

Climate of Change

A set of policies and actions taken by local governments and the State of California to reduce greenhouse gas emissions



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Glossary

AB	Assembly Bill
AFV	Alternative fuel vehicle
ARB	Air Resources Board
BART	Bay Area Rapid Transit
BAS	Building auto-system
BTH	Business, Transportation and Housing Agency
CACP	Clean Air Climate Protection software
CEC	California Energy Commission
CPUC	California Public Utility Commission
CDD	Cooling degree day
DGS	Department of General Services
DOC	Diesel oxidation catalyst
DPF	Diesel particulate filter
DWR	Department of Water Resources
GHG	Greenhouse gases
GWP	Global warming potential
HDD	Heating degree day
HVAC	Heating, ventilation and air conditioning
IOU	Investor owned utility
IWMB	Integrated Waste Management Board
LCFS	Low carbon fuel standard
LED	Light-emitting diode
LEED	Leadership in Energy and Environmental Design
MVACS	Motor vehicle air conditioning system
PCB	Polychlorinated biphenyl
PM	Particulate matter
SWP	State Water Project
ULEV	Ultra-low emission vehicle
ULSD	Ultra-low sulfur diesel
VERP	Vehicle emissions reduction program
VIP	Vehicle Incentive Program
VMT	Vehicle miles traveled
ZEV	Zero emission vehicle

“A little knowledge that acts is worth infinitely more than much knowledge that is idle.” Khalil Gibran.

Introduction

The last decade has witnessed a growing number of U.S. cities taking action to combat the urgent threat of climate disruption. Whether through the Mayors Climate Protection Agreement (MCPA), the ICLEI-Local Governments for Sustainability Cities for Climate Protection (CCP) campaign, or other organized forms of climate action plans, municipalities are leading the way in climate change mitigation through actions and policies focused on energy efficiency, transportation options, land use, and several other categories of Greenhouse Gas (GHG) emissions reduction.

In addition to their positive environmental effects, the actions and policies adopted by the cities investigated in this research serve as a helpful reference to the City of Laguna Beach as it creates its own blueprint for climate protection. Because an inventory of the policies adopted by these cities is a substantial, and thus overwhelming, set of references, a subset of cities geographically and demographically similar to Laguna Beach was prepared, as well as an explanation of the importance of these variables in GHG reduction. This subset will result in a set of policies and programs that are compatible with Laguna’s geographic and demographic characteristics.

Also, this report contains a set of actions implemented or considered by the State of California, including various programs that require partnerships and coordinated efforts with municipalities. Most of these programs provide funds and technical assistance in areas such as solar power, energy efficiency and waste management. Lastly, information is provided on how Laguna Beach can track and measure GHG emissions within its jurisdiction.

Chapter 1 Comparative Analysis of Climate Change-Conscious Cities with Laguna Beach

The U.S. Mayors Climate Protection Agreement is a nationwide protocol initiated by the mayor of Seattle, Greg Nickels, and unites cities from across the country toward the goal of reducing the effects of climate change, in part by reducing GHG emissions. In this chapter, a list of cities that took independent action to mitigate climate change is developed. From this large list, a subset of cities similar to Laguna Beach in geographic and demographic characteristics is created. These variables include climate, population size, land area, population and housing unit densities, and average household income. The importance of these variables in regulating GHG emissions is explained as each of these parameters influences energy use, transportation, renewable energies, and other GHG emissions sectors differently. The result is a list of cities whose policies and actions on climate change may serve as a set of references in Laguna Beach's climate protection decision making.

I. List of cities that took independent action to reduce GHG emissions

Over 530 mayors have signed to the Mayors Climate Protection Agreement, an accord by which cities strive to reduce their GHG emissions to 7% (or more) below 1990 levels (Gerlash, 2007). The City of Seattle's website provides case studies on cities that have already initiated pioneering actions to reduce their GHG emissions. These cities are listed below, in addition to members of the Cities for Climate Protection Campaign (CCP), a campaign that includes cities that have publicly recognized global climate change as a legitimate local concern and have committed themselves to develop and implement policies and programs to reduce emissions (ICLEI, 2007).

Also listed below are cities and counties whose innovative work on energy conservation and efficiency was published in the U.S. Mayors Energy & Environment Best Practices Guide of 2007 (U.S. Conference of Mayors, 2007).

Connecticut	Massachusetts	New York	California
<ul style="list-style-type: none"> •Bridgeport •Fairfield •Hamden •Hartford •New Britain •New Haven •Plainville •Stamford •Weston •Windham •Windsor 	<ul style="list-style-type: none"> •Amherst •Arlington •Barnstable •Belmont •Boston •Brookline •Cambridge •Falmouth •Gloucester •Hull •Lenox •Lynn •Medford •Natick •Newburyport •Newton •Northampton •Pittsfield •Reading •Salem •Shutesbury •Somerville •Springfield •Watertown •Williamstown •Worcester 	<ul style="list-style-type: none"> •Babylon •Buffalo •Cooperstown •Greenburg •Huntington •Ithaca •Jamestown •Mount Vernon •New Rochelle •New York •Saratoga Springs •Oneonta •Syracuse 	<ul style="list-style-type: none"> •Arcata •Berkeley •Chula Vista •Cloverdale •Cotati •Davis •Dublin •Fairfax •Hayward •Healdsburg •Irvine •Los Angeles •Long Beach •Novato •Oakland •Petaluma •Rohnert Park •Sacramento •San Anselmo •San Diego •San Francisco •San Jose •Santa Barbara •Santa Cruz •Santa Monica •Santa Rosa •Sausalito •Sebastopol •Sonoma •Vista •West Hollywood

			•Windsor
Washington •Bellingham •Burien •Olympia •Seattle •Spokane •Spokane County •Tacoma	Texas •Austin •San Antonio •Eules •Bedford •Houston •Arlington •Sugar Land •San Marcos	Colorado •Aspen •Boulder •Fort Collins •Carbondale •Denver •Colorado Springs	Florida •Alachua County •Broward County •Gainesville •Hillsborough County •Lakeland •Miami Beach •Miami-Dade County •Orange County •Riviera Beach •Tampa
Maine •Augusta •Farmington •Portland	Vermont •Brattleboro •Burlington •Middlebury •Montpelier	New Jersey •Belmar •Hamilton •Maplewood •Newark	Oregon •Ashland •Corvallis •Portland •Eugene
South Carolina •Charleston •Georgetown	Pennsylvania •Philadelphia •Pittsburgh •West Chester	North Carolina •Asheville •Carrboro •Chapel Hill •Durham •Orange County •Charlotte	Maryland •College Park •Montgomery County •Mount Rainier •Prince George's County •Takoma Park
Illinois •Chicago •Village Of Palatine •Pekin	Michigan •Ann Arbor •Delta County •Washtenaw •Dearborn	Minnesota •Duluth •Hennepin county •Minneapolis •Ramsey County •Saint Paul	Wisconsin •Dane County •Madison •Milwaukee •New Berlin
Virginia •Alexandria •Arlington County	New Hampshire •Keene •Nashua	Rhode Island •Pawtucket •Providence	Georgia •Atlanta •Decatur
Arkansas •Little Rock	Indiana •Elkhart	Louisiana •New Orleans	Kentucky •Louisville-Jefferson County Metro Government
Tennessee •Memphis	Kansas •Overland Park County	Ohio •Dayton •Toledo	Arizona •Mesa •Tucson •Yuma
New Mexico •Albuquerque •Santa Fe	Montana •Missoula	Utah •Salt Lake City	Hawaii •Honolulu

Due to the great number of these cities, a subset of cities similar to Laguna Beach in policy-relevant climate and demographic variables was developed to construct a more compatible and compact set of useful references. The list of variables used in this selection is first explained, as well the importance of each of these parameters in reducing GHG emissions.

II. The role of demographic and geographic variables in determining GHG emission levels, and reduction policies and actions

Recently, the Climate Protection Action Workgroup (working under the aegis of the Laguna Beach Environmental Committee) developed a list of six potential areas to regulate and reduce GHG emissions: residential buildings, commercial buildings, municipal buildings and operations, transportation, land use and management and public outreach. To develop a subset of cities similar to Laguna Beach, various geographic and demographic variables including climate, population, area size, population density, housing unit density, and household income, were selected in order of importance as each relate differently to the GHG reduction categories stated above.

1. Climate

In selecting cities with climate similar to Laguna Beach, different climate characteristics were used, including the heating degree day (HDD) and cooling degree day (CDD) indices, the number of sunny days per year, total annual precipitation, and type of climate. These characteristics have a significant impact on GHG emissions, and therefore appropriate policy, through effects on energy consumption- mostly interior heating, air conditioning, and lighting – as well as the viability of alternative energy resources such as solar power, and transportation fuels.

- Effect of climate on indoor energy consumption:** A survey of residential energy use by sector conducted in 2001 showed that indoor energy consumption varies largely by climatic zones, geographic areas divided mainly by CDD and HDD values (Energy Information Administration, 2001). CDD and HDD are quantitative indices defined as the total sum of differences in a year between each day's mean daily temperature and the "balance point" temperature of 65°F. These indices reflect the need for space heating, air-conditioning, water heating and other use of weather-sensitive appliances. As shown in Table 1.1 below, the average total energy consumption in space heating decreases from 63.2 million BTU per household in colder climate zones that are more than 7,000 HDD and fewer than 2,000 CDD, to 18.9 million BTU per household in warmer climate zones of fewer than 4,000 HDD and more than 2,000 CDD. Energy use from air-conditioning and water heating also varies significantly by climate zones, while lighting depends on average number of sunny days per year and total annual precipitation. Consequently, climate characteristics largely impact the potential for energy conservation in terms of affordable and simple changes such as insulation and switching to fluorescent light bulbs.

		Climate Zone ¹				
		Fewer than 2,000 CDD and --				2,000 CDD or More and Fewer than 4,000 HDD
Total		More than 7,000 HDD	5,500 to 7,000 HDD	4,000 to 5,499 HDD	Fewer than 4,000 HDD	

Total Btu Consumption per Household, Where the End Use Is:	Million Btu per Household ^{3,a}					
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
Space Heating	43.9	63.2	66.2	48.6	27.5	18.9
Electric Air-Conditioning	7.7	3.6	4.1	5.7	7.9	13.8
Water Heating	15.8	15.7	17.9	16.0	15.1	13.6
Refrigerators	5.0	4.6	4.6	4.6	4.7	6.2
Other Appliances and Lighting	22.5	21.7	22.8	21.9	22.1	23.2

Table 1.1 Energy consumption by end use sectors and climate zones.

(http://www.eia.doe.gov/emeu/recs/recs2001/detail_tables.html)

- Effect of climate on renewable energy use:** The number of sunny days per year and total annual precipitation also play a significant role in determining the feasibility and performance of solar energy, and the use of daylight in energy efficient buildings. While the actual amount of sunlight required depends on each specific solar application, the number of sunny days available in a year can be a major factor for practical application of photovoltaic and solar-thermal systems (Marion and Wilcox, 1995). A map of average solar radiation during the month of January shows the highest concentration of solar radiation in the nation's most arid climate zones, mainly regions of the Southwest.

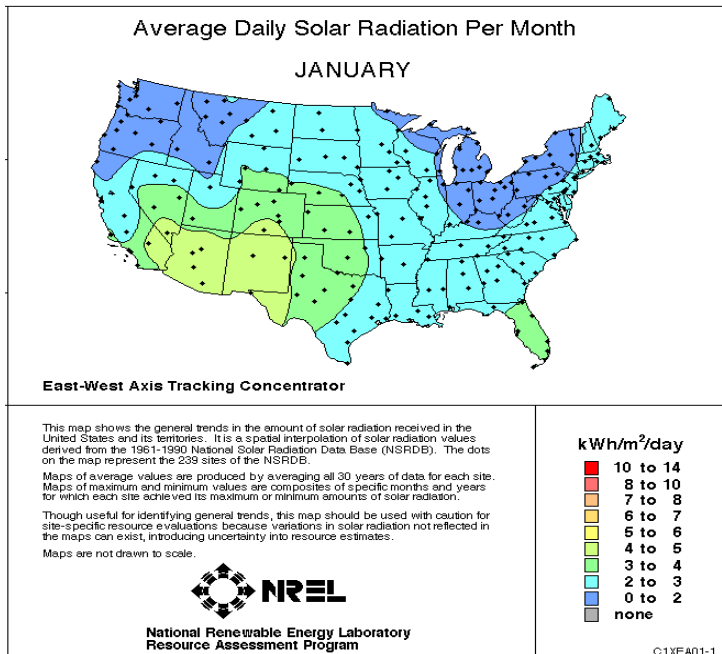


Figure 1.2 U.S. map of average daily solar radiation per month

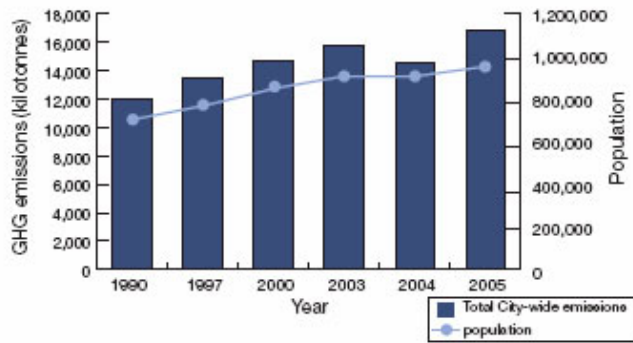
(http://rredc.nrel.gov/solar/old_data/nsrdb/redbook/atlas/serve.cgi).

- **Effects of climate on other GHG emission sources:** Climate also has an important effect on energy used in city operations, transportation and land use. In fact, total annual precipitation reflects a city's need for water resources, including the energy used to pump water. Consequently, actions and policies concerning water recycling and conservation programs may significantly influence the ability to conserve energy. Also, local microclimates are influenced by greener land use, such as tree planting, and play a substantial role in reducing the need for air-conditioning, and encourage cleaner modes of transportation such as biking, walking and mass transit (Pataki et al, 2006). Mild climates have a direct effect on transportation as larger numbers of sunny days and lower total annual precipitation provide for more incentive to use mass transit, biking, walking, and other cleaner transportation options.

Due to the considerable effects that climate has on energy consumption, renewable energy feasibility, and other factors of GHG emission categories, this variable will largely drive the ability to reduce GHG emissions, and is considered a major characteristic in selecting cities that are similar to Laguna Beach in this study.

2. Population

Total indoor energy consumption, transportation, municipal operations, land use, and other factors that drive GHG emissions depend strongly on the population size of the cities. Thus, there is great potential to utilize this variable in developing GHG reduction actions and policies. Figure 1.2 shows an example of the effect of population change on the amount of GHG emissions.



Sources: Electricity - ENMAX Energy Corporation, Energy Utilities Board; Natural Gas - ATCO GAS; Vehicle Fuel - Alberta Transportation; Propane - Propane Association of Canada (data not available after 2002); Waste - City of Calgary Waste & Recycling Services; Population of Calgary - City of Calgary Civic Census Information.

Note: 1 kilotonne = 1,000 tonnes.

Figure 1.3. GHG emissions and changes in population in Calgary, Alberta

(http://www.calgary.ca/docgallery/bu/environmental_management/2003_community_emissions_report.pdf)

- **Effects of population on total indoor energy consumption:** Population largely defines the size of a city, and consequently its non-industrial indoor energy demand. Larger population cities require greater numbers of residential housing units, and municipal and commercial buildings, which entail a greater use of energy in indoor activity, such as air-conditioning, space heating, water heating, lighting, and electronic appliances. Thus, population size would determine the importance of focusing on energy conservation programs such as energy efficient appliances and the retrofit of municipal, commercial and residential buildings.

- **Effects of population on transportation and land use:** The population size of a city also largely determines the types and total amount of transportation used, and consequently has a significant impact on the amount of GHG emissions. In fact, CO₂ emission projections from transportation are very sensitive to population size and dynamics (Pataki et al, 2006). Thus an advantage to utilizing population as a variable is the ability to incorporate land-use-transportation

models in influencing decision-making in transportation systems, land use management and future CO₂ emission scenarios.

- **Effects on city operations and public outreach:** Population as an aspect of urban form may influence the magnitude of GHG emissions and their rate of change through affecting the amount of municipal and commercial operations the city has to provide to accommodate the needs of its residents, including trash hauling, waste management, street lighting and other kinds of GHG-generating operations. Also, population size may be a factor in determining the size and number of various public outreach programs and their outcome.

3. Area

The area of a city is another geographic variable used in the subset selection because it relates strongly to urban planning, transportation options, and city operations (Marshall et al., 2005). The effects of area on climate change mitigation programs and policies are explained through population and housing unit densities as these two variables are defined by area.

4. Population and housing unit densities

Population and housing unit densities are key aspects of urban form and are directly influenced by urban planning. Both densities have a large impact on city operations, transportation, and residential energy use, as they relate highly to kilometers traveled per person, and energy use per capita. Housing unit density defines the overall spatial patterns of housing and development, and is a very important variable in determining and preventing urban sprawl which has been linked qualitatively to increasing fossil fuel emissions per capita (Marshall et al., 2005). Also, while cities with high population densities tend to rely on larger and more extensive mass transit systems, less dense cities tend to rely more on passenger-vehicle

transportation, and thus higher distance per person. Figure 1.4 below shows that vehicle-kilometers traveled per person decrease as population density increases.

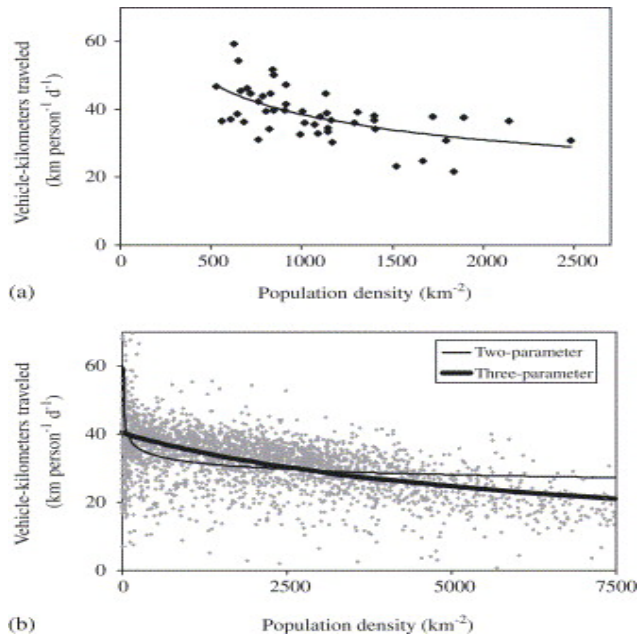


Figure 1.4. Population density and vehicle-kilometers traveled (Marshall et al, 2005).

5. Household income

Average household income is another demographic variable in selecting similar cities as it affects residential energy consumption. Data in Table 1.2 below show that residential energy consumption increases with increasing income (Energy Information Administration, 2001). Household income also largely drives the ability to invest in residential use of renewable energy and energy efficiency programs, such as residential building retrofits and energy-efficient appliances.

Household Demographics	Total End-Use Energy					
	Households (millions)	Total		Per Household		
		Consumption (quadrillion Btu)	Expenditures (billion dollars)	Consumption (million Btu)	Expenditures (dollars)	Square Feet
RSE Column Factor:	1.3	1.5	1.4	0.8	0.7	0.9

2001 Household Income

Category	Households (millions)	Consumption (quadrillion Btu)	Expenditures (billion dollars)	Consumption (million Btu)	Expenditures (dollars)	Square Feet
Less than \$9,999	11.0	0.72	11.47	65.2	1,039	1,168
\$10,000 to \$14,999	7.7	0.53	8.62	69.7	1,124	1,328
\$15,000 to \$19,999	8.9	0.72	11.49	80.5	1,290	1,494
\$20,000 to \$29,999	14.0	1.17	18.38	83.4	1,315	1,555
\$30,000 to \$39,999	13.9	1.21	19.43	86.9	1,398	1,725
\$40,000 to \$49,999	13.2	1.22	20.03	92.8	1,518	2,068
\$50,000 to \$74,999	21.7	2.22	36.47	102.5	1,683	2,360
\$75,000 to \$99,999	8.1	0.91	14.75	112.5	1,825	2,690
\$100,000 or More	8.6	1.17	19.09	136.1	2,231	3,395

Table 1.2. Total residential energy consumption by house hold income (http://www.eia.doe.gov/emeu/recs/recs2001/detail_tables.html)

III. Subset of cities resembling Laguna in their geographic and demographic variables

1. Demographic and geographic profile of Laguna Beach

- **Climate:** Laguna Beach enjoys Southern California's mild coastal Mediterranean climate, a climate zone with 1756 average annual HDD and 660 average annual CDD, an average total annual precipitation of 12.86 inches, and an average number of 281 sunny days per year (Whitehurst, 2004).
- **Population:** According to the U.S. Census Bureau, Laguna Beach is home to 24,653 residents as of early 2007 (U.S. Census Bureau, 2007).
- **Area size:** City area is 9.1 mi², of which 8.8 mi² is land, and 0.9mi² is water (U.S. Census Bureau, 2007).

- **Population density:** According to the U.S. Census Bureau, population density is estimated at 2781 person/mi² as of 2007 (U.S. Census Bureau, 2007).
- **Housing unit density:** According to the U.S. Census Bureau, housing unit density is an estimate of 1,465.2 HU/mi² as of 2007 (U.S. Census Bureau, 2007).
- **Average household income:** According to the U.S. Census Bureau, average household income is estimated at 86,271 \$/year (U.S. Census Bureau, 2007).

2. Subset of cities resembling Laguna Beach

In developing a subset of cities that are similar to Laguna Beach, climate and demographic characteristics described above served as selection parameters organized in a scale of importance, with climate being the most important and average household income as the least important variable. Cities that were found to be similar to Laguna Beach include but are not limited to:

Albuquerque, NM	Hayward, CA
Ashland, OR	Irvine, CA
Austin, TX	Medford, MA
Berkeley, CA	Santa Cruz, CA
Boulder, CO	Santa Monica, CA
Chapel Hill, NC	Sugar Land, TX
Dublin, CA	Vista, CA
Eules, TX	

While the federal government has been reluctant to implement any significant policies and actions to reduce the greenhouse gas effects, cities across the nation are voluntarily adopting various actions and programs to mitigate the negative effects of climate change. Many of these cities are similar to Laguna Beach in their demographic and geographic characteristics, and may be looked at as inspiration for at least some of the City's potential actions to reduce GHG emissions. Climate and demographic variables were key parameters in selecting such cities, as they each have various effects on energy use and efficiency. While cities listed in the subset above represent the best examples of GHG reduction actions and policies that are compatible with the City's characteristics, the larger list of U.S. cities developed earlier may also serve as a reference set as many of the programs adopted elsewhere may be attainable and even economically advantageous to Laguna Beach.

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Chapter 2 A Compilation of Policies and Actions Adopted by Cities Similar to Laguna Beach

After developing a subset of cities similar to Laguna Beach in geographic and demographic variables, a list of the policies, actions and proactive programs adopted by these cities was obtained. This set is further organized in the next chapter through GHG sources sectors, while costs and benefits data are added to the compilation. This chapter introduces the policies enacted by cities to combat the threat of climate change, and sorts the policies and actions by cities including sources and contact information for each city. It is highly recommended that the City of Laguna Beach visit the cited websites and contact appropriate staff members of these cities if it is interested in a particular policy or program, and wishes to receive more information on the implementation process and/or the cost and benefit data. The subset of cities from which the set of policies was extracted includes the following 15 cities:

Albuquerque, NM	Hayward, CA
Ashland, OR	Irvine, CA
Austin, TX	Medford, MA
Berkeley, CA	Santa Cruz, CA
Boulder, CO	Santa Monica, CA
Chapel Hill, NC	Sugar Land, TX
Dublin, CA	Vista, CA
Eules, TX	

1. Albuquerque, NM

The City of Albuquerque is among the leading U.S. cities in implementing strong climate protection action and policies, including:

- A partnership with the Department of Energy Million Solar Roofs Program through which solar thermal and photovoltaic systems will be installed in public buildings.
- Adoption of the Energy Efficient Green Building Performance 2030 Challenge Targets that require all new municipal projects and buildings to be carbon neutral.
- Through various energy audits, the inspection of municipal facilities resulted in the retrofit of traffic signals to LED technology, the improvement of insulation, the installation of occupancy sensors, and the replacement of old lightbulbs with energy-efficient bulbs at City Hall, City-owned parking structures, police substations, fire stations, and community centers.
- Through the Green Building Initiative, the city launched a Build Green NM guide to promote commercial and residential energy-efficient buildings and appliances.
- The development of the City Urban Forest Master Plan, an urban forestry program to regulate and manage the City's 160,000 trees, and plant 2000 trees per year, was initiated.
- Conversion of 15% of the City's electricity use to wind-power energy, supplying electricity to over one hundred commercial, residential and municipal buildings and facilities was initiated.
- Installing landfill gas (LFG) collection and control systems at closed landfills, where methane (a powerful GHG) produced by waste decomposition is collected through deep wells and used to fuel a turbine to generate electricity.

- The Air Aware-Gas Cap Exchange Project, which exchanges leaking, missing, or otherwise faulty gas caps for new ones by passenger cars, trucks, and recreational vehicles is being implemented.
- Requiring that all of Albuquerque's motor vehicle purchases and replacements be alternative fuel vehicles, including trash trucks, street sweepers, fire trucks, city buses, and other municipal operation vehicles to run on biodiesel, ethanol, compressed natural gas, or hybrid technology.
- In addition to Albuquerque's new carpool matching program and additional hybrid diesel/electric buses that will provide transportation alternatives, the city is considering the use of free bus passes to city employees for both city business and personal use, and free parking for all hybrid vehicles at parking meters.
- Raising the capital program set-aside for energy conservation and renewable energy from 1% to 3% to fund the design, installation, purchase, user training and monitoring of energy conservation and/or renewable energy that reduce fossil fuel based energy costs and energy consumption.
- The city also completed a GHG emission inventory that showed a 64% reduction in GHG emissions from 1990 to 2005 (about 10 times the Kyoto 7% reduction requirements).

Sources of Information:

The U.S. Conference of Mayors. (January 2007). *Energy and Environment Best Practices Guide*. pp 24, 28, 38, 52, 72. Retrieved June 10th 2007, from http://usmayors.org/uscm/best_practices/EandEBP07.pdf

City's Official Website Climate Page <http://www.cabq.gov/sustainability>

Contact Information:

Name: Richard Kennedy **Title:** Deputy Director **Department:** Env. Health Department

E-mail: rkennedy@cabq.gov **Phone:** 505.768.2625

2. Ashland, OR

The City of Ashland's actions and policies are focused on energy conservation and renewable energy programs including:

- Rebates and state tax credits for energy-efficient appliances that meet Energy Star or stricter standard models, including refrigerators, washing machines, electric water heaters and dishwashers.
- Free residential energy audits that offer energy efficiency program assistance, air and duct leakage tests, and insulation system analysis.
- Rebates and zero interest loans for various residential energy saving projects, such as rebates up to 80% for duct replacement and sealing, 40% for insulation installation, cash rebates up to 1000\$ for solar water heaters, 500\$ for Energy Star heat pump systems, 2.00 \$/ft² for Energy Star windows, and other weatherization measures.
- Energy audits, rebates and zero-interest loans to commercial customers for lighting retrofits and other resource-saving measures. A business that adopts various sustainability practices is recognized as a green business.
- Net metering policy, through which customers that invest in small-scale wind or solar electric systems will be compensated at full retail rates for excess electricity they produce.
- The Solar Electric Rebate Program designed to encourage residents and businesses to invest in photovoltaic generation installations by paying rebates for qualifying installations. Cash

incentives offered by the City of Ashland for grid-connected solar electric systems are \$2.25 per watt of the system up to a maximum of \$10,000 per site.

- Renewable Pioneers/Green Tag Program, through which Ashland utility customers can support clean, renewable energy by purchasing Green Tags from the Bonneville Environmental Foundation, which directs a portion of the purchase to local renewable energy projects such as installation of solar electric systems.

Sources of Information:

City's Official Website <http://www.ashland.or.us>

City's Energy Conservation Webpage: www.ashland.or.us/Page.asp?NavID=1366

City's Renewable Energy Webpage: <http://www.ashland.or.us/Page.asp?NavID=1532>

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3. Austin, TX

While the City of Austin is one of the most pollution-intensive cities in the country, it is also increasingly involved in climate protection programs, including:

- Rebates, free home energy improvements and low-interest loans on energy efficient appliances, solar water heaters, and solar systems installed in residential and commercial buildings.

- Requiring that all new municipal buildings and projects achieve the LEED Silver rating, be carbon-neutral by 2020, and rely mainly on renewable energy provided by the GreenChoice Program.
- One of the city's Climate Action Plan goals is to reach 30% total city energy reliance on renewable energy by 2020, mainly wind power and landfill methane gas.
- The Green Building Program offers resources, consulting, workshops and educational events to residential and business owners to encourage energy efficient buildings and renewable energies.
- The Bicycle and Pedestrian Program integrates bicycles and walking into the transportation system of the City of Austin by working with all city departments and other governmental agencies to create complete and accessible sidewalk networks, more bicycle lanes, wide curb lanes, and other facilities.
- The Heat Island Containment Policy offers private and municipal development incentives for reflective roofs and extensive shade tree plantings to offset the heat island effect.
- The Austin's Plug-in Partners Campaign is a national grass-roots initiative initiated and organized by the City of Austin, to demonstrate to automakers that a market for flexible-fuel plug-in hybrid electric vehicles exists today.
- Austin proposes to achieve over 30 percent of its overall emission reductions from improved vehicle efficiency and trip reductions in transportation.

Information Sources:

The U.S. Conference of Mayors. (January 2007). *Energy and Environment Best Practices Guide*. pp 24 Retrieved June 10th 2007, from http://usmayors.org/uscm/best_practices/EandEBP07.pdf

The City's Official Website Climate Page <http://www.ci.austin.tx.us/environmental/>

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4. Berkeley, CA

The City of Berkeley has a rich history in climate protection through effective actions and programs such as:

- Measure G, setting a goal of 80 % reduction for community-wide GHG emissions by 2050 through various energy conservation programs.
- The installation of the first wind turbine on the city-owned Shorebird Nature Center, producing 1.8 kW of electricity.
- The Smart Solar program, through which Berkeley won a Solar America City title and a 200,000\$ grant from the Department of Energy to help implement extensive Solar System installations in residential homes as well as small and medium sized businesses.
- The Community Choice Aggregation, a several-cities partnership that would give cities the ability to invest in more green power than current purchases by the regional electric utility.
- The Smart Light program, which offers assistance and rebates of up to 60% for lighting retrofits to residents and business owners.
- Free residential energy audits and retrofits offered by the city and the California Youth Energy Services program, including free weatherization services such as insulation, duct replacement, solar system installations and lighting retrofits.
- The Green City Buildings program, requiring all new/remodeled municipal buildings to be built to the LEED Silver standard.

- The Build It Green program, a nonprofit agency created by the City to assist developers and homeowners with green building advice, technical assistance, referrals, and other services.
- Sustainable development requirements, which impose a permit fee to fund sustainable development efforts and a green building coordinator, and requires all major projects to go through a green building review.
- Free bus passes and transit incentives such as subsidies for use with BART or other transit operators to all city employees.
- Bicycle Boulevard Network created by the City to provide bicyclists with clearly marked and safe routes throughout the City.
- Conversion of 100% of city traffic signals to energy efficient (LED) systems.
- Extensive tree planting, with an existing 36,000 trees and additional 300 trees planted per year, increasing shade and cooling effects, and improving air and life qualities.
- Zero Waste by 2020, a goal adopted by the city to reduce the waste going to landfills, through curbside recycling and commercial food waste collection programs.
- Conversion of the city's entire fleet of diesel vehicles (from garbage trucks to street sweepers) to biodiesel fuel, in addition to numerous hybrid, CNG, and electric vehicles.
- The city also completed a GHG inventory showing reductions of 9% from 2000 to 2005.

Information Sources:

City of Berkeley. (June 2007). *Climate Action in the City of Berkeley*. Retrieved June 20th 2007, from http://www.ci.berkeley.ca.us/sustainable/MeasureG/FrameworkReport_June07.pdf

The City's Official Website Climate Page <http://www.ci.berkeley.ca.us/sustainable/>

Other related websites: <http://www.kyotousa.org/> and <http://www.risingsunenergy.org>

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5. Boulder, CO

The City of Boulder has already achieved a series of accomplishments through actions and policies such as:

- Organizing workshops, lectures, and educational events such as Solar Week and October Energy Awareness Month to raise public awareness about climate protection issues, renewable energies and energy efficiency programs.
- Low cost residential energy audit programs offering retrofit options, referrals and technical assistance in insulation, air leakage, heating and cooling, lighting and energy efficient appliances, with free and low-rate weatherization services for income-qualified residents.
- Free commercial energy audits and various rebates and low-interest loans for Energy Star appliances and retrofits.
- The Solar Rebate Ordinance, whereby 35% of solar system sales tax is rebated by the city for solar PV systems and water heaters installed locally. The remaining 65% portion of the sales tax funds the Renewable Energy Account, dedicated to the installation of renewable energy systems in low-income residences and site-based non-profit organizations.
- Orphan Solar Program providing system evaluations and financial resources to bring “orphaned” solar domestic hot water systems back to life through 50% cost sharing.
- The carbon tax program, created by the city and approved by voters, consists of a tax on electricity consumption, including rates of 0.0022\$/kWh for residential, 0.0004\$/kWh for

commercial, and 0.0002\$/kWh for industrial customers. These revenues totaling over 1,000,000\$/year are used to fund climate protection programs.

- Free energy efficiency starter kits are distributed to interested individuals and groups at farmers markets and community meetings. The starter kit includes a collection of information and simple energy efficiency measures and actions residents can take and green building practices.

- An increase in renewable energy sources to 10% by 2015, including mostly wind energy, but also a 4% of these sources from solar systems installed locally.

- A trash tax and the zero waste resolution, which provide both funding and recycling programs that reduce dramatically residential and commercial waste generation.

- G.O. Boulder is a program whereby the city works with residents and institutions to address future transportation needs through educational information, outreach programs and innovative programs such as the Community Transit Network of high frequency buses and the extensive system of off-street bicycle paths, pedestrian paths and underpasses.

- The purchase of alternative fuels and hybrid vehicles only for city fleet operations, and reduce vehicle-miles traveled.

- The Green Points Program, requiring that homebuilders accrue a number of points (depending on the project size) from a wide selection of green building practices, including solar water heaters, use of recycled material, water conservation, and weatherization programs.

- Tree planting program through which the city plants an average of 130 trees / year.

- Completion of a GHG inventory tracking system, showing an increase in GHG emissions of 16% from 1990 to 2005.

Sources of Information:

City of Boulder. (2007). *Climate Action Plan*. Retrieved June 19th 2007, from www.bouldercolorado.gov/index.php?option=com_content&task=view&id=1058&Itemid=396

City's Official Website Climate Page www.environmentalaffairs.com

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6. Chapel Hill, NC

Through Chapel Hill's Comprehensive Plan, compact mixed-use development, alternative transportation, greenway development, and environmental protection measures are aimed toward minimizing fossil fuel dependency, and reducing GHG emissions through:

- The Carbon Reduction Program, by which the Town of Chapel Hill became the first U.S. municipality to commit to a 60 percent reduction in carbon dioxide emissions by 2050, beginning with an initial goal of 5 percent reduction by 2010.
- The creation of the Sustainability, Energy, and Environment (SEE) Committee, which develops and supports sustainability policies and programs that encourage developers to address energy efficiency and alternative energy in their projects, and which provides incentives for developers seeking to "build green".
- The LEED-Based Energy Ordinance by which any new or expanded municipal building shall meet the LEED Silver rating.
- Renewable energy planning in rezoning applications, by which applicants seeking approval of conditional use rezoning shall demonstrate energy efficient site planning,

landscaping, and structure design by reducing the demand for artificial heating, cooling, ventilation, and lighting, and facilitating the use of solar and other energy resources.

- The Energy Bank, a bond-supported revolving loan fund created by the city to acquire, construct, and install solar systems and energy efficient appliances including lighting, heating, ventilating, air conditioning equipment in city-owned buildings. Money saved on utilities is put back into the Energy Bank to fund similar projects in the future.
- The creation of the Million Solar Roofs Steering Committee, which promotes solar energy installations on buildings throughout Chapel Hill and Orange County.
- The Green Fleets Policy, which requires the city to obtain energy efficient vehicles, including biofuel and hybrid vehicles, for the municipal fleet.

Sources of Information:

The U.S. Conference of Mayors. (January 2007). *Energy and Environment Best Practices Guide*. pp 28. Retrieved June 10th 2007, from http://usmayors.org/uscm/best_practices/EandEBP07.pdf

City's Official Website Climate Page: <http://www.townofchapelhill.org/index.asp?NID=1344>

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7. Dublin, CA

The City of Dublin has implemented several programs to address energy efficiency, environmental performance and emissions reductions within the community, and especially throughout city facilities and operations, including:

- The Clean Air Consortium Checklist, through which city employees are directed to comply with a set of energy efficient practices, including anti-idling policy.
- The Operational Guidelines for Green Building Practices, which mandate that municipal buildings with an estimated construction cost of \$3 million or greater meet the LEED Silver rating, and be registered and certified by the US Green Building Council.
- The city executed a new franchise agreement with Amador Valley Industries for solid waste collection in January, 2005. This agreement includes requirements for natural gas to be used in collection vehicles in lieu of diesel fuel and specifies the use of recycled oil and lubricants.
- The replacement of all signal lights with LED lightbulbs and retrofit of all municipal interior lighting and street lights with energy efficient lighting.
- All landscape renovations, construction and maintenance performed by the city, shall employ sustainable landscape management techniques, including integrated pest management, grasscycling, drip irrigation, composting, and procurement and use of mulch and compost produced from regionally generated plant debris and food waste programs.
- The city maintains a network of bicycle and pedestrian trail that provide access for commuters to the business parks and BART (Bay Area Rapid Transit) stations. New development projects include a requirement to provide connecting trails when possible.
- Approval of high-density residential housing developments to be built adjacent to the existing East Dublin and proposed West Dublin BART stations.

Sources of Information:

The U.S. Conference of Mayors. (January 2007). *Energy and Environment Best Practices Guide*. pp 13, 25. Retrieved June 10th 2007, from http://usmayors.org/uscm/best_practices/EandEBP07.pdf

City's Official Website Climate Page: <http://www.ci.dublin.ca.us/Departments.cfm?PL=env>

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8. Euless, TX

The City of Euless aims to keep its buildings and fleet maintained in a “green environment.”:

- A new policy was issued for all vehicles purchased by the city to be low emission, ultra low emission or zero emission vehicles. Approximately 95percent of the city's fleet has met this mandate, including trash haulers and street sweepers.
- Euless adopted various forms of recycling or waste reduction technology to reduce its waste generation. Among these operations are residential curbside recycling, ethylene glycol recycling, filtration and reuse, oil and fuel filter recycling, and maintaining a dry cleaned shop floor and workstations, thus eliminating gray water discharges into the waste stream.
- The city's use of a 100% digital work order system also promotes a paperless environment, and reduces waste generation.
- The conversion of city traffic signals from incandescent to LED fixtures, retrofit of city facilities to low-E type lighting that contains no PCB materials.
- The installation of three-zone programmable thermostats in all city structures, ozone-friendly and energy-efficient refrigerants, HVAC cleaners and solvents, and computer-controlled HVAC systems that enable chilled water systems to go in economy mode during unoccupied times. The installation of automatic light dimming switches in bathrooms and closets so that they automatically turn off after a short time period also decreases energy use.

Sources of Information:

The U.S. Conference of Mayors. (January 2007). *Energy and Environment Best Practices Guide*. pp 14. Retrieved June 10th 2007, from http://usmayors.org/uscm/best_practices/EandEBP07.pdf

City's Official Website: www.ci.eulesstx.us

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9. Hayward, CA

- Hayward has passed a resolution calling for Residential Green Building Guidelines. The City Council's resolution calls for building methods that promote natural resource conservation, energy, and water efficiency, and also good indoor air quality.
- The Solar Power Generation Program, through which the city operates a 276 kW roof top solar array, covering 60,000 square feet, generating enough power during the day to power 275 homes, with an average savings of \$51,400 annually.
- Methane gas recovery, through which Hayward has reduced its consumption of power company electricity by using methane gas previously flared off at the water pollution control facility, as fuel for engines driving electric generators, providing about 300 kWh of electricity, and eliminating a powerful source of air pollution.
- The Alternative Fuel Vehicle program, through which the City is replacing its municipal fleet with hybrid, compressed natural gas, liquid propane gas, or electric vehicles.

Sources Information:

The U.S. Conference of Mayors. (January 2007). *Energy and Environment Best Practices Guide*. pp 15, 43, 57. Retrieved June 10th 2007, from http://usmayors.org/uscm/best_practices/EandEBP07.pdf

City's Official Website: www.ci.hayward.ca.us

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10. Irvine, CA

Within California, Irvine has become a leader in municipal programs and policies to reduce GHG emissions.

- Irvine's comprehensive Green Building Program, a voluntary program that incorporates the use of energy and water efficient products, reused or recycled building resources, and non-toxic materials in residential, commercial and municipal buildings. All new municipal building projects are required to be LEED certified and Silver rated. The city also developed a Green Building Resource Guide. This Guide will assist local residents and builders in identifying green building systems and materials available from local suppliers.
- The city is one of only a few nationwide to support a zero-emission shared-use vehicle program using electric cars. Initiated in April 2002, the Zero Emission Vehicle-Network Enabled Transport program (ZEV-NET) makes zero-emission vehicles available to participating employers to transport employees to and from the Irvine Transportation Center.
- The City of Irvine is a founding member of the Plug-in Partners, a national grass-roots campaign that promotes a market for flexible-fuel hybrid electric vehicles. The viability of this

market will be demonstrated through development of rebates and incentives, “soft” fleet orders, petitions and endorsement by other cities across the country.

- To encourage even greater recycling efforts, the City of Irvine and Waste Management of Orange County have partnered to provide new and expanded programs with additional rate options for curbside recycling, demolition and construction recycling, free recycling containers, and plastic bag recycling.

Sources of Information:

The U.S. Conference of Mayors. (January 2007). *Energy and Environment Best Practices Guide*. pp 15. Retrieved June 10th 2007, from http://usmayors.org/uscm/best_practices/EandEBP07.pdf

City’s Official Website Climate Page: www.cityofirvine.us

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11. Medford, MA

- The City of Medford through the Medford Energy Task Force converted all traffic lights in Medford to highly efficient light emitting diodes (LEDs). It also incorporates innovations such as battery backup using solar photovoltaic systems on traffic lights.

- The city constructed a greenhouse gas (GHG) emissions inventory, and set GHG reduction targets.

- The city implemented a Vehicle Emissions Reduction Program (VERP), a large program that involves retrofitting all Department of Public Work fleet including the addition of Diesel Particulate Filters (DPF) and Diesel Oxidation Catalysts (DOC) on retrofitted Ultra Low Sulfur

Diesel (ULSD) and biodiesel (B-20) fuel vehicles used by the highway, parks, forestry, trash haulers and recycling trucks. New municipal fleet purchases are now limited to electric, hybrid, and biodiesel vehicles.

- The city also implemented the Clean School Bus Program, which retrofitted the entire school bus fleet to ULSD fuels, and the addition of DOCs and DPFs on all buses. The school also initiated the No-Idling Policy, which created No Idle Zones around every school in the city by requiring that neither buses nor passenger vehicles be left running outside of the schools, and educating the staff and the parents on the benefits of reduced idling.

- Medford also initiated the Medford Leads With Clean Energy Campaign, aimed at educating the public and investigating opportunities for clean renewable energy projects through the creation of numerous public outreach materials including poster/flyers, banners, website, direct mailing, PR materials, and other events

- The creation of a renewable energy website (www.medfordcleanenergy.org) providing options to sign up for the National Grid's GreenUp Program, which allows residents to choose to have all or part of their electricity generated from renewable resources, while earning Clean Energy Choice Matching Grants for Medford (www.cleanenergychoice.org).

- The City had been working on a number of clean energy initiatives including the installation of solar panels on City Hall and Hormel Stadium, installation of a wind turbine at its public schools, conducting preliminary wind energy feasibility studies and coordinating field trips to Hull Wind Turbine and the IBEW turbine for a group of about 200 Medford students.

Sources of Information:

The U.S. Conference of Mayors. (January 2007). *Energy and Environment Best Practices Guide*. pp 16, 32, 47. Retrieved June 10th 2007, from http://usmayors.org/uscm/best_practices/EandEBP07.pdf

City's Official Website www.medford.org

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12. Santa Cruz, CA

- Bike programs such as Police on Bikes, free bike racks for local businesses supplied upon request, 0% interest bike loans for city employees, and the Yellow Bike Program, which requires impounded bikes to be repaired, painted yellow, and then distributed throughout the city for residents to use for local commutes.

- Free bus passes for city employees to commute to work. CNG (Compressed Natural Gas) van employee carpool for city employees, and other carpool incentives such as permits for reserved parking spaces at City Hall for employees who carpool a minimum of twice a week.

- 9/80 work weeks for City Hall employees. A voluntary, alternative work week which yields one less trip every two weeks and prevents congestion.

- A buy efficiency resolution requiring all energy consuming municipal equipment purchased to be energy efficient.

- Energy efficient building audits and retrofits including the installation of energy efficient lighting and room occupancy light sensors in many city buildings, in addition to installing sleep modes on computers within municipal facilities.

- LED traffic signal retrofits have been installed on 95% of traffic signals.

- The City of Santa Cruz has shown support for the Million Solar Roofs Initiative, aiming to place one million solar energy systems on new and existing residential and commercial

buildings in California. Various photovoltaic cell systems have been installed on the roof of the City Hall Annex Building, the Corporation Yard building, and the Regional Wastewater Treatment Facility.

- The Santa Cruz Water Department promotes public outreach programs and the use of water- and energy-efficient toilets, clothes washing machines and other products through rebates and incentives.

- Landfill methane gas recovery systems. A system has been installed that captures 75% of methane emitted from the city's main landfills through vertical wells, and burns it to generate electricity at a Gas-To-Energy plant.

- A Zero Waste Task Force was established and is charged with developing a long range plan to increase waste reduction and recycling, through a variable refuse rate structure. The customer rate increases with the volume of refuse collected, and recycling is provided to residents and businesses for no cost, including a divided recycling cart for mixed paper and containers (glass, metal, plastic). Used oil filters and used motor oil are also accepted through curbside recycling. Christmas tree collection is available seasonally for recycling.

Sources of Information:

City's Official Website Climate Page <http://www.ci.santa-cruz.ca.us/pw/ep/measures.html>

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13. Santa Monica, CA

- Through a Million Solar Roofs grant, the city performed a detailed analysis of the physical potential of the community's infrastructure for the Community Energy Independence Initiative (CEII), a demonstration project that will select up to 50 residential, commercial, and municipal buildings to voluntarily participate in integrating solar power and energy efficiency that will demonstrate to residents and businesses how effectively energy efficiency, solar energy, and distributed generation work together and how energy independence provides economic benefit to the community.

- Santa Monica is the first U.S. city to purchase 100% renewable energy for all its municipal electricity needs.

- More than 80% of the municipal fleet is fueled with cleaner and more sustainable fuel alternatives through retrofits and purchases of electric, natural gas, hydrogen, biodiesel, and gas-electric hybrid vehicles.

- Free energy efficiency consultations and audits are provided to qualified small businesses and residents, offering rebates and incentives for energy efficient appliances.

- The retrofit of municipal buildings through cool roof technology and other weatherization practices. The city also requires all new municipal buildings to meet the LEED standards. Santa Monica has the highest number of LEED certified green buildings per capita in the U.S. and also built the first LEED certified park in the U.S.

Sources of Information:

The U.S. Conference of Mayors. (January 2007). *Energy and Environment Best Practices Guide*. pp 51. Retrieved June 10th 2007, from http://usmayors.org/uscm/best_practices/EandEBP07.pdf

City's Official Website Climate Webpage <http://www.smgov.net/epd/index.htm>

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14. Sugar Land, TX

- LED (light emitting diode) technology was implemented throughout the city streets by replacing 135 watt incandescent bulbs with 12 watt LED indications in all traffic signals. Also, school zone flashers now utilize LED technology. Solar technology has also been installed on most flashers.

- All new buildings will incorporate building automatic systems (BAS), which provide the capability to remotely monitor the operation of a building's HVAC system to insure that the system is operating within prescribed parameters and at optimum efficiency. Building lighting will be designed to permit two modes of operation: half-light and full-light through the use of timers and switches. The placement of interior and exterior windows in the new facilities will help to take advantage of natural light and thus reduce energy costs.

Sources of Information:

The U.S. Conference of Mayors. (January 2007). *Energy and Environment Best Practices Guide*. pp 21. Retrieved June 10th 2007, from http://usmayors.org/uscm/best_practices/EandEBP07.pdf

City's Official Website www.sugarlandtx.gov

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15. Vista, CA

The City of Vista conducts several programs to improve energy efficiency, cut energy costs and reduce emissions.

- The city-owned and operated Wave Waterpark uses solar heat for heating pool water. This increases energy efficiency while it decreases operating costs.
- A small inventory of hybrid cars (Honda Civics) is part of the city's fleet and this promotes savings in fuel costs and it reduces air emissions.
- The city conducted an energy efficiency evaluation with help from the San Diego Regional Energy Office at all city operated facilities that is anticipated to realize 30% cost savings from improved energy efficiency.
- City employees work a 9/80 schedule, to alleviate traffic congestion, achieve emissions reductions, and improve energy efficiency.

Sources of Information:

The U.S. Conference of Mayors. (January 2007). *Energy and Environment Best Practices Guide*. pp 77. Retrieved June 10th 2007, from http://usmayors.org/uscm/best_practices/EandEBP07.pdf

City's Official Website www.ci.vista.ca.us

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The set of policies obtained from the subset of cities similar to Laguna Beach is a useful resource for the city as it creates its own climate action blueprint. Information on these policies, including cost and benefit data, will be crucial in deciding which policies will result in the most

cost effective regulation of GHG emissions reduction. The city thus may avoid unsuccessful and unpopular programs, and implement policies and actions with a greatest rate of success. The following chapter sorts the policies briefly described above into various GHG source categories identified by the Environmental Committee Climate Action Subcommittee and workgroup, and includes a brief analysis of corresponding cost and benefit data.

Chapter 3 The List of Policies Adopted by Cities in the Subset, Compiled by GHG Source Categories

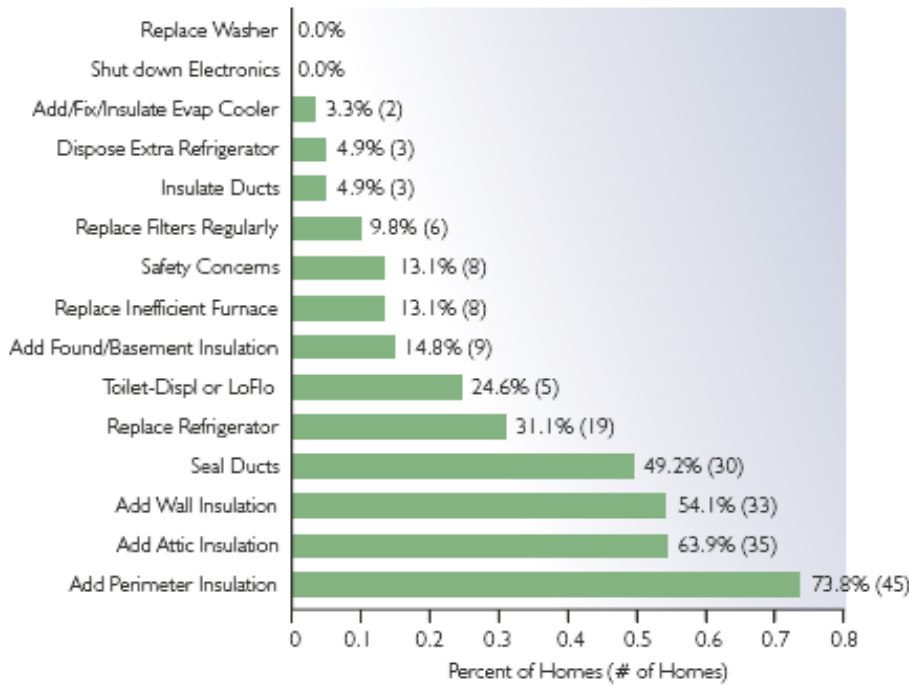
Below is the list of actions, policies and programs adopted by various cities in the subset (as reported in Chapter 2), sorted by GHG emission source categories. These sources were selected to correlate with the Laguna Beach Climate Protection Workgroup's action plan, which identified the following as primary GHG emission sources that are at least to some degree within the city's purview: Residential Energy Use, Commercial Operations, Municipal Operations, Transportation, Land Use, and Public Outreach.

I. Residential Targets

Energy Audits and Weatherization Retrofits

- Boulder's low cost residential energy audit programs offer retrofit options, referrals and technical assistance in insulation, air leakage, heating and cooling, lighting and energy efficient appliances, with free and low-rate weatherization services for income-qualified residents. The graph below summarizes the one-hour audit recommendations:

CONSERVATION MEASURE RECOMMENDED IN LPEC ONE HOUR AUDITS



Cost and Benefits:

COMPLEX	NUMBER OF UNITS	POTENTIAL ANNUAL ELECTRICAL ENERGY SAVINGS (KWH)	POTENTIAL ANNUAL WATER SAVINGS (GAL)	POTENTIAL ANNUAL NATURAL GAS SAVINGS (THERMS)	POTENTIAL ANNUAL GHG EMISSION REDUCTIONS (MTCO2)	POTENTIAL ANNUAL COST SAVINGS	ESTIMATED CAPITAL COST	SIMPLE PAYBACK (YEARS)
Remington Post	278	56,120	1,052,400	6,930	203	\$13,510	\$15,260	1.1
Stratford Park	120	10,860	0	2,606	68	\$2,430	\$5,660	2.3
Coronado	124	26,840	1,693,000	3,350	98	\$17,087	\$34,960	2.1
Sunnyside Apts	8	2,400	101,000	780	20	\$870	\$3,310	3.8
TOTALS	530	96,220	2,846,400	13,666	389	\$33,897	\$59,190	2.325

(Boulder City, 2007).

- Free residential energy audits and retrofits offered by the City of Berkeley and the California Youth Energy Services program, including free weatherization services such as insulation, duct replacement, solar system installations and lighting retrofits

Cost and Benefits: This year, nine students provided free in-home energy education and hardware installation to 343 Berkeley households, saving Berkeley residents approximately \$199,000 in energy dollars. Measures installed include compact fluorescent lamps (CFLs), efficient-flow showerheads and faucet aerators, energy efficient torchieres, and attic insulation.

(<http://www.risingsunenergy.org>)

- Ashland offers free residential energy audits and energy efficiency program assistance, air and duct leakage tests, and insulation system analysis

(www.ashland.or.us/Page.asp?NavID=1366)

- Ashland offers rebates and zero interest loans for various residential energy saving projects, such as rebates up to 80% for duct replacement and sealing, 40% for insulation installation, cash rebates up to 1000\$ for solar water heaters, 500\$ for Energy Star heat pump systems, 2.00 \$/ft² for Energy Star windows, and other weatherization measures

(www.ashland.or.us/Page.asp?NavID=1366).

Renewable Energy Programs

- Medford supported creation of a renewable energy website

(www.medfordcleanenergy.org) providing options to sign up for the National Grid's GreenUp Program, which allows residents to choose to have all or part of their electricity generated from renewable resources, while earning Clean Energy Choice Matching Grants for Medford at www.cleanenergychoice.org (U.S. Mayors Conference 2007, pp 47)

- Boulder's Solar Rebate Ordinance, whereby a rebate of 35% of solar system sales tax is offered by the city for solar PV systems and water heaters installed locally. The remaining 65% portion of the sales tax funds the Renewable Energy Account, dedicated to the installation

of renewable energy systems in low-income residences and site-based non-profit organizations (Boulder City, 2007).

- Berkeley's Smart Solar Program, which won the city a Solar America City title and a 200,000\$ grant from the Department of Energy to help implement extensive Solar System installations in residential homes as well as small and medium sized businesses.

Cost and Benefits: Since 1998, 379 photovoltaic (PV) systems have been established in Berkeley under the California Energy Commission's Emerging Renewables Program, which offers rebates to consumers who install qualifying renewable energy systems on their property. These systems produce a total of 1.4 megawatts of peak power, from an investment of over \$13 million. It is estimated that these systems will produce over 2 million KWh per year, and over 30 years, will produce more than 61 million KWh, the equivalent of taking 5,891 cars off the road for one year (<http://www.ci.berkeley.ca.us/sustainable/>).

- Ashland's Net Metering Policy established a simple grid interconnection policy committing the city to purchase, at full retail price, up to 1,000 kW of excess electricity per month from small wind or solar generation resources produced by local residents and businesses.

Cost and Benefits: In 1999, the Bonneville Environmental Foundation offered Ashland a grant in the amount of \$62,500 to fund the Solar Pioneer Program. The Bonneville Power Administration then added \$100,000 to increase the size of the system by purchasing 20 years of solar output of the larger system. In the spring of 2000, more than 250 citizens voluntarily added a Solar Pioneer surcharge to their electric bill. This surcharge of \$4.00 per month will be used to reimburse the Festival and the University for solar generated electricity at \$.25 kWhs, until their investment is fully recouped. It is anticipated that the institutions will be fully reimbursed in 8-12 years (www.ashland.or.us/Page.asp?NavID=1366).

Energy Efficient Appliances

- Ashland offers city rebates and state tax credits for energy-efficient appliances that meet Energy Star or stricter standard models, including refrigerators, washing machines, electric water heaters and dishwashers (www.ashland.or.us/Page.asp?NavID=1366).
- Austin offers rebates, free home energy improvements and low-interest loans on energy efficient appliances, solar water heaters, and solar systems installed by residential and commercial buildings (<http://www.ashland.or.us/Page.asp?NavID=1532>)
- Boulder's Orphan Solar Program providing system evaluations and financial resources to bring "orphaned" solar domestic hot water systems back to life through 50% cost sharing (Boulder City, 2007).

Green Building

- Hayward has passed a resolution calling for Residential Green Building Guidelines. The City Council's resolution calls for building methods that promote natural resource conservation, energy, and water efficiency, and also good indoor air quality (U.S. Mayors Conference, pp15).
- Chapel Hill's Renewable Energy Planning in Rezoning Applications, by which applicants seeking approval of conditional use rezoning shall demonstrate energy efficient site planning, landscaping, and structure design by including a "20 percent more energy efficient" feature in their development plans and reducing the demand for artificial heating, cooling, ventilation, and lighting, and facilitating the use of solar and other energy resources (<http://www.townofchapelhill.org/index.asp?NID=1344>).
- Through the Green Building Initiative, Albuquerque launched the Build Green NM guide to promote commercial and residential energy-efficient buildings and appliances (<http://www.cabq.gov/sustainability/green-goals/green-building>).

- Boulder's Green Points Program, requiring homebuilders to accrue a number of points (depending on the project size) from a wide selection of green building practices including solar water heaters, use of recycled material, water conservation, and weatherization programs (Boulder City, 2007).
- Berkeley's Build It Green program is a nonprofit agency created by the city to assist developers and homeowners with green building advice, technical assistance, referrals, and other services (City of Berkeley, 2007).

II. Commercial Operations

Energy audits and weatherization retrofits

- Boulder offers free commercial energy audits and various rebates and low-interest loans for Energy Star appliances and retrofits

Cost and Benefits:

RESULTS	2005	2006
Buildings Benchmarked	31	15
Buildings Audited	16	7
Potential Annual Energy Savings	\$220,000	\$17,888
Estimated Capital Investment	\$800,000	\$58,298
Average Payback (years)	3.84	3.42
Potential GHG reductions (mtCO ₂)	2,575	348
New ENERGY STAR labels	1	1

(Boulder City, 2007).

Ashland offers energy audits, rebates and zero-interest loans to commercial customers for lighting retrofits and other resource-saving measures. A business that adopts various sustainability practices is recognized as a Green Business

(www.ashland.or.us/Page.asp?NavID=1366).

Renewable Energies

- Ashland's Solar Electric Rebate Program was designed to encourage residents and businesses to invest in photovoltaic generation installations by paying rebates for qualifying installations. Cash incentives offered by the City of Ashland for grid-connected solar electric systems are \$2.25 per watt of the system up to a maximum of \$10,000 per site (<http://www.ashland.or.us/Page.asp?NavID=1532>).

Appliances and Lighting

- Berkeley's Smart Light program offers assistance and rebates of up to 60% for lighting retrofits to residents and business owners

Cost and Benefits: Over 1,200 businesses have made use of this service, saving them over \$450,000 a year in energy costs (City of Berkeley, 2007).

Green Buildings

- Austin's Green Building Program offers free resources, consulting, workshops and educational events to residential and business owners to encourage energy efficient buildings and renewable energies

(<http://www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/index.htm>).

- Berkeley established the Sustainable Development Requirements, a resolution that imposes a permit fee to fund sustainable development efforts and a green building coordinator, and requires all major projects to go through a green building review (City of Berkeley, 2007).

III. Municipal Operations

Climate Program Funding

- The carbon tax program, created by the City of Boulder and approved by voters, consists of a tax on electricity consumption, including residential, commercial, and industrial energy use. The revenues from this tax are used to fund climate protection programs

Costs and benefits: The tax will generate about \$1 million annually through 2012 when the tax is set to expire. The City Council set the first year tax at a maximum rate of \$0.0022 per kWh for residential customers; \$0.0004 per kWh for commercial customers; \$0.0002 per kWh for industrial customers. These amounts are based upon the first year Climate Action Plan implementation costs of \$860,265 and are designed to reflect projected program and service expenditures by which 58% will go to the residential sector; 39% to the commercial sector; and 3% to the industrial sector in the first year. The average household will pay \$1.33 per month and an average business will pay \$3.80 per month (City of Boulder, 2007).

- Boulder's Trash Tax and the Zero Waste resolution provide both funding and recycling programs that reduce dramatically residential and commercial waste generation

Costs and benefits: As part of the 2005 budget process, City Council approved a two-year increase to the Trash Tax, allocating \$258,000 a year for 2005 and 2006 to fund GHG reduction and energy efficiency programs (City of Boulder, 2007).

- Albuquerque is raising the capital program set-aside for energy conservation and renewable energy from 1% to 3% to fund the design, installation, purchase, user training and monitoring of energy conservation and/or renewable energy that reduce fossil fuel based energy costs and energy consumption.

Costs and benefits: Department of Finance and Administrative Services will budget 3% of the General Obligation Bond Program, which represents about \$3.6 million dollars each bond cycle. Capital expenses of a project should be regained from energy savings generated from the project

within the expected life of the equipment and projects using renewable energy shall have a lower life cycle cost than a project using conventional energy. Project allocations cannot exceed 40% of the total funding available (U.S. Mayors Conference 2007, pp72)

- The Energy Bank, a bond-supported revolving loan fund created by the city to acquire, construct and install solar systems and energy efficient appliances including lighting, heating, ventilating, air conditioning equipment in Town-owned buildings. Money saved on utilities is put back into the Energy Bank to fund similar projects in the future.

Cost and benefits: In the November 4, 2003, bond referendum, the citizens of the Town of Chapel Hill voted in favor of a \$500,000 (current balance is \$475,000) bond for creation of an Energy Bank. It is envisioned that the documented savings attributable to projects completed with these funds will be used to reimburse the fund for the cost of the project

(<http://www.townofchapelhill.org/index.asp?NID=1344>).

Municipal Fleet

- The City of Medford (MA) implemented a Vehicle Emissions Reduction Program (VERP), a large program that involves retrofitting all the Department of Public Work's fleet including the addition of Diesel Particulate Filters (DPF) and Diesel Oxidation Catalysts (DOC) on retrofitted Ultra Low Sulfur Diesel (ULSD) and Biodiesel (B-20) fuel vehicles used by the highway, parks, forestry, trash haulers and recycling trucks. New municipal fleet purchases are now limited to electric, hybrid, and Biodiesel vehicles.

Costs and benefits: By installing DPFs and DOCs in the school buses and DPW fleet, the City continues to reduce the amount of Carbon Dioxide (CO₂), hydrocarbons (HC), particulate matter (PM), and carbon monoxide (CO) emitted in and around the City. Hydrocarbons are known to contribute to the formation of ozone and particulate matter is a primary source of respiratory

illnesses. EPA's estimated emissions reductions from the specific technology used in Medford's program are summarized below.

Diesel Particulate Filters (DPF)	Diesel Oxidation Catalysts (DOC)
HC = 60%	HC = 50%
PM = 60%	PM = 20%
CO = 60%	CO = 40%

With the addition of the ULSD, the reductions for the DPF increase up to 90% and up to 60% for the DOC. The City of Medford received \$483,300 to implement Phase II of the VERP from the US Environmental Protection Agency's Clean School Bus USA Grant Program and received \$5,000 from the Massachusetts Department of Environmental Protection for a portion of Phase I of the VERP (U.S. Mayors Conference 2007, pp32).

- Conversion of Berkeley's entire fleet of diesel vehicles (from garbage trucks to street sweepers) to Biodiesel fuel, in addition to numerous hybrid, CNG, and electric vehicles (City of Berkeley, 2007).
- All of Albuquerque's motor vehicle purchases and replacements are now required to be alternative fuel vehicles, including trash trucks, street sweepers, fire trucks, city buses, and other municipal operation vehicles to run on biodiesel, ethanol, compressed natural gas, or hybrid technology. Biodiesel emits 78% less CO₂ than regular petroleum diesel (U.S. Mayors Conference 2007, pp 52).

- Hayward's alternative fuel vehicle (AFV) program, through which the city is replacing its municipal fleet with hybrid, compressed natural gas, liquid propane gas, or electric vehicles.

Costs and benefits: The use of AFVs has reduced fuel costs by about 35 to 40% over conventional gas engine powered vehicles. The city has also realized significant reductions in tailpipe emissions. Vehicles operating under full electric power do not produce any tailpipe

emissions. The Bay Area Air Quality Management District offers Vehicle Incentive Program funds to fleets to help offset their slightly higher purchase price. VIP grants up to \$2,000 per new AFV vehicle purchased. With the increased fuel efficiency and reliability of these AFVs, the reduced operating costs quickly recoup the extra money required to purchase the vehicle (U.S. Mayors Conference 2007, pp 57).

- Boulder's purchase of alternative fuels and hybrid vehicles only for city fleet operations, and reduce vehicle-miles traveled (City of Boulder, 2007).
- Chapel Hill's Green Fleets Policy requires the city to obtain energy efficient vehicles including biofuel and hybrid vehicles for municipal fleet (<http://www.townofchapelhill.org/index.asp?NID=1344>).
- A new policy was issued by Eules for all vehicles purchased by the city to be low emissions, ultra low emissions or zero emissions vehicles. Approximately 95% of the city's fleet has met this mandate, including trash haulers and street sweepers (U.S. Mayors Conference, pp14).

Waste management and recycling

Eules adopted various forms of recycling or waste reduction technology to reduce its waste generation. Among these operations are residential curbside recycling, ethylene glycol recycling, filtration and reuse, oil and fuel filter recycling, and maintaining a dry cleaned shop floor and workstations, thus eliminating gray water discharges into the waste stream. Then city also uses a 100% digital work order system which promotes a paperless environment, and reduces waste generation (U.S. Mayors Conference, pp 14).

- The Zero Waste Task Force was established in Santa Cruz and is mandated with developing a long range plan to increase waste reduction and recycling, through a variable refuse

rate structure. The customer rate increases with the volume of refuse collected, and recycling is provided to residents and businesses for no cost including a divided recycling cart for mixed paper and containers (glass, metal, plastic). Used oil filters and used motor oil are also accepted through curbside recycling. Christmas tree collection is available seasonally for recycling (<http://www.ci.santa-cruz.ca.us/pw/ep/measures.html>).

- Berkeley's Zero Waste by 2020 objective, a goal adopted by the city to reduce the waste going to landfills, through curbside recycling and commercial food waste collection programs (<http://www.kyotousa.org/index.php?p=berkeley>).

- To encourage even greater recycling efforts, the city of Irvine and Waste Management of Orange County have partnered to provide new and expanded programs with additional rate options for curbside recycling, demolition and construction recycling, free recycling containers, and plastic bag recycling (http://cityofirvine.us/recycle_home.html)

- Dublin executed a new franchise agreement with Amador Valley Industries for solid waste collection in January, 2005. This agreement includes requirements for natural gas to be used in collection vehicles in lieu of diesel fuel and specifies the use of recycled oil and lubricants (U.S. Mayors Conference, pp 13).

Renewable Energy

- Through a Million Solar Roofs grant, Santa Monica performed a detailed analysis of the physical potential of the community's infrastructure for the Community Energy Independence Initiative (CEII), a demonstration project that will select up to 50 residential, commercial, and municipal buildings to voluntarily participate in integrating solar power and energy efficiency that will demonstrate to residents and businesses how effectively energy

efficiency, solar energy, and distributed generation work together and how energy independence provides economic benefit to the community.

Costs and benefits: The 15 months of the demonstration project (through FY 2006-2007) will be funded by the city's Energy Efficiency/ Conservation Fund, which was established in 2001 with one-time utility user tax revenues totaling over \$600,000. The table below shows the numerous benefits of the CEII:

kWh saved per year	Annual value of energy saved	Tons of CO2 mitigated
Year 1 293,095	Year 1 \$ 43,964	Year 1 103.2
Year 2 927,465	Year 2 \$139,120	Year 2 326.7
Total 1,220,560	Total \$183,084	Total 429.9

(U.S. Mayors Conference, pp 51).

- The City of Santa Cruz has shown support for The Million Solar Roofs Initiative, aiming to place one million solar energy systems on new and existing residential and commercial buildings. Various photovoltaic cell systems have been installed on the roof of the City Hall Annex Building, the Corporation Yard building, the Regional Wastewater Treatment Facility.

Costs and benefits: The solar power system installed on City Hall generates 25,000 kilowatt hours per year, providing about 7% of the power used in the building. The larger 55 kilowatt system installed on the Corporation Yard building will produce 70,000 kilowatt hours per year. The 50.7 kilowatt photovoltaic system installed at the Regional Wastewater Treatment Facility is expected to produce about 76,000 kilowatt hours per year, saving the city \$15,000 per year in energy costs. When these systems produce more electricity than is consumed, the city's utility

meter will run backwards giving the city credit for that energy produced (<http://www.ci.santa-cruz.ca.us/pw/ep/measures.html>).

- The City of Medford had been working on a number of clean energy initiatives including the installation of solar panels on City Hall and Hormel Stadium, installation of a wind turbine at its public schools, conducting preliminary wind energy feasibility studies and coordinating field trips to Hull Wind Turbine and the IBEW turbine for a group of about 200 students (U.S. Mayors Conference, pp 47).

- Hayward's Solar Power Generation Program, through which the city operates a 276 kW roof top solar array, covering 60,000 square feet, generating enough power during the day to power 275 homes.

Costs and benefits: The average savings from this solar program are \$51,400 annually. Carbon dioxide will be reduced by 2,000 tons over 30 years, which is equivalent to planting 600 acres of trees. The approximate cost is \$ 1.8 million, of which 50% is paid by the city's General Fund, and 50% is paid by PG&E Solar Power Grant (U.S. Mayors Conference, pp 43).

- Boulder set out a goal to increase renewable energy sources to 10% by 2015, including mostly wind energy, but also a 4% of these sources from solar systems installed locally

Costs and benefits: As of December 31, 2006, there were over 400 new wind power subscribers in Boulder County, subscribing to approximately 2,065,393 kWh of wind energy per year. This is equivalent to a reduction of 1,617 mt CO₂. Of the new subscribers through the end of the year, 313 were in the city of Boulder, subscribing to 1,145,000 kWh of wind energy per year, equivalent to a reduction of 897 mt CO₂ (Boulder City, 2007).

- Santa Monica is the first U.S. city to purchase 100% renewable energy for all its municipal electricity needs (<http://www.smgov.net/epd/index.htm>).

- Berkeley's Community Choice Aggregation, a several-cities partnership that would give cities the ability to invest in more green power than current purchases by the regional electric utility (City of Berkeley, 2007).

- Berkeley's installation of the first wind turbine on the city-owned Shorebird Nature Center produces 1.8 kWh of electricity that is used to power the Center's aquarium, computers, and lighting (<http://www.ci.berkeley.ca.us/sustainable/>).

- One of Austin's Climate Action Plan goals is to reach a 30% total city energy consumption reliance on renewable energy by 2020, including a 100 MW of solar power, in addition to wind power and landfill methane gas (<http://www.ci.austin.tx.us/environmental/>).

- The Town of Chapel Hill created the Million Solar Roofs Steering Committee, which promotes solar energy installations on buildings throughout Chapel Hill and Orange County (<http://www.townofchapelhill.org/index.asp?NID=1344>).

- Ashland's Renewable Pioneers/Green Tag Program, through which Ashland utility customers can support clean, renewable energy by purchasing Green Tags from the Bonneville Environmental Foundation which directs a portion of the purchase to local renewable energy projects such as installation of solar electric systems.

Costs and benefits: Ashland has partnered with BEF on several successful projects. BEF contributed about \$60,000 to fund and build Solar Ashland, which encompasses the solar installations at the Civic Center, Oregon Shakespeare Festival, and Southern Oregon University. (<http://www.ashland.or.us/Page.asp?NavID=1532>).

- Albuquerque is in a partnership with the Department of Energy Million Solar Roofs Program through which solar thermal and photovoltaic systems will be installed in public buildings (U.S. Mayors Conference 2007, pp38).

- Albuquerque has converted 15% of the City's energy needs to wind-power energy.

Costs and benefits: Electricity generated from wind turbines is used to power over one hundred commercial, residential and municipal buildings and facilities, totaling about 18 million kWh per year (<http://www.cabq.gov/sustainability/green-goals/alternative-energy/wind-energy>).

Green Buildings

- All new Sugar Land municipal buildings will incorporate building automatic systems (BAS), which provide the capability to remotely monitor the operation of a buildings HVAC system to insure that the system is operating within prescribed parameters and at optimum efficiency. Building lighting will be designed to permit two modes of operation: half-light and full-light through the use of timers and switches. The placement of interior and exterior windows in the new facilities will help to take advantage of natural light and thus reduce energy costs.

Costs and benefits: The city anticipates a 5-7 year payback period (U.S. Mayors Conference 2007, pp 21).

- Dublin's Operational Guidelines for Green Building Practices, which mandates municipal buildings with the estimated cost of \$3 million or greater to meet the LEED Silver rating and must be registered and certified by the US Green Building Council (U.S. Mayors Conference 2007, pp 13).

- Chapel Hill established the LEED-based energy ordinance by which any new or expanded municipal building shall meet the LEED Green Building Silver Rating System (<http://www.townofchapelhill.org/index.asp?NID=1344>).

- Berkeley's Green City Buildings Program, requiring all new/remodeled municipal buildings to be built to the LEED Silver standard

Costs and benefits: With recent energy efficiency improvements on city-owned facilities, the City of Berkeley is currently saving 2.1 million kilowatt hours of electricity, and 37,520 therms of heat (primarily natural gas) annually. This amounts to a savings of more than \$370,000 of taxpayer's money annually. It also reduced carbon emissions by more than 1,200 tons per year (City of Berkeley, 2007).

- Albuquerque's adoption of the Energy Efficient Green Building Performance 2030 Challenge Targets, that requires all new municipal projects and buildings to be carbon neutral by 2030. This will be done incrementally by reducing fossil fuel usage in buildings by 60% in 2010, 70% in 2015, 80% in 2020, 90% in 2025 and 100% in 2030 (<http://www.cabq.gov/sustainability/green-goals/green-building/the-2030-challenge>).

- Austin requires all its new municipal buildings and projects to achieve the LEED Silver rating, be carbon-neutral by 2020, and rely mainly on renewable energy provided by the GreenChoice Program (<http://www.ci.austin.tx.us/environmental/>).

- Irvine's comprehensive Green Building Program, a voluntary program that incorporates the use of energy and water efficient products, reused or recycled building resources, and non-toxic materials in residential, commercial and municipal buildings. All new municipal building projects are required to be LEED certified and Silver rated. The city also developed a Green Building Resource Guide. This Guide will assist local residents and builders in identifying green building systems and materials available from local suppliers

Costs and benefits: The costs to implement the Municipal Green Building Program are expected to range between 1 and 3% of the construction costs for municipal facilities. The voluntary residential program costs to be paid by the development community will vary depending on the scale of the development and option chosen (U.S. Mayors Conference 2007, pp 15).

Building Retrofits

- Santa Monica has been very active in the retrofit of its municipal buildings through cool roof technology and other weatherization practices. The city also requires all new municipal buildings to meet the LEED standards. Santa Monica has the highest number of LEED certified green buildings per capita in the U.S. and also built the first LEED certified park in the U.S.

(<http://www.smgov.net/epd/index.htm>).

- Santa Cruz achieved various energy audits and retrofits on municipal buildings including the installation of energy efficient lighting and room occupancy light sensors in many city buildings, in addition to installing sleep modes on computers within Santa Cruz's municipal facilities (<http://www.ci.santa-cruz.ca.us/pw/ep/measures.html>).

- The installation of three-zone programmable thermostats in all Eules city structures, ozone-friendly and energy-efficient refrigerants, HVAC cleaners and solvents, and computer-controlled HVAC systems that enable chilled water systems to go in economy mode during unoccupied times. The installation of automatic light dimming switches in bathrooms and closets so that they automatically turn off after a short time period also decreases energy use.

Costs and benefits: The energy reduction measures in this program were of comparable cost to expenses for previous business practices and were paid through the city's general fund (U.S. Mayors Conference 2007, pp 14).

- Through various energy audits, the inspection of Albuquerque's municipal facilities resulted in the retrofit and the improvement of insulation, the installation of occupancy sensors, and the replacement of old lightbulbs with energy-efficient bulbs at City Hall, city-owned parking structures, police substations, fire stations, and community centers.

Costs and benefits: This simple retrofit measure has resulted in an energy savings of 5,000,000 kWh and a financial savings of \$375,000 per year (<http://www.cabq.gov/sustainability/green-goals/alternative-energy/alternative-energy>).

- Alexandria's Department of General Services developed a Green Building Policy and adopted it in February 2004. This policy establishes procedures for analyzing LEED feasibility for facilities 5,000 sq ft or greater, outlines staff resource and training goals, and it identifies program participation opportunities, including Energy Star, Rebuild America, and the USGBC. Since the establishment of the Green Building Policy:

1. The city implemented several projects including rain gardens and vegetated green roofs.
2. The city registered three USGBC LEED projects and has two more projects in planning phases.
3. Made procurement changes in its architectural/engineering section including those affecting cleaning supplies and procedures, painting and flooring.
4. Set up an energy conservation fund to assist with design and construction efforts and to reduce energy consumption in city facilities.

Costs and benefits: Alexandria's Energy Conservation Program is funded through bond revenue and from \$200,000 budgeted per year for its activities. The costs and benefits data from completed projects is outlined in the table below: (U.S. Mayors Conference 2007, pp 4)

Completed Projects & Projects Underway in the City of Alexandria, Virginia

Project, Scope	Cost	FY 03 Savings	FY 04 Savings	FY 05 Savings	FY2006 Savings estimate	To-date Savings
Fire Station 203: Retro-fit with energy-efficient lighting fixtures	\$13,500	\$908	\$883	\$900	\$900	\$3,591
Fire Station 205: Retro-fit with energy-efficient lighting fixtures	\$14,600	\$687	\$679	\$400	\$400	\$2,166
Beatley Library: HVAC modifications	\$3,000			\$20,000	\$35,000	\$55,000
Community Shelter: HVAC replacement	\$5,200				\$3,000	\$3,000
Torpedo Factory: HVAC replacement	\$9,000				\$5,000	\$5,000
Yearly Sub-total Savings	\$45,300	\$1,595	\$1,562	\$21,300	\$44,300	
GRAND TOTAL						\$68,757

Outdoor Retrofits

- LED traffic signal retrofits have been installed on 95% of traffic signals within the City of Santa Cruz (<http://www.ci.santa-cruz.ca.us/pw/ep/measures.html>).
- LED technology was implemented throughout Sugar Land city streets by replacing 135 watt incandescent bulbs with 12 watt LED indications in all traffic signals. Also, school zone flashers now utilize LED technology. Solar technology has also been installed on most flashers and so the combination of LED and solar creates a long lasting, efficient, and environmentally sound product.

Costs and benefits: Benefits of LED technology include improved brightness, reduction in maintenance and electricity cost savings of approximately 80%. It is estimated that the cost of the above programs will pay for themselves in a 5–7 year timeframe (U.S. Mayors Conference, pp 21).

- Medford converted all traffic lights in Medford to highly efficient light emitting diodes (LEDs). It also incorporates innovations such as battery backup using solar photovoltaic systems on traffic lights.

Costs and benefits: In addition to the environmental benefits, there are economic incentives for the city conversion of signal lights. Over 45% (\$40,000) of the capital costs of the conversion was returned to the city in the form of a rebate from Massachusetts Electric. Since the conversion to using the more efficient LEDs in traffic lights, the average annual energy savings has been \$15,000. The LED technology resulted in lower maintenance due to an increased life of a minimum of seven years, but also and most importantly an energy reduction of about 90% (U.S. Mayors Conference, pp16).

- The conversion of Eules city traffic signals from incandescent to LED fixtures, and retrofit of city facilities to low-E type lighting that contains no PCB materials.

Costs and benefits: Conversion of the city traffic signals is anticipated to reduce average dollar cost and energy consumption by 75% (U.S. Mayors Conference 2007, pp14).

- Dublin replaced all signal lights with LED lightbulbs and retrofitted all municipal interior lighting and street lights with energy efficient lighting (U.S. Mayors Conference 2007, pp 13).

- Albuquerque converted 575 of its traffic signals to LED technology.

Costs and benefits: The LED technology uses 90% less energy, and this simple retrofit measure resulted in an energy savings of 12,000,000 kWh and a financial savings of \$900,000 per year (<http://www.cabq.gov/sustainability/accomplishments/accomplishments#energyconservation>).

- Conversion of 100% of Berkeley traffic signals to energy efficient (LED) systems.

Costs and benefits: This simple retrofit measure saved the city hundreds of thousands of dollars in energy saving and reduced maintenance (City of Berkeley, 2007).

- Since 2005, Portland's Offices of Sustainable Development and Transportation are working with the Climate Trust on a project to improve the timing of traffic signals in seventeen major metropolitan arteries. This five-year project is to help reduce CO₂ emissions from vehicles by reducing the amount of time cars spend idling at and accelerating between traffic lights. This project allots funding for traffic signal system operators to conduct studies.

Costs and benefits: Program costs are absorbed in a pay-for-performance contract with the Climate Trust. After the signal timing has been completed, the Climate Trust pays Portland based on the amount of CO₂ emissions that will be avoided. Portland transfers ownership of the CO₂ offsets created by these reduced emissions to the Climate Trust. Other benefits unrelated to decreasing GHG gas emissions include:

- Commuters save on gasoline costs and time traveling across town
- Reductions in other vehicular air pollutants
- The development of a useful model for efficiently using energy and traffic signals

(U.S. Mayors Conference 2007, pp 35).

IV. Transportation

Mass Transit and Carpool options

- City employees work a 9 days / 80 hours schedule, to alleviate traffic congestion, achieve emissions reduction and improve energy efficiency.

Costs and benefits: This schedule, implemented at no cost, resulted in emissions reductions, traffic congestion reduction, and improved energy efficiency due in part to electricity to facilities being off for two extra days per month (U.S. Mayors Conference 2007, pp 77).

- Berkeley offers free bus passes and transit incentives as subsidies for use with BART or other transit operators to all city employees (City of Berkeley, 2007).

- Santa Cruz offers free bus passes for city employees to commute to work, CNG (compressed natural gas) van employee carpool for city employees, and other carpool incentives such as permit for reserved parking spaces at City Hall for employees who carpool a minimum of twice a week (<http://www.ci.santa-cruz.ca.us/pw/ep/measures.html>).

- In addition to Albuquerque's new carpool matching program and additional hybrid diesel/electric buses that will provide transportation alternatives, the city is considering the use of free bus passes to city employees for both city business and personal use, and free parking for all hybrid vehicles at parking meters (<http://www.cabq.gov/sustainability/green-goals/transportation-options>).

Bike and Pedestrian Programs

- Santa Cruz's bike programs, such as Police on Bikes, Free Bike Racks for local businesses supplied upon request, 0% interest bike loans for city employees, and the Yellow Bike Program, which requires impounded bikes to be repaired, painted yellow, and then distributed throughout the city for residents to use for local commutes (<http://www.ci.santa-cruz.ca.us/pw/ep/measures.html>).

- Austin's Bicycle and Pedestrian Program integrates bicycles and walking into the transportation system of the city by working with all city departments and other governmental agencies to create complete and accessible sidewalk networks, more bicycle lanes, wide curb lanes, and other facilities (<http://www.ci.austin.tx.us/bicycle/>)

- Dublin maintains a network of bicycle and pedestrian trails that provide access for commuters to the business parks and BART (Bay Area Rapid Transit) stations. New development projects include a requirement to provide connecting trails when possible.

Costs and benefits: The city maintains nine miles of trails at a cost of \$47,000 annually, which is slightly over 1% of the city's overall annual public works operating budget of nearly \$3 million (U.S. Mayors Conference 2007, pp 13).

- G.O. Boulder is a program where the city works with residents and institutions to address future transportation needs through educational information, outreach programs and innovative programs such as the Community Transit Network of high frequency buses and the extensive system of off-street bicycle paths, pedestrian paths and underpasses (Boulder City, 2007).
- Berkeley's Bicycle Boulevard Network was created by the city to provide bicyclists with clearly marked and safe routes throughout the city (City of Berkeley, 2007).

Alternative Fuels

- The Austin's Plug-in Partners Campaign is a national grass-roots initiative initiated and organized by the City of Austin to demonstrate to automakers that a market for flexible-fuel plug-in hybrid electric vehicles exists today.

Costs and Benefits: Plug-in hybrids vehicles have several advantages as they can drive from 20 to 60 miles without the use of gasoline after being charged in a standard electrical outlet. A motorist driving 9,000 annual gasoline-free miles and 3,000 using gasoline would get 100 mpg mileage (U.S. Mayors Conference 2007, pp 53).

- The City of Irvine is one of only a few nationwide to support a zero-emission shared-use vehicle program using electric cars. Initiated in April 2002, the Zero Emission Vehicle-Network Enabled Transport program (ZEV-NET) makes zero-emission vehicles available to participating employers to transport employees to and from the Irvine Transportation Center (U.S. Mayors Conference 2007, pp 59).

Costs and benefits: Key benefits from this program include less traffic congestion, clean air quality, raising awareness of alternative fuels and promoting mass transit and carpooling.

- The City of Irvine is a founding member of the Plug-in Partners, a national grass-roots campaign that promotes a market for flexible-fuel hybrid electric vehicles. The viability of this market will be demonstrated through development of rebates and incentives, “soft” fleet orders, petitions and endorsement by other cities across the country (U.S. Mayors Conference 2007, pp 59).

- Medford implemented the Clean School Bus Program which retrofitted the entire school bus fleet to ULSD fuels, and the addition of DOCs and DPFs on all buses. The school also initiated the No-Idling Policy, which created No Idle Zones around every school in the city by requiring that neither buses nor passenger vehicles should be left running outside of the schools and educating the staff and the parents on the benefits of reduced idling and using clean diesel fuel (U.S. Mayors Conference 2007, pp 32).

V. Land Use

Urban Planning

- Approval of high-density residential housing developments to be built adjacent to the existing East Dublin and proposed West Dublin BART stations.

Costs and benefits: There are no direct costs to the city for this program, which prevents urban sprawl, reduces passenger transportation miles traveled, and encourages mass transit, while reducing a variety of emissions (U.S. Mayors Conference 2007, pp 13).

Landscaping

- All landscape renovations, construction and maintenance performed by the City of Dublin must employ sustainable landscape management techniques, including integrated pest

management, grasscycling, drip irrigation, composting, and procurement and use of mulch and compost produced from regionally generated plant debris and food waste programs

(<http://www.ci.dublin.ca.us/Departments.cfm?PL=env>).

- The development of the Albuquerque City Urban Forest Master Plan, an urban forestry program to regulate and manage the city's 160,000 trees, and plant an additional 2000 trees per year (<http://www.cabq.gov/sustainability/green-goals/trees/urban-forest>).
- Berkeley implemented an extensive tree planting program, which includes an existing 36,000 trees and additional 300 trees planted per year, decreasing energy use through increasing shade and cooling effects, while improving air and life qualities (City of Berkeley, 2007).
- Austin established the Heat Island Containment Policy which offers private and municipal development incentives for reflective roofs and extensive shade tree plantings to offset the heat island effect (<http://www.ci.austin.tx.us/trees/programs.htm>).
- Boulder initiated a tree planting program through which the city plants an average of 130 trees per year. It is estimated that Boulder's trees store an estimated 109,000 metric tons of carbon and sequester about 1,900 tons annually (Boulder City, 2007).

Landfill use

- Landfill methane gas recovery systems have been installed in Santa Cruz's landfills. These systems capture 75% of methane emitted from the city's main landfills through vertical wells, and burn it to generate electricity at a gas-to-energy plant

Costs and benefits: In addition to reducing methane emissions by 75%, the Gas-To-Energy plant converts the collected landfill gas into electricity, which is then sold to the Pacific Gas and Electric Company. The city receives royalties from these power sales ((<http://www.ci.santa-cruz.ca.us/pw/ep/measures.html>)).

- Methane gas recovery, through which Hayward has reduced its consumption of power company electricity, uses methane gas previously flared at the water pollution control facility, as fuel for engines driving electric generators.

Costs and benefits: This co-generation plant provides about 300 kWh of electricity, which is equal to a third of the facility's energy needs, eliminated a source of air pollution and reduced the amount of electricity the local energy supplier would otherwise have to deliver. The city has realized savings of between \$300,000 and \$400,000 a year for purchased electricity. The program results in an overall savings through cost avoidance, which benefits wastewater system rate payers (U.S. Mayors Conference 2007, pp 43).

- The City of Albuquerque has finished installing landfill gas (LFG) collection and control systems at Albuquerque's closed landfills, where methane (a powerful GHG) produced by waste decomposition is collected through deep wells, and used to fuel a turbine to generate electricity (U.S. Mayors Conference 2007, pp 38).

VI. Public Outreach

- Austin's Green Building Program offers resources, consulting, workshops and educational events to residential and business owners to encourage energy efficient buildings and renewable energies (<http://www.austinenergy.com>)

- Boulder organizes workshops, lectures, and educational events such as Solar Week and October Energy Awareness Month to raise public awareness about climate protection issues, renewable energies and energy efficiency programs (Boulder City, 2007).

- Boulder's free Energy Efficiency Starter Kits are distributed to interested individuals and groups at farmers markets and community meetings. The starter kit includes a collection of

information and simple energy efficiency measures and actions residents can take and green building practices

Costs and benefits: 550 homes were visited; 300 kits were distributed; 81 kits were given away to delivery staff and walk-ins. 63 households in two neighborhoods took advantage of the free home energy audits. 3,048 CFLs were distributed. Based on both the audit and kit evaluation results, recipients appear to have immediately used, on average, about 4.3 bulbs per household. 1,524,000 kWh savings in electricity use are expected over the life of the bulbs, assuming all bulbs distributed will be used. The equivalent GHG emissions reduction is 1,193 mtCO₂ (Boulder City, 2007).

- Dublin's Clean Air Consortium Checklist, through which city employees are required to comply with a set of energy efficient practices including anti-idling policy (U.S. Mayors Conference 2007, pp 25).
- The City of San Marcos Electric Department purchases program materials for the 600 sixth grade students in the area, at an annual cost of \$14,000 to raise awareness of energy efficiency and resource conservation. Each student is given a workbook to take home and fill out with parents. The PowerHouse workbook asks for details concerning electrical appliances and water use, and other energy resources used at the student's home. Students and parents alike learn about the everyday impacts and choices they have on natural resources (U.S. Mayors Conference 2007, pp 51).
- Medford also initiated the Medford Leads with Clean Energy Campaign, aimed at educating the public and investigating opportunities for clean renewable energy projects through the creation of numerous public outreach materials including poster/flyers, banners, website, direct mailing, PR materials, and other events.

Costs and benefits: During the campaign, almost 3,000 people visited the website in an eight month period. It is estimated that about 39,000 residents were reached in some way by this campaign. The MCEC was awarded \$15,000 to participate in Mac's Education and Outreach Awareness Program which funded the *Medford Leads with Clean Energy Campaign*. Through this campaign the city of Medford has earned almost \$20,000 in MTC Clean Energy Choice matching grants that will be used for future renewable energy related projects throughout the city (U.S. Mayors Conference 2007, pp 47).

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Chapter 4 The Compilation of Actions Taken on Climate Change by the State of California and Impacts on the City's Potential Climate Actions

As evidence of human induced climate change has mounted within the last few years, states across the country have responded with various ways to confront the impending threat. Climate change is widely recognized by scientists throughout the world to be one of the most daunting challenges of our time. The adoption of climate change mitigation programs and precautionary measures is imperative if climate change emissions are to be reduced and stabilized, and communities are to successfully adapt to the coming impacts of climate change.

California is ranked as the twelfth largest source of annual GHG emissions in the world, exceeding most entire countries. Therefore, actions taken in this state make a significant difference, not only because we are a major contributor to the problem, but also because California is known throughout the world as a leader in effectively addressing public health and environmental issues. Though adequate attention and action related to combating climate change has been lacking at the federal level, California – soon to be followed by at least dozen other states - has been leading the charge at the state level through legislation, regulation, and other proactive programs and actions.

I. Policies and Actions Taken by California on Climate Change

A. Climate Change Legislation

California's involvement in climate change legislation dates back nearly 20 years. In 1988, the Energy Commission was made the lead agency for climate change issues under Assembly Bill 4420 of 1988 (City of Berkeley 2007, pp32), and since then, much other legislation has emerged, including most importantly:

Senate Bill 1771 Sher, 2000, required the California Energy Commission (CEC) to prepare an inventory of the state's GHG emissions, to study data on global climate change, and to provide government agencies and businesses with information on the costs and methods for reducing GHG. It also established the California Climate Action Registry to serve as a certifying agency for companies and local governments to quantify and register their GHG emissions for possible future trading systems (State of California, 2007)

SB527 Sher, 2001, required the California Energy Commission to provide guidance to the California Registry on a number of issues, such as developing GHG emissions protocols, and third-party organizations to provide technical assistance and certification of emissions baselines and inventories (State of California, 2007).

Senate Bill 1078 Sher, 2002, established a Renewable Portfolio Standard, which required electricity providers to increase purchases of renewable energy resources to 20% renewable resources. This law requires California's three large privately owned utilities – Pacific Gas & Electric, Southern California Edison, and San Diego Gas & Electric – to increase utility renewable energy sales 1% annually to reach 20% by 2017 (City of Berkeley 2007, pp32).

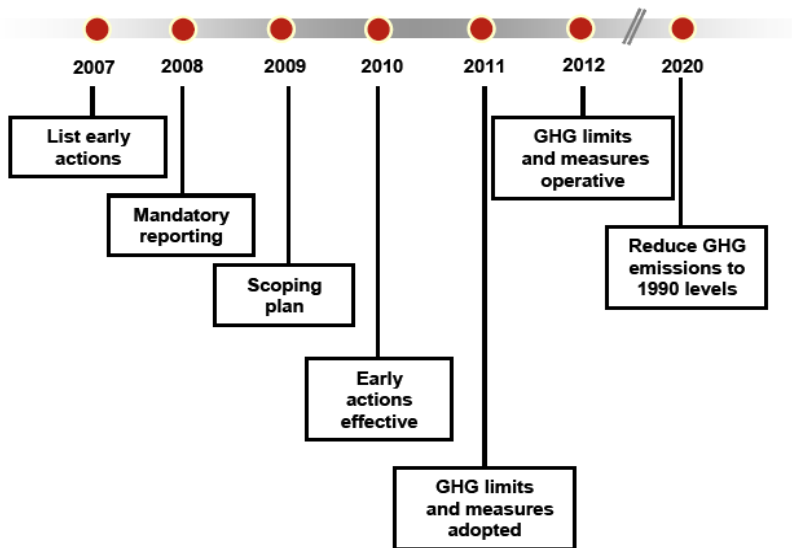
Senate Bill 1368, Perata 2002, mandated that the California Energy Commission, in consultation with the California Public Utilities Commission and the California Air Resources Board, institute a proceeding for establishing a GHG emission performance standard for all baseload generation of locally publicly owned electric utilities at a rate of GHG emissions that is no higher than the rate of emissions of GHG for combined-cycle natural gas baseload generation (State of California, 2007).

Assembly Bill 1493 Pavley, 2002, required the State Air Resources Board to develop and adopt regulations that achieve the maximum feasible reduction of GHG from vehicles primarily used

for non-commercial transportation by January 2005. This bill requires automakers to reduce emissions by 30% by 2016. Although it has been challenged in the courts by the automakers, support for the law is growing as other states have adopted similar legislation (State of California, 2007).

AB 32 Núñez & Pavley, 2006, widely known as the Global Warming Solutions Act, this bill institutes a mandatory limit on GHG emissions - reducing emissions in California to 1990 levels by the year 2020, or 25% below forecasted levels. This agreement represents the first enforceable state-wide program in the U.S. to cap all GHG emissions from major industries that includes penalties for non-compliance. This requires the Air Resources Board (ARB) to establish a program for statewide greenhouse gas emissions reporting and to monitor and enforce compliance with this program. The bill authorizes ARB to adopt market-based compliance mechanisms including cap-and-trade, and allows a one-year extension of the targets under extraordinary circumstances. On June 1, 2005, Governor Schwarzenegger signed Executive Order #S-3-05 establishing a GHG reduction target of reducing emissions to 2000 levels by 2010, to 1990 levels by 2020 and 80 percent below 1990 levels by 2050 as shown in the figure below (City of Berkeley 2007, pp32).

Figure 1
Comprehensive Multiyear Program
Established by AB 32



(http://www.climatechange.ca.gov/climate_action_team/reports/2007-04-20_ARB_early_action_report.pdf)

B. California Climate Actions and Programs

California has long been the state-level pioneer in environmental actions related to global warming and has shown some impressive leadership in the last four years, demonstrated in various programs and actions such as:

1. The California Climate Action Registry (the Registry)

The Registry was established by SB 1771 as a non-profit voluntary registry for GHG emissions, with the purpose of helping companies and organizations with operations in the state to establish GHG emissions baselines against which any future GHG emission reduction requirements may be applied. Participants including businesses, non-profit organizations, municipalities, state agencies, and other entities can record their GHG emissions inventory using any year from 1990 forward as a base year. The Registry encourages voluntary actions to increase energy efficiency and decrease GHG emissions, as the State of California, in turn, provides participants with appropriate consideration for early actions in the event of any GHG

regulatory scheme. The Registry has developed a General Protocol and additional industry-specific protocols which give guidance on how to inventory GHG emissions for participation in the Registry. The Registry requires the reporting of only CO₂ emissions for the first three years of participation, although participants are encouraged to report the remaining five GHGs covered in the Kyoto protocol (CH₄, N₂O, HFCs, PFCs, and SF₆). The reporting of all six gases is required after three years of Registry participation (The Climate Registry, 2007)

2. The Climate Action Team's Proposed Early Actions

The Climate Action Team (CAT) was created by the Governor (via Executive Order) and is chaired by the Secretary of the California Environmental Protection Agency (Cal-EPA). Headed by The Cal-EPA, members, including representatives of various state agencies listed below, developed a set of actions and programs aimed at reducing California's GHG emissions. Most of these actions are underway or are projected to be in effect no later than January 1st of 2010, while other actions may be implemented at a later date. The following actions were proposed in the Climate Action Team's Proposed Early Actions document available online at: http://www.climatechange.ca.gov/climate_action_team/reports/2007-04-20_CAT_REPORT.PDF

The Business Transportation and Housing Agency (BTH):

- Smart Land Use and Transportation Efficiency: The Department of Transportation (Caltrans) will reduce congestion, improve travel time, and promote integrated land use-transportation decisions that include GHG emissions analysis and energy efficiency factors into the land use planning, transportation plans and development projects. The BTH Agency intends to join the California Climate Action Registry, which will complement efforts to determine GHG emissions from transportation. This strategy is expected to result in GHG emissions reduction of

approximately 10 million metric tons of CO₂ emissions (MMTCO₂E) by 2020 (Climate Action Team, pp 7).

The Department of General Services (DGS):

- **Green Building Initiative and Other Related Efforts:** There are 27 retro-commissioning projects underway or completed that will yield an 8 percent to 10 percent reduction in energy usage and corresponding GHG emission reductions for each building. At least 21 more buildings will be retro-commissioned during calendar year 2007. DGS is putting substantial efforts into retro-commissioning state buildings owned and operated by DGS and other departments including: Department of Motor Vehicles, Transportation, Developmental Services, Veterans Affairs, Technology Services, Parks and Recreation, Health Services, Food and Agriculture, the California Highway Patrol and the California State Lottery (Climate Action Team, pp 8).

- **Solar Generation:** Within the last year, California has implemented over 3 megawatts of clean solar power generation, with another 1 megawatt coming on line this year. The second round of solar generation implementation is anticipated to total 10 additional megawatts and may include UC/CSU campuses and state fairgrounds (Climate Action Team, pp 8).

- **Energy Efficiency Benchmarking:** The DGS has benchmarked its 52 state-owned buildings for energy efficiency and is leading an effort to support other state agencies in benchmarking the remainder of 1,600 state-owned facilities by June 1, 2007 (Climate Action Team, pp 8).

- **Desktop Power Management:** The DGS has implemented server-based desktop power management software that will reduce electricity use by desktop computers by 40 %. The Cal-EPA, the DMV and the Department of Transportation are implementing the software as well (Climate Action Team, pp 8).

- **LEED Certification:** The State now has 9 buildings that are certified by the Leadership in Energy and Environmental Design (LEED) program, which includes lower energy usage and lower GHG emissions. LEED certification is being pursued on 85 additional new and renovated buildings totaling over 5.4 million square feet, as well as eight existing buildings totaling over 2.6 million square feet. Additionally, all smaller buildings less than 50,000 square feet in size are being designed and constructed to meet LEED standards (Climate Action Team, pp 8).

- **High Performance Schools:** The state has adopted new guidelines for energy and resource efficient schools and is currently processing the first applications for up to \$100 million in bond money for construction of sustainable, high performance schools (Climate Action Team, pp 8).

- **Contracting for Environmentally Preferable Products:** New state contracts have been created for more energy and resource efficient IT goods, copiers, low mercury florescent lamps, the California Gold Carpet Standard, and office furniture all of which lower GHG emissions due to environmentally preferable design and manufacturing standards. These combined strategies are expected to result in GHG emissions reduction of 2 MMTCO₂E by 2020 (Climate Action Team, pp 8-9).

- **Transportation Policy Implementation:** This policy, which is implemented by the DGS, requires a minimum ultra low emission vehicle (ULEV) standard for DGS gasoline vehicles and requires the purchase of alternative fuel and hybrid-electric vehicles, and replacing 800 additional vehicles this year with new, more efficient vehicles (Climate Action Team, pp 9).

The California Air Resources Board (CARB):

- **The Vehicle Standards Policy:** AB32 required ARB to adopt regulations to achieve the maximum feasible and cost-effective reduction of GHG emissions from passenger vehicles and

light-duty trucks. These vehicles standards are scheduled to take effect in the 2009 model year, and are estimated to result in an emissions savings of approximately one MMTCO₂E by 2010 and 30 MMTCO₂E by 2020. While the ARB's request for a federal waiver to implement its motor vehicle regulations is currently pending before the U.S. EPA, (and Attorney General Brown intends to litigate should the waiver not be granted) the ARB is defending its legal authority to impose such standards in federal court (Air Resources Board, pp 10).

- The Diesel Reduction Measure: ARB has adopted numerous regulations to reduce diesel particulate matter (PM) since 2001, and further regulation is under near-term consideration. In addition to the net warming effect of black carbon and other health effects from PM, some of the diesel rules result in fleet modernization, fuel switching, and/or greater fuel savings. Twenty diesel risk reduction measures have been adopted between October 2001 and November 2006, including rules for low-sulfur diesel fuels, diesel truck operational idling limits, transit bus rules, garbage truck rules, school bus replacements and retrofits, stationary diesel engine rules, agricultural engine rules, portable engine rules and border truck inspection protocols (Air Resources Board, pp 10).

- Low Carbon Fuel Standard: This measure will require fuel providers (including producers, importers, refiners, and blenders) to ensure that the mix of fuels they sell in California meets, on average, a declining standard for GHG emissions that result from the use of transportation fuel. The Low Carbon Fuel Standard (LCFS) would establish a "carbon content" standard that will reduce the "carbon intensity" of California's vehicle fuel by at least 10 percent by 2020. The LCFS requires suppliers to bring lower carbon intensity fuels to the market, including biofuels such as ethanol and biodiesel, as well as hydrogen, electricity, compressed natural gas, liquefied petroleum gas and biogas (Air Resources Board, pp 13).

- **Restrictions on High Global Warming Potential (GWP) Refrigerants:** These measures have recently been adopted, and will restrict the use of high GWP refrigerants - mainly Hydrofluorocarbons (HFCs) - for non-professional recharging of leaky motor vehicle air conditioning systems (MVACS). Most importantly, HFC-134a, has a GWP of 1300 as compared to CO₂ (with a GWP of 1). Specifically, the Climate Action Plan identified five HFC reduction measures include:

- Mitigation of impacts of refrigerant available at retail for servicing MVACS.
- Requirement of low-GWP refrigerants in new MVACS.
- Improvements in stationary refrigeration and air conditioning.
- Inclusion of a refrigerant leak test and repair in California's Smog Check Program
- Enforcement of the federal ban on release of HFCs during servicing and dismantling of MVACS (Air Resources Board, pp 14).

The California Department of Forestry and Fire Protection (CalFire):

- **Urban Forestry:** CalFire is working on a new forestry protocol for urban forestry. An initial draft protocol outline for measuring urban forestry emission reductions has been completed. Partnering with local government and private sector entities, the objective of this strategy is to expand efforts with the end result of five million additional trees in urban areas by 2020 (Climate Action Team, pp9).

- **Forest Conservation and Reforestations Measures:** CalFire has met several times with the ARB to discuss carbon protocols for reforestation that have been approved by CCAR. PG&E has an accepted voluntary tariff to subsidize tree planting. SC-Edison has contacted CalFire to discuss carbon sequestration opportunities through voluntary forest projects. This strategy is

expected to result in GHG emissions reduction of 2 MMTCO₂E by 2020. CalFire is also looking at opportunities for carbon sequestration in the Prop 84 Forest Land Conservation program to conserve an additional 75,000 acres of forest landscape by 2010 (Climate Action Team, pp 9).

The California Energy Commission (CEC):

- **Regulation of Greenhouse Gases from Load Serving Entities:** In response to SB 1368, the CEC and the CPUC have been collaborating on utility procurement practices to address ways to transition away from carbon-intensive electricity sources. The CPUC adopted its regulations for the investor-owned utilities in January, 2007. The CEC intends to adopt regulations by June, 2007 requiring municipal utilities to transition away from carbon-intensive generation. These strategies are expected to result in a GHG emissions reduction of over 15 MMT CO₂E by 2020 (Climate Action Team, pp 6).

- **Energy Efficient Appliance Standards:** CEC has the authority to regulate light bulb efficiency. The California Energy Commission is considering options for light bulb standards and anticipates adopting standards by January 1, 2010 (Climate Action Team, pp 5).

- **New Solar Homes Partnership:** The CEC approved implementation rules for new residential solar installations. Effective in January 2007, approved solar systems will receive incentive funds based on system performance above building standards. This program will result in 400 MW of new, emissions-free generating capacity. More details about this program are discussed further below (Climate Action Team, pp 5).

The Department of Water Resources (DWR):

- **Water Use Efficiency:** DWR will adopt standards for projects and programs funded through water bonds that would require consideration of water use efficiency in construction and

operation, including the implementation of the Urban Best Management Practices that are locally cost-effective (Climate Action Team, pp 5).

- **State Water Project:** DWR will evaluate the State Water Project (SWP) energy resources and include feasible and cost-effective renewable energy in the SWP's portfolio. As DWR completes a GHG assessment through membership with the Climate Action Registry, and investigations of cleaner energy sources to replace reliance on the Reid Gardner power plant, the SWP will be able to significantly reduce its GHG emissions. In renewing energy supply contracts for the State Water Project, it is DWR's goal not to renew contracts supplied by conventional coal power generation. One specific example of this is DWR's ownership interest in the Reid Gardner power plant near Las Vegas, Nevada. Upon expiration of the contract in 2013, DWR will not extend its ownership interest in the Reid Gardner plant (Climate Action Team, pp 5-6).

The Integrated Waste Management Board (IWMB):

- **Zero Waste/High Recycling Strategy:** Building from the successful 50% statewide recycling goal, substantial efforts to move toward zero waste through requiring commercial recycling and waste prevention are projected to provide an additional 3 MMTCO₂e by 2020 (Climate Action Team, pp 11).

- **Landfill Gas Recovery:** The IWMB is jointly developing a regulatory measure that will require landfill gas recovery systems on the few dozen small to medium landfills that do not have them, and increase the efficiency of existing landfill methane systems to represent best capture and destruction efficiencies (Climate Action Team, pp 6).

The California Public Utilities Commission (CPUC):

- **Energy Efficiency Programs:** Planning has begun for 2009-2011 energy efficiency portfolios. In 2007, the CPUC is evaluating the design of a risk/reward incentive mechanism for utilities to encourage additional investment in energy efficiency. Also in 2007, the CPUC will develop new aggressive targets for efficiency between 2007 and 2020. In developing 2009-2011 portfolios, the CPUC will evaluate new technologies and new measures that could deliver additional energy savings through these programs; new ideas include new options for encouraging compact fluorescent lighting in residential and commercial buildings. This strategy is expected to result in GHG emissions reduction of 4 MMTCO₂E by 2020 (Climate Action Team, pp 12).

- **Water Conservation:** The CPUC adopted a Water Action Plan which includes a number of initiatives to encourage water conservation, including: rate design reform, conservation program investment by water utilities, and partnering with energy utilities (Climate Action Team, pp 12).

Carbon Capture and Sequestration: Several proposals for power plants with integrated gasification combined cycle (IGCC) and/or carbon capture are expected in the next 18 months. If projects proposed to sell to California IOUs, CPUC would need to approve the contracts. This item falls under the auspices of SB1368. The project approval process will be handled on a case by case basis as it relates to reaching the GHG emissions goals of SB 1368 (Climate Action Team, pp 14).

3. **The California Solar Initiative / Million Solar Roof Program:**

As part of Governor Schwarzenegger's \$ 3.3 billion Million Solar Roofs Program, California has set a goal to create 3,000 megawatts of new, solar-produced electricity by 2017.

The State is moving toward a cleaner energy future and helping lower the cost of solar systems for consumers by providing incentives for existing and new residential homes, and commercial, industrial, and agricultural properties based on system performance. This strategy is expected to result in GHG emissions reduction of 1 million metric ton of CO₂ by 2020.

The overall goal is to help build a self-sustaining photovoltaic, solar electricity market through:

- Photovoltaic incentives starting at \$2.50 per watt for systems up to one megawatt in size.
- Funds for solar installations for existing and new low-income and affordable housing.
- A pay-for-performance incentive structure to reward high-performing solar projects.

The California Energy Commission manages also a 10-year, \$400 million program to encourage solar power in new home construction through its New Solar Homes Partnership.

The California Solar Initiative will be coordinated with the state's energy efficiency, "smart" metering, and building standards programs at the Public Utilities Commission and Energy Commission, ensuring that the state is using its energy resources wisely (California Energy Commission, 2007)

II. Impact of state legislation and proposed actions and programs on Laguna Beach's potential actions to reduce GHG emissions

While the city of Laguna Beach's emerging Climate Action Plan will produce important cost-effective actions to reduce the local GHG emissions (and provide other environmental and safety benefits), preemptive state and regional authority may stand as a limit to implementing some changes and policies. However, due to the enthusiastic leadership demonstrated in climate change mitigation legislation and policies recently adopted by California, many of what might have been barriers have now being replaced with incentives and partnership programs that

require a collaborative effort with the state and regional governments, and often provide grants and funds to the municipalities to achieve their shared goals.

Many GHG-producing activities are outside the jurisdiction of municipal governments, as most U.S. cities have limited control over local utilities, or vehicle emissions controls and fuels, and are thus unable to induce large scale energy conservation and/or fuel switching (Betsil, 2001). For instance, the city has little authority over the amount of renewable energy it purchases, since the city's electricity needs are provided by non-municipal energy providers, namely SC Edison and the San Diego Gas and Electric companies (www.lagunabeachcity.net). Thus any policies or actions aimed at increasing the amount of renewable energies used by the entire city would require combined effort with the energy providers and the regional utilities.

Energy audits and building retrofits are also managed by these entities and further magnify the need for combined efforts. Also, The California Solar Initiative is managed by the California Energy Commission and coordinated with the California Public Utilities Commission's Smart Metering and Energy Efficient Building programs; consequently actions and programs developed by the city will require a careful study of the various opportunities and partnerships available for cities and large communities. The city should also serve as a portal to renewable energy opportunities and incentives through public outreach programs and local campaigns.

Policies and actions focused on transportation, including efforts to reduce traffic congestion, retrofit signal lights into LED technology, or/and improve alternative transportation options must be coordinated at the state/regional level through the Department of Transportation (Cal-Trans) or/and the Orange County Transportation Authority (OCTA). Switching the trash-hauler trucks fuels from diesel to biodiesel and installing diesel particulate filters will need a

coordinated effort with Waste Management. Actions aimed at switching fuels for school buses may also be superseded by state actions, as these operations do not fall within the city's jurisdiction. Religious centers, museums and other buildings and facilities that do not fall within the city's authority may require an inter-community combined effort.

Furthermore, tree planting programs, methane recovery projects, and recycling measures may be superseded by the state's existing policies and programs, such as the CalFire's Urban Forestry program, the Department of Water Resources' Water Use Efficiency Program, and the Integrated Waste Management Board's Zero Waste Measure and Landfill Methane Recovery Program. Laguna Beach may, however, benefit from these programs through grants, funds, and technical assistance as most of California's programs require combined efforts with the municipalities. Finally, the City of Laguna Beach may participate in the Climate Action Registry, to which it can report its GHG emissions after a complete GHG inventory program is achieved, and may benefit from the technical and administrative assistance offered through the Registry.

Conclusion

While California remains one of the world's largest generators of GHG emissions, it is at the forefront of the movement to combat climate change. A variety of legislation and actions testify to California's commitment to mitigate climate change in the most cost-effective manner. To achieve the ambitious goals stated on Assembly Bill 32, the measures proposed by the Climate Action Team need to be implemented as planned, but should also adapt to the changing technologies and involve municipalities and the community through accessible partnership programs and activities. In developing its own Climate Action Plan, the city of Laguna Beach's proposed actions and policies may be superseded by state (and potentially federal) actions and

legislation. In the absence of municipal ownership or jurisdiction, the city of Laguna Beach can send market signals to local utilities in the form of demand for green power, require technical and financial assistance from state agencies in the development of renewable energy systems and energy efficiency programs, develop local outreach and education programs, and participate in the State's various programs described earlier. Cities also typically retain the authority to establish many building standards. While California demonstrates once again its national and international leadership in environmental legislation and policy implementation, more comprehensive regulations will also be necessary at the federal, state and local level to encourage large-scale energy conservation and switching to alternative fuels and renewable energies, and ensure a cleaner and safer future for the many generations to come.

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Chapter 5 Information on how the City of Laguna Beach can Construct a GHG Inventory

Although a relatively new field, accounting for greenhouse gas emissions has evolved rapidly over the last ten years as pioneer practitioners worldwide standardize methods and protocols for calculating GHG emissions. ICLEI – Local Governments for Sustainability, is a leader in developing accounting methodology and setting standards for local communities' GHG emission inventories such as the Clean Air Climate Protection Software (CACPS) (ICLEI, 2007).

Provided by the ICLEI's Cities for Climate Protection Campaign (CCP), the CACPS is used by many communities worldwide to help organize and convert data into GHG emissions and create reports that display the emissions levels through different categories including: energy use, transportation, waste management and other GHG sources (City of Berkeley 2007, p6). Each category is analyzed separately by obtaining data from corresponding agencies and utilities, and converting this information into GHG emission using appropriate conversion factors. GHG accounting may sometimes be challenging, first because of the relative newness of its methodology, and second because of the lack of availability of GHG emissions data and precision in its calculations (BAQMD 2007, p14). However, since most local governments use relatively similar methods in tracking their GHG emissions levels- the CACPS being the most used, the GHG emissions inventory results are kept reasonably consistent.

A. Methods and Analysis

A GHG inventory identifies and quantifies the GHG emissions produced by both government operations and the community at large in a particular year. This emissions analysis identifies the activities that contribute to emitting the GHG and the quantity generated by each of these activities (City of Seattle et al., p8)

An inventory is established by collecting data about energy use, transportation, waste management and any GHG emitting source within the jurisdiction of the city. This information is inputted into the CCP software and converted from its unit of measure, such as kilowatt hour of electricity, therms of gas, or gallons of oil, into million British Thermal Units (MMBTU) and tons of equivalent carbon dioxide (eCO₂) (City of Medford, p6). Municipalities can calculate city-wide GHG emissions for a base year (e.g. 1990) and for a forecast year (e.g. 2012). Expertise in climate science is not necessary, and a wide range of government staff members, from public works to environment and facilities departments, can conduct an inventory (City of Seattle et al., p8).

B. The Cities for Climate Protection Campaign's Clean Air/Climate Protection Software

This software, available upon joining the ICLEI Cities for Climate Protection Campaign, allows cities to calculate emissions and emissions reductions, as it helps track and quantify emissions outputs and develop emissions scenarios to inform the planning process from energy use, transportation, waste data, and land use data (City of Seattle et al, p8). ICLEI's Technical Program Officers provide training and technical expertise to cities using the CACP software and implementing the CCP five milestones. This program is available at:

<http://www.cacpsoftware.org> : The Software's Official Website.

<http://www.iclei.org/index.php?id=1118> : The Cities for Climate Protection Campaign Website.

ICLEI coordinates its work with the California Climate Action Registry, the U.S. Department of Energy, the U.S. Environmental Protection Agency, Canada-based software developers Torrie Smith Associates, and, more recently, the State and Territorial Air Pollution Program Administrators-Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) (BAQMD 2007, p 14).

The CACP software determines emissions using specific coefficients according to the type of fuel used. Emissions are aggregated and reported in terms of equivalent carbon dioxide units, or CO₂e. (City of Berkeley 2007, p 6) Converting all emissions to equivalent CO₂e units allows for the consideration of different greenhouse gases in comparable terms. For example, methane is twenty-one times more powerful than carbon dioxide in its capacity to trap heat, so the model converts one ton of methane emissions to 21 tons of CO₂e (City of Berkeley 2007, p 6). The CACP software has been and continues to be used by over 200 U.S. cities and counties to quantify the reduction in their GHG emissions.

C. Constructing a GHG Emissions Inventory

1. Energy Use

California's electricity grid receives power from many locations and energy sources (BAQMD 2007, p 15). It is impractical to determine the exact amount of greenhouse gases emitted by electricity consumption because this would require identifying the exact sources, coefficients, and mix for the electricity. The U.S. Department of Energy annually determines each state's emissions coefficient based on the average amount of power supplied from various sources. The coefficient used for California is 0.73 lbs of CO₂ emissions for every 1 kWh consumed (BAQMD 2007, p 15). Converting natural gas usage to GHG emissions requires no coefficient specific to time or place. Natural gas is almost entirely methane. Each molecule of methane becomes one molecule of CO₂ upon combustion, equal to about 12 pounds of CO₂ released for each therm of natural gas consumed (BAQMD 2007, p 16). To construct the energy use portion of the city's GHG inventory, the following steps should be taken:

- a. Obtain electricity (kilowatt-hours) and natural gas (therms) data from the California Energy Commission (www.energy.ca.gov), the California Public Utility Commission

(www.cpuc.ca.gov), SC Edison (www.SCE.com), and the San Diego Gas and Electric companies (www.sdge.com). This data is organized by the following sectors: residential, commercial, municipal use and other categories if available.

- b. Enter this data into the CACP software, or use standard coefficients of conversion to compute GHG emissions.
- c. Obtain geographic and demographic data from the U.S. Census, including total population, number of residential, commercial and municipal establishments, and any other related data.
- d. Enter these census figures into the software to compute per capita, per employee, and per establishment emissions.

However, it is worth noting that, although the software provides a sophisticated and useful tool, calculating emissions from energy use with precision is difficult. The model depends upon numerous assumptions, and it is limited by the quantity and quality of available data (City of Berkeley 2007, p 6). With this in mind, it is useful to think of any specific number generated by the model as an approximation, rather than an exact value.

2. Transportation

Traffic and vehicle data including vehicle miles traveled, traffic counts (number of vehicles and trucks per day per location), and other traffic information are available online through the Traffic and Vehicle Data System Unit by the Department of Transportation (CalTrans) at <http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/> . Other information concerning traffic data, fuel consumption, and GHG emissions per vehicle may be obtained from the California Air Resource Board (<http://www.arb.ca.gov>), the South Coast Air Quality Management District (<http://www.aqmd.gov>), the Orange County Transportation Authority (www.octa.net), and other state and regional agencies. This data may be categorized into

commercial (truck) operations, and vehicle passenger emissions, and then converted into GHG emissions through coefficients of conversion that include average miles-per-gallon, and average lbs of CO₂ emitted per gallon of gasoline. Steps for calculating GHG emissions from transportation are (BAQMD 2007, p 20):

1. Obtain the number of total daily vehicle miles traveled (VMT) from the Department of Transportation, and multiply by 365 to calculate annual VMT.
2. Using state averages available from the MTC, break down VMT figures using a complex breakdown based on vehicle type and size class. CACP software performs this step.
3. Calculate the number of gallons of fuel used given average fuel efficiency of each type of vehicle. CACP software performs this step.
4. Convert estimated gallons of gasoline and diesel combusted in Sonoma County vehicles into GHG emissions. CACP software also performs this step.

GHG emissions from transportation data are considered the most difficult to estimate, first due to the variability in MPG per vehicle type and second because of the lack of availability of information on vehicle types in traffic data.

3. Solid Waste Data

Data on methane emissions from Laguna Beach's waste generation may be obtained from the Orange County Integrated Waste Management District (www.OCLandfills.com), the Integrated Waste management Board (<http://www.ciwmb.ca.gov/>), and the OC Waste Management Company (<http://www.wmorangecounty.com>). Data may be difficult to obtain due to the lack of availability of methane emissions measurements from landfills. However, the CACP software calculates solid waste emissions and is designed to be used in communities with a variety of waste disposal methods, including open dumping, landfilling and incineration (City

of Berkeley 2007, p 9). The CACPS's emissions calculations from waste disposal are based on the U.S. EPA's Waste Reduction Model (WARM) and are consistent with national standards. The CACP software calculates waste sector emissions based on a number of factors, including: the methane recovery factor at the landfills to which the city's solid waste is sent; the total amount of solid waste sent to the landfill(s); the composition of the waste sent to the landfill(s); and emissions coefficients derived from the WARM model.

Other important data may be necessary, and can be obtained from a variety of other agencies and utilities. Finally, after a careful analysis and organization of this data, the Climate action group would have completed a city-wide GHG inventory which represents the first step in completing a Climate Action Plan.

Conclusion

While the City of Laguna Beach Climate Action Group may independently complete a GHG inventory, it is highly recommended to use the CACP software available for a membership fee of 600\$ (www.iclei.org/usa). In fact, over 600 local governments worldwide-including 200 U.S. cities, participate in ICLEI's Cities for Climate Protection campaign, and use the CAPC software, suggesting the importance of having a standard GHG emission protocol, as well as the role ICLEI plays in promulgating standards (BAQMD 2007, p 14).

While obtaining energy use, transportation and waste generation data may be difficult at times to obtain, coordinated efforts and effective communication with the various public utilities, energy providers, and state and regional agencies will result in a great approximation of the city-wide GHG emissions levels. The completion of this inventory and forecast will provide a benchmark against which the city can measure the progress in terms of its own operations and that of its citizens.

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Conclusions

The U.S. Mayors Climate Protection Agreement is an organized effort that embodies the true spirit of this nation, uniting hundreds of cities in a common cause. As climate-conscious cities pave the way through a variety of programs aimed at energy efficiency, clean energies and alternative fuels and other innovative goals, more and more mayors are signing the Climate Protocol, and through their commitment cities contribute to reducing GHG emissions and their ultimate effects. While these local actions have a significant impact on the United States' GHG emissions, most municipalities have limited control over energy sources and alternative fuels, thus federal action is also necessary to have a substantial impact on controlling climate change.

By joining cities from all around the world in this climate protection movement, the City of Laguna Beach demonstrates once again its unwavering commitment to protecting the environment and improving the quality of life of its residents. Laguna Beach is one of the greatest cities in the country, known for its scenic beauty, mild climate and energetic spirit. The city should take full advantage of its location on the Pacific Coast and its Mediterranean climate to focus on solar energy and green building options. Also, located in California, the City of Laguna Beach should coordinate its effort with the state government and regional utilities through the many recently developed partnerships and programs. While the policies and actions in this report provide many cost-effective solutions to the GHG effects, the city should also consider exploring long-term solutions to adapt to the inevitable impacts of climate change. Using the list of existing actions taken on climate change by cities similar to Laguna Beach and the state as a whole, Laguna Beach can implement a variety of compatible and cost-effective

programs that will reduce its energy use, enhance transportation, save taxpayers' dollars and set an example for other neighboring cities in environmental stewardship.

Research Methods

In compiling a list of actions taken by cities similar to Laguna Beach in geographic and demographic variables, various methods of research were used. Most of the information in this report is web-based, due to the recent nature of the topic and lack of availability of printed material.

- The first chapter of this report, dealing with selecting a list of climate-conscious cities that are similar to Laguna Beach in geo/demographic variables, involved intensive data collection from the U.S. Bureau of Census website and other sources. Geographic and demographic data, including HDD and CDD indices, average precipitation, population size, land area size, demographic densities, and average per capita income, from each city in the larger 150+ list was analyzed and compared to Laguna Beach's geo/demographic characteristics. Cities were selected using a parameter scale of importance, with climate being the most important criterion. The subset of similar cities included a list of cities that resembled Laguna Beach in three or more criteria.
- The second chapter, which lists the policies and actions taken by each comparable city, was completed through data collection from cities official websites and climate action guides and publications including the cities' climate action plans and progress reports. Contact information was provided for more information on the actions taken by these cities.
- The third chapter, which compiled the policies adopted by cities in the subset by GHG sources sectors, was completed through organizing the data into sectors and subcategories. The compilation was in accordance with the Laguna Beach Climate Protection Subcommittee's plan of action. Cost and benefit data were attached to each policy when available. This data were collected from the city's websites and climate protection publication.
- The fourth chapter, citing California's actions and policies to mitigate climate change, involved data collection from various California government agency websites, and climate protection publications. Analysis of this data was performed to emphasize any impact the state's actions may have on cities' policies and activities. Any policies superseding the city's actions were confirmed by visiting the various regional utilities websites, and exploring the programs and partnerships provided.
- The last chapter, giving some information on how a city can measure and track GHG emissions, was completed by collecting data from other cities' completed GHG inventory examples, and other GHG inventory guidelines explained in climate protection publications. Further explanations of how such inventory guidelines can be applied to the city were achieved by visiting the regional and California agencies' websites, and collecting data including traffic data, energy use, and waste generation.
- Finally, a set of recommended actions and policies was compiled through careful analysis of these programs and how they can benefit the city's wellbeing. Costs and benefits were key criteria in selecting these policies, as well the feasibility of each action in respect to cities' jurisdiction.