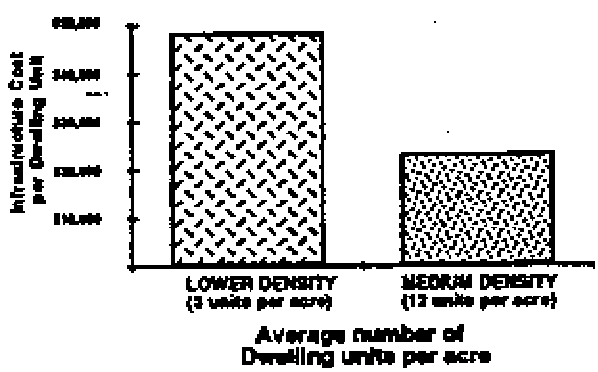
Proximity of Residence from a Transit Station, and Frequency of Transit Use



Travel Behavior at an Urban and a Suburban Shopping Center



Infrastructure Costs In Relation To Residential Density



Source: Air Resources Board, 1994.

The CO_2 implications of Chula Vista's general plan were recently evaluated as part of SANDAG's regional energy planning and growth management processes. Using SANDAG's geographic information system, and an energy planning methodology known as PLACE³S, the energy efficiency of Chula Vista land-use designations to 2010 were evaluated. The results, shown in Figure 4.2, are displayed in two steps: 1) potential efficiencies if land-uses were to take maximum advantage of their locational attributes, e.g., proximity to transit; and 2) net efficiencies given land-uses as actually planned. Figure 4.2 reveals the following conditions:

- Potential Efficiencies

Much of the older, western portion of Chula Vista is rated "very good" because of its higher densities, greater mix, and better pedestrian and transit orientation. Potential efficiencies fall to "fair" in the eastern portion of the community as land-use becomes primarily low-density single-family residential. This efficiency reduction (and CO_2 increase) occurs because of the auto dependence created by single-use, low-density development patterns. Such patterns also increase building and infrastructure energy use, and CO_2 emissions, even further.

- Net Efficiencies

Interestingly, when net efficiencies are determined by comparing planned land-uses with locational potentials, the east/west ratings are inverted. Much of the eastern portion is raised to a "good" rating because planned land-uses at least limit the amount of population growth at the urban fringe through low-density designations. Unfortunately, the western core of the community is downgraded from "high" to "moderate" efficiency because its planned land-uses do not take maximum advantage of their locational values, such as creating high-density areas close to transit and shopping. But steps are being taken to correct this problem, such as the case with the "Broadway Business Homes" development project that aims to create and enhance mix use and take advantage of higher densities.

This PLACE³S evaluation points up the opportunity to reduce emissions with land-use designations and transportation improvements that match the capacity of Chula Vista's built environment. Figure 4.3 is a simplified illustration of the contrast in built form on either side of Interstate 805, with the west side favored by an integrated grid of streets and small lots patterns compared to the east side where street connectivity falls of rapidly, making the auto the dominant mode of travel. The major opportunity ahead for Chula Vista is how CO_2 friendly the SR125 corridor will be once it is developed.

Figure 4.2

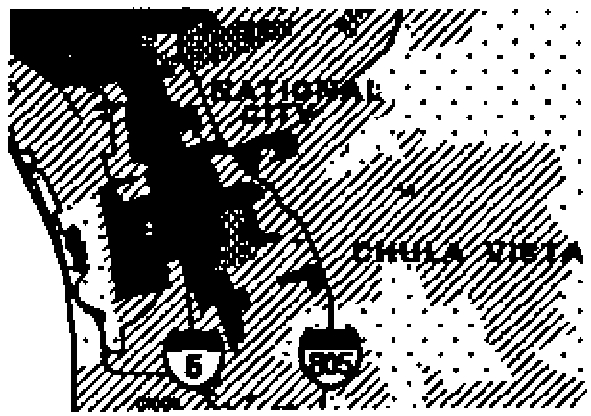
PROJECTED LAND-USE EFFICIENCIES IN 2010

(SANDAG RGMS Existing Policies)

Potential Efficiencies with
<u>Maximized Land-Use</u>

<u>Subarea Potential*</u>

- High (Near Rail Center)
- High (Near Bus Center)
- Moderate
- Low

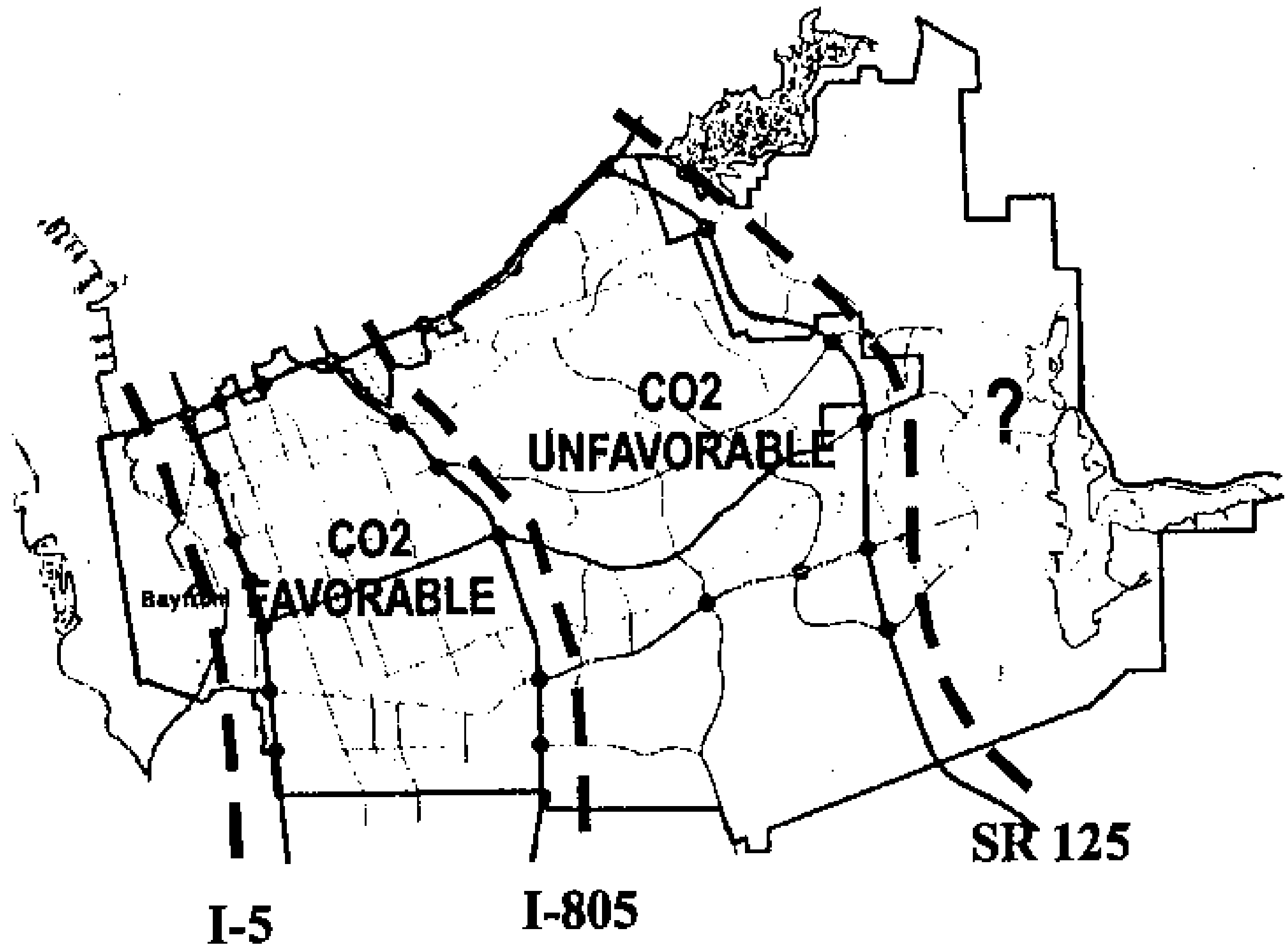


Net Efficiencies with
<u>Planned Land-Uses</u>

<u>Energy Efficiency*</u>

- Very Good
- Good
- Fair
- Poor

Figure 4.3
CO_2 FRIENDLINESS OF THE BUILT ENVIRONMENT



Source: SANDAG, 1994.

The Task Force reviewed a variety of measures recommended by SANDAG, the California Air Resources Board, and others. Planning Department staff participated in this review, and commented on measure suitability, including, in some cases, partial implementation of some techniques already developed. Those land-use measures preferred by the Task Force include the following:

- Use mix
  - Increasing mix of residential and complementary nonresidential uses. For example, neighborhood grocery stores close to homes.
  - Increasing mix of residential types, e.g., detached and attached single-family dwellings in the same neighborhood.
  - Decentralized services at dispersed locations. Activity and shopping areas readily accessible from neighborhoods throughout the City.

- Housing density
  - Increasing housing density near transit (transit overlay zone).
  - Encourage infill housing that takes advantage of vacant, already-serviced land in developed areas.

- Site design and orientation
  - Traditional neighborhood development (TND) emphasizing pedestrian/transit connections.
  - Locate schools/parks for efficient access.
  - Pedestrian/bike orientation. Provide direct, short, convenient linkages for pedestrian and bicyclists.
  - Transit orientation. Provide direct, short, convenient linkages to transit.
  - Solar orientation for passive and/or active use for commercial.
  - Vegetative cooling via shading to reduce building space cooling requirements.
  - Light-colored exterior surfacing that reflects heat to reduce building space cooling demands.
  - Carbon-absorbing landscaping planted strategically for that purpose (rather than purely for shading).

- Mobility
  - Pedestrian oriented street design, including direct, short, convenient linkages.
  - Integrated street networks (multi-modal streets with high connectivity).
  - Revise minimum/appropriate parking requirements, including shared parking and disincentives for single-occupant autos.

As noted earlier, some of these measures have already been adopted to some extent by the City in its planning for new growth in the Sweetwater area and Eastern Territories. Several features have been incorporated into plans for Otay Ranch; a detailed review of CO_2 reduction measure applicability for Otay Ranch is given in Appendix C. Extension of these techniques throughout the City will maximize CO_2 benefits.

Clean Transportation Fuels

Clean transportation fuels is the category of CO_2 reduction measures that substitutes "clean" vehicle fuels for traditional petroleum products through vehicle engine conversion or new vehicle purchases. The City, the Chula Vista Elementary School District, and Southwestern College all currently have natural gas vehicles (NGV) in operation. As of September 1995, the City and Southwestern College both have NGVs in service, while the School District operates seven compressed natural gas (CNG) school buses. The U.S. Postal Service in Chula Vista has 112 CNG vehicles in service, and Metropolitan Transit Development Board will operate 51 CNG buses to serve Chula Vista and the South Bay corridor. A CNG fueling station, which is open to the public, was installed at the Chula Vista Elementary School District in 1993. The U.S. Postal Service has its own CNG fueling station which was installed in 1994. MTDB also has its own station which was completed in 1995. Likewise, the City will employ three hydrogen fuel cell powered zero emission buses in its transit system in 1997-98.

The California Air Resources Board (ARB) adopted low-emission vehicle regulations in September 1990.These regulations established four new categories of emission standards for passenger cars and light-duty trucks: Transitional Low-Emission Vehicle (TLEV), Low-Emission Vehicle (LEV), Ultra-Low-Emission Vehicle (ULEV) and Zero-Emission Vehicle (ZEV). The regulations established a progressively more stringent fleet average emission requirement for non-methane organic gases, which manufacturers can meet by producing any combination of TLEVs, LEVs, ULEVs and ZEVs. In addition to meeting the fleet average emission requirement, the seven largest manufacturers are required to produce and offer for sale in California ZEVs in amounts equal to two percent of their total vehicle sales beginning with the 1998 model year, rising to five percent in the 2001 model year and ten percent in the 2003 model year.

The ARB staff conducted a series of public forums during 1995 to discuss all aspects of the ZEV program, including hybrid-electric vehicles, consumer marketability, infrastructure, fleet issues, technology, benefits and costs. The ARB staff also established a Battery Technology Advisory Panel to evaluate the status of batteries for the 1998 implementation of ZEVs. Based on information gathered through the public forums and the Battery Panel, the ARB is now proposing to amend the regulations to eliminate the percentage ZEV requirements for model years 1998 through 2002. The ten percent requirement for the 2003 model year would remain unchanged. This modification would allow auto manufacturers more time to develop and demonstrate ZEVs powered by advanced batteries and flexibility to determine the best time to introduce this new technology to the market. To encourage the early production of advanced ZEVs, the ARB is also proposing to add a provision to allow multiple credits for longer-range ZEVs produced prior to the 2003 model year. These ZEV credits could be applied to a manufacturer's 2003 and subsequent model year requirements. To ensure that no emission reductions are lost by suspending the ZEV requirements, the ARB is recommending that it enter into agreements with each of the seven auto manufacturers that are subject to the 1998 through 2002 model year percentage ZEV requirements. These agreements would formalize commitments by the auto manufacturers to achieve the air quality benefits of the percentage ZEV requirements, to continue investing in advanced batteries, to produce ZEVs powered by advanced batteries for demonstration purposes, and to ramp up to large-volume ZEV production in the 2003 model year.

The Federal Energy Policy Act (EPACT) of 1992 requires conversion of fleet vehicles to clean fuels according to the schedule given in Table 4.2. EPACT required federal fleets to begin purchasing alternate fuel vehicles in 1993. The Act requires state fleets and alternative fuels providers to begin purchasing alternative fuel vehicles in model year 1996. And the law may require private and municipal fleets to acquire alternative fuel vehicles starting as early as model year 1999. Under EPACT, the Secretary of Energy has two opportunities to mandate private and municipal fleet action as shown in Table 4.2. If a rule making is issued by December 15, 1996, then "early rule making" will apply; and if rule making is not issued until January 1, 2000, then "future rule making" will apply. If no rule making is issued by the later date, there will be no private or municipal fleet mandates.

Table 4.2

EPACT CLEAN FUEL TIMETABLE FOR PRIVATE AND MUNICIPAL FLEETS

Model Year	*Early Rule Making Scenario*	*Future Rule Making Scenario*
1999	*20%*	- - -
2000	*20%*	- - -
2001	*20%*	- - -
2002	*30%*	*20%*
2003	*40%*	*40%*
2004	*50%*	*60%*
2005	*60%*	*70%*
2006 on	*70%*	*70%*

Source: Federal Energy Policy Act

In considering clean fuels, Chula Vista has three choices in the near term based on the current commercialization of alternative fuels and their supporting technologies:

- Electricity
- Compressed natural gas (CNG)
- Methanol

There are other emerging fuel options, such as hydrogen, clean diesel, and biodiesel. The timing of their commercial status is uncertain at this point. The City should actively monitor emerging alternatives, such as hydrogen and clean diesel, while it focuses on commercialized alternatives in the near term. Implementation options for clean fuels include the purchase of new vehicles equipped to use them; the conversion of existing vehicles to use them; and the provision of new or modified fueling (or charging) infrastructure to support widespread clean fuel use. In the near-term, the most cost effective and emission-reducing opportunities exist in vehicle fleets operated by public and private organizations, where large numbers of vehicles are fueled and maintained by single owners at centralized locations.

Currently, the general public refueling network for clean fuels is also very limited. Key barriers that need to be eliminated, in part through local planning, have been identified by the CEC in its 1994 Calfuels plan as follows:

- All clean fuels
  - Lack of training for vehicle technicians and emergency personnel.
  - Need for increased public awareness of clean fuels and their benefits.

- Electric vehicles
  - Lack of standard charging equipment and connectors.
  - Need for code revisions and information dissemination.

- Natural gas vehicles
  - Limited fueling network.
  - Need for code revisions and information dissemination.

Preferred implementation measures within clean fuel market segments include the following:

- Fleet operator conversion/purchase commitments and phase-in schedules. For example, the City can exercise leadership by developing a municipal fleet that is 100% clean fueled or high conventionel fuel efficient by 2010.

- Comprehensive municipal departmental review and removal of any code barriers to clean fuels commercialization. In particular, safety requirements should not create unnecessary obstacles to clean fuel commercialization while still maintaining adequate safety standards.

- Provide technical assistance and/or referral services for persons interested in conversion/purchase. Conversion assistance should include information on the importance of CARB-certified retrofit kits.

- Expansion of adult and/or college job training aimed at maintenance of clean fuel vehicles and fueling infrastructure.

- Preferential treatment of clean fueled vehicles, such as special parking privileges.

- Use of high visibility special applications, such as meter reading, to demonstrate clean fuel vehicles to the community at large.

- Recruitment of designers and parts manufacturers supplying components to the clean fuel industry, consistent with the Border Environmental Commerce Alliance and Boarder Environmental Technology Resource Center respectively.

- Awards program to recognize exemplary clean fuel efforts in the community.

Residential, Commercial, and Industrial Sectors

This category of CO_2 reduction measures consists of energy efficiency measures for building space conditioning, lighting, and process improvements. Measures have been organized as follows:

- Residential/commercial new construction
  - Space heating
  - Space cooling
  - Domestic hot water
  - Appliances
  - Pools and spas
  - Lighting
  - Office equipment

- Residential/commercial retrofit and remodeling
  - Space heating
  - Space cooling
  - Domestic hot water
  - Appliances
  - Pools and spas
  - Lighting
  - Office equipment

- Industrial retrofit and new construction
  - Space conditioning
  - Lighting
  - Ventilation
  - Motors

Since the 1970s, builders and consumers alike have demonstrated clear preferences for increased efficiency measures in these areas that are cost-effective. This is reflected in the growing market preference for efficient homes generally, and increasing consumer purchases of high-efficiency models of appliances. If builders and consumers are provided with good information on measures that are economically sound, experience has shown that the buying public will respond accordingly. In fact, there is strong evidence that builders and the public can be motivated as much by non-energy benefits as by direct energy savings. In mounting a voluntary implementation effort for building efficiency based on information and incentives the City should promote the types of non-energy benefits detailed in Appendix D in addition to energy and CO_2 savings.

The major thrust of a voluntary effort is increasing awareness of building efficiency benefits, including public cost savings, housing affordability improvements, business productivity increases, and reduced resource consumption generally. These messages can be conveyed to the community using a variety of methods, including the following examples:

- Information dissemination

  This can occur at the permit counter, vendor and material outlets, and professional meetings. Information can be distributed in printed and video form; with interactive learning software; and through a speakers bureau involving local professional organizations such as the American Institute of Architects and the American Society of Heating, Refrigeration, and Air Conditioning Engineers. Table 4.3 presents a checklist of building design and construction practices that an information program can be built around. Appendix D contains information on non-energy benefits that should also be stressed.

- Design assistance

  Homeowners and designers should be able to obtain limited technical help, or access to self-help information, from sources such as the City's Web Page or other on-line services.

- Design competitions and awards

  Exemplary efforts should be encouraged through annual efficiency competitions and well-publicized awards.

- Home efficiency rating system

  One of the best voluntary approaches used in many parts of the country are home energy efficiency ratings that occur when a residence is built or sold. Austin, Texas has a successful "Greenstar" program, and California has a very successful non-profit statewide program called CHEERS (California Home Energy Efficiency Rating System). The City plans to establish a GreenStar Building program. Information is to be provided in the Department of Building and Housing.

SAMPLE CHECKLIST:

Table 4.3

ENERGY-EFFICIENT BUILDING DESIGN AND CONSTRUCTION CHECKLIST

DESIGN	
Smaller is better.	*Optimize use of interior space through careful design so that the overall building size--and resource use in constructing and operating it--are kept to a minimum.*
Design an energy-efficient building.	*Use high levels of insulation, high-performance windows, and tight construction. Choose glazings with low solar heat gain.*
Design buildings to use renewable energy.	*Passive solar heating, daylighting, and natural cooling can be incorporated cost-effectively into most buildings. Also consider solar water heating and photovoltaics--or design buildings for future panel installation.*
Optimize material use.	*Minimize waste by designing for standard sizes. Avoid waste from structural over-design (use optimum-value engineering/advanced framing).*
Design water-efficient, low-maintenance landscaping.	*Conventional lawns have a high impact because of water use, pesticide use, and pollution generated from mowing. Landscape with drought-resistant native plants and perennial groundcovers.*
Make it easy for occupants to recycle waste.	*Make provisions for storage and processing of recyclables: recycling bins near the kitchen, undersink door-mounted bucket with lid for compostable food waste, etc.*
Design for future reuse.	*Make the structure adaptable to other uses, and choose materials and components that can be reused or recycled.*
Avoid potential health hazards: radon, EMF, pesticides.	*Follow recommended practices to minimize radon entry into the building and provide for future mitigation if necessary. Plan electrical wiring and placement of electrical equipment to minimize electromagnetic field exposure. Design insect-resistant detailing that will require minimal use of pesticides.*
SITING	
Renovate older buildings.	*Conscientiously renovating existing buildings is the most sustainable construction.*
Evaluate site resources.	*Early in the siting process carry out a careful site evaluation: solar access, soils, vegetation, important natural areas, etc.*
Locate buildings to minimize environmental impact.	*Cluster buildings or build attached units to preserve open space and wildlife habitats, avoid especially sensitive areas including wetlands, and keep roads and service lines short. Leave the most pristine areas untouched, and look for areas that have been previously damaged to build on.*
Pay attention to solar orientation.	*Reduce energy use by orienting buildings to make optimal use of passive solar heating, daylighting, and natural cooling.*
Situate buildings to benefit from vegetation.	*Trees on the east and west sides of a building can dramatically reduce cooling loads. Hedge rows and shrubbery can block cold winter winds or help channel cool summer breezes into the building.*

Table 4.3 *Continued*

MATERIALS	
Avoid ozone-depleting chemicals in mechanical equipment and insulation.	Chlorofluorocarbons (the main contributor to ozone and facilitator of global warming) have largely been phased out, but their primary replacements--Hydrofluorocarbons-- also damage the ozone layer and should be avoided where possible. Reclaim Chlorofluorocarbons when servicing or disposing of equipment and, if possible, take Chlorofluorocarbon-based foam insulation to a recycler who can capture Chlorofluorocarbons.
Use durable products and materials.	Because manufacturing is very energy-intensive, a product that lasts longer or requires less maintenance usually saves energy. Durable products also contribute less to solid waste problems.
Choose building materials with low embodied energy.	One estimate of the relative energy intensity of various materials (by weight) is as follows: Lumber = 1, Brick = 2, Cement = 2, Glass = 3, Fiberglass = 7, Steel = 8, Plastic = 30, Aluminum = 80
Buy locally produced building materials.	Transportation is costly in both energy use and pollution generation. Look for locally produced materials to replace products imported to your area.
Use building products made from recycled materials.	Building products made from recycled materials reduce solid waste problems, cut energy consumption in manufacturing, and save on natural resource use.
Use salvaged building materials when possible.	Reduce landfill pressure and save natural resources by using salvaged materials: lumber, millwork, certain plumbing fixtures, and hardware, for example.
Avoid materials that will offgas pollutants.	Solvent-based finished, adhesives, carpeting, particle board, and many other building products release formaldehyde and volatile organic compounds (VOCs) into the air. These chemicals can affect workers' and occupants' health as well as contribute to smog and ground-level ozone pollution outside.
Minimize use of pressure-treated lumber.	Use detailing that will prevent soil contact and rot. Where possible, use alternatives such as recycled plastic lumber. Take measure to protect workers when cutting and handling pressure-treated wood, and never burn scraps.
EQUIPMENT	
Install high-efficiency heating and cooling equipment.	Well-designed high-efficiency furnaces, boilers, and air conditioners (and distribution systems) not only save money, but also produce less pollution during operation. Install equipment with minimal risk of combustion gas spillage, such as sealed-combustion appliances.
Install high-efficiency lights and appliances.	Fluorescent lighting has improved dramatically in recent years and is now suitable for homes. High-efficiency appliances offer both economic and environmental advantages over their conventional counterparts.
Install water-efficient equipment.	Water-conserving toilets, showerheads, and faucet aerators not only reduce water use, they also reduce demand on sewage treatment plants. Reducing hot water use also saves energy.
Install mechanical ventilation equipment.	Mechanical ventilation is usually required to ensure safe, healthy indoor air. Heat recovery ventilators are preferred in cold climates because of energy savings, but simpler, less expensive exhaust-only ventilation systems are also adequate.

Adapted from RMI, 1995.

- Demonstration projects

  Construction and monitoring of experimental or pilot projects that demonstrate innovative concepts is often a useful method of showcasing efficiency.

- Municipal design review criteria

  Adding stronger energy efficiency items to Chula Vista's existing design review criteria would help institutionalize efficiency and lead to more energy-conscious projects generally.

- Expedited permit reviews and bonuses

  The City could offer expedited permit reviews or other zoning bonuses to builders who voluntarily exceed minimum code energy standards.

The Task Force and City staff have indicated interest in combining these voluntary measures into a Chula Vista "Greenstar" program that stresses information dissemination and recognition of outstanding efforts.

In addition to voluntary implementation, the strategy should include ongoing review of building code standards to ensure that they reflect improving technologies and efficiencies. This part of the strategy requires the assistance of local building officials, designers, and builders who are best equipped to study code changes in detail and recommend appropriate amendments. Code amendments can be proposed not only at the local level, but also importantly for CO_2 reduction, at the state and national code levels as well.

Municipal

This category of CO_2 reduction measures concerns City government keeping its own emissions to a minimum. This includes everything from operating municipal vehicles to space conditioning municipal offices. The municipal category is organized as follows:

- Municipal management
  - Comprehensive energy accounting

- Municipal transportation
  - Employee commuting
  - Clean fuel conversion/purchase
  - High efficiency conventional fuel vehicle purchase
  - Maintenance and driving improvements.

- Municipal buildings
  - Space conditioning
  - Lighting
  - Office equipment

- Municipal infrastructure
  - Street lights
  - Traffic signals
  - Large pumps and motors

Municipal measures have been reviewed under the broader general categories of transportation and building efficiency, except for energy accounting. An energy accounting system allows a city to track energy use room-by-room, building-by-building. This provides insight for decision makers on where conservation will be more or less effective. This is perhaps the most noteworthy municipal measure because the lack of an energy accounting system severely handicaps any municipal energy improvement effort. Based on interviews with City staff and review of municipal records, it does not appear that Chula Vista is readily able to track energy use comprehensively; nor to identify usage anomalies and take focused corrective action. An energy accounting system will perform these duties, which are essential for achieving reliable and consistent energy and CO_2 reductions. One of the most popular systems of this type is ENACT, which is available from the Washington State Energy Office. Use of a system like this can produce the following benefits:

- Identifying where energy is being wasted or used inefficiently.

- Showing where energy costs have been reduced in order to confirm conservation effectiveness.

- Providing better information for budgeting and capital improvement programming.
- Providing a rational basis for evaluating competing energy efficiency options.
- Identifying billing and rate schedule errors.
- Promoting energy cost savings so funds can be redirected to other municipal needs.

Electricity and Natural Gas Supply Systems

In contrast to all of the foregoing categories of CO_2 action that can be directly controlled by City government, this category is concerned with municipal advocacy of CO_2 reduction by organizations supplying electricity and natural gas to the community.

The issues under these organizations' control that affect CO_2 emissions include:

- Efficiency improvements in existing electric and natural gas supply systems (SDG&E, other investor-owned utilities, independent producers, state, federal).
- Use of low carbon intensity fuels in new electric generation (SDG&E, other investor-owned utilities, independent producers, state, federal).

Opportunities for Chula Vista to advocate CO_2 reductions occur regularly in the electric and natural gas supply policy areas. A prominent example at present is the California Public Utilities Commission's intent to deregulate electricity services. In this case, municipalities could have an opportunity to promote consideration of environmental issues such as CO_2 reduction when electric utilities are competing in a deregulated market. The League of California Cities supports electricity deregulation if it results in permanently lower rates and complies with the following criteria:

- Equitable benefits: any restructuring program should result in all ratepayers directly sharing benefits equitably.