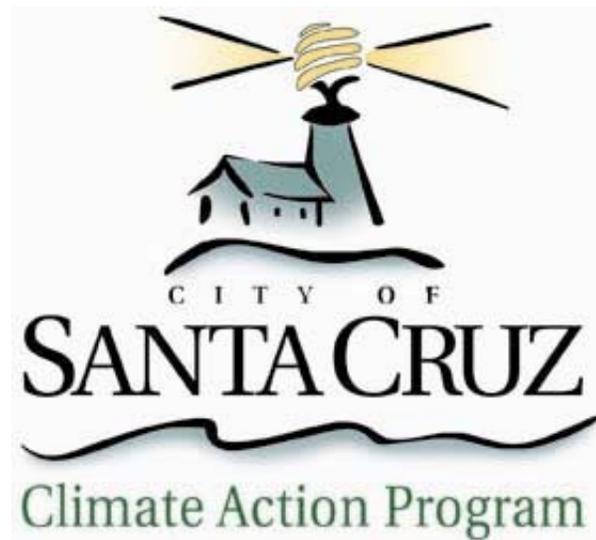


**City of Santa Cruz  
Greenhouse Gas Emissions Inventory**

**2005 Municipal and Community Emissions  
Summary of Findings**



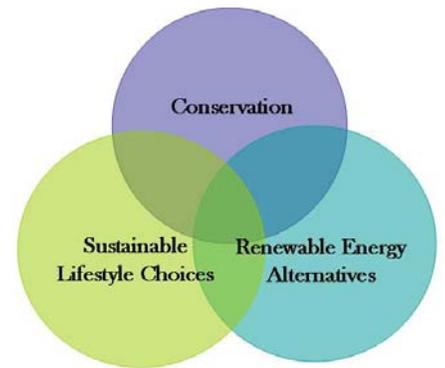
**Ross Clark & Charlie Lewis  
Climate Action Program**

**October 2008**

## Climate Change and the City of Santa Cruz

For over two decades, the City of Santa Cruz has taken steps to reduce and respond to Global Warming. In June 2007, the city council adopted a set of General Plan goals and policies on climate change; including reducing community-wide greenhouse gas emissions thirty percent by 2020, reducing eighty percent by 2050 (compared to 1990 levels), and for all new buildings to be emissions neutral by 2030.

This Greenhouse Gas Emissions Inventory Summary provides information regarding municipal and community wide emissions. This document and the full Inventory report (available on the city web site [www.ci.santa-cruz.ca.us](http://www.ci.santa-cruz.ca.us)) provide the data and guidance to city staff and council to direct future program implementation. Specifically, 2005 emissions levels have been quantified for each community sector (business, residential, municipal, and transportation) and by fuel source (natural gas, electricity, petroleum, other). Benchmark emissions for 1990 have been estimated to prioritize reduction opportunities. This inventory also establishes a standard reporting procedure that can be replicated periodically to meet State requirements and demonstrate the feasibility and effectiveness of the various city programs. This inventory does not, however, replace facility specific (wastewater and landfill) reporting requirements mandated by the State Air Resources Board.



### *City of Santa Cruz Climate Action Program*

In November 2007, the City of Santa Cruz hired a Climate Action Coordinator to help facilitate the multitude of actions and programs related to climate change currently underway as well as provide a point of contact for local interest and regional partnerships. Responsibilities for the position include:

- Researching municipal best practices in reducing greenhouse gas emissions and responding to climate change impacts
- Coordinating volunteer and consultant resources
- Coordinating city participation in regional global warming initiatives
- Supporting internal City staff efforts to reduce and respond to global warming
- Drafting and evaluating proposed General Plan Action Programs
- Communicating the City's global warming efforts and initiatives

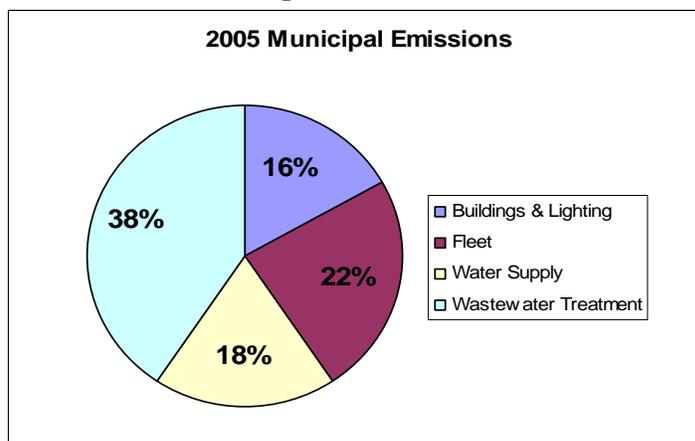
The Coordinator is also responsible for completion of this inventory, assisted by the Climate Action Program technical intern.

The first step in establishing a Climate Action Plan is to quantify the current greenhouse gas emissions from both the municipality and from the various community sources (transportation, residential homes, business and industry). This information will help identify key emissions sectors, help focus reduction strategies and set initial levels from which to track program success.

## 2005 Greenhouse Gas Emissions Inventory

Creating an emissions inventory requires compiling energy use data and reporting emissions from various emissions sectors. The municipal inventory quantifies all the energy and direct emissions that the City emitted while providing services such as light and heat for city buildings, public safety, parks, water and wastewater services.

The City of Santa Cruz municipal operations emitted the equivalent of 12,017 metric tons of CO<sub>2</sub> in 2005 to provide the services required by its residents, businesses and visitors (Table 1). The lighting and heating of municipal buildings led to 16% of municipal emissions (Fig 1). The City fleet of heavy equipment, emergency response, and staff vehicles were responsible for 22% of emissions. The transport and treatment of municipal water supplies resulted in 18% and wastewater treatment resulted in 38% of emissions.



Methane emitted from the landfill (leakage not captured for electricity generation) equated to an additional 12,455 tons (comparable to emissions from all other city services, not presented in Fig 1).

**Figure 1.** 2005 Municipal Emissions by Sector

In 2005, water and wastewater treatment resulted in over half of the municipal energy use and emissions. These numbers are not surprising since 20% of California's state wide emissions come from the treatment and movement of water. A 2005 report outlined the energy and emissions from several San Francisco Bay area water service providers and Santa Cruz Water Department was one of the least energy intensive systems analyzed (Green Building Studio, 2007).

**Table 1.** Energy Use and Greenhouse Gas Emissions Totals for Santa Cruz Municipal Operations

**2005 Municipal Energy Use**

Sector	Emissions							
	Sector	kWh	Therms	Gallons	Million BTUs	Tonnes CO2e	Tonnes Avoided	Cost
<b>Buildings</b>	<b>1&amp;2</b>	3,922,060	112,443	-	24,373	<b>1,893</b>	-	\$678,098
<b>B - Solar</b>	<b>1</b>	<i>90,000</i>	-	-	307	-	<b>29</b>	
<b>Fleet</b>	<b>1</b>	-		<b>282,302</b>	34,212	<b>2,684</b>	-	<b>\$544,709</b>
<b>Streetlights</b>	<b>2</b>	2,588,491	-	-	8,832	<b>833</b>	-	\$405,348
<b>Water</b>	<b>1&amp;2</b>	6,414,031	9,790	3550 mill	22,860	<b>2,119</b>	-	\$784,587
<b>Wastewater</b>	<b>1&amp;2</b>	2,051,092	12,104	3696 mill	8,209	<b>728</b>	-	\$303,958
<b>Cogen (NG)</b>	<b>1</b>	<i>4,991,034</i>	678,089	-	67,809	<b>3,760</b>	-	\$16,520
<b>Methane Cogen</b>	BE	<i>5,658,384</i>	<i>840,058</i>	-	84,005	-	<b>24,876</b>	
<b>WW - Solar</b>	<b>1</b>	<i>70,000</i>	-	-	239	-	<b>23</b>	
<b>Waste</b>	<b>1</b>	-	-	-	-	<b>12,455</b>	-	
<b>W-CH4 Capture</b>	BE	<i>4,800,000</i>	-	-	16,378	-	<b>45,668</b>	
<b>Total</b>		<b>25,785,092</b>	<b>1,652,484</b>	<b>282,302</b>	<b>250,846</b>	<b>24,472</b>	<b>70,596</b>	<b>\$2,733,220</b>

Italicized values are energy generated from city resources (methane & solar). BE indicates Biogenic Emissions not contributing to net GHG emissions

## 1.1 Community Emissions

Community emissions include all energy and fuel used within the City of Santa Cruz by residents, visitors and businesses as well as those of the municipality reported above. Primary fuels used in Santa Cruz include electricity, natural gas, gasoline, diesel and methane. In total, Santa Cruz released the equivalent of **339,652 metric tons** of CO<sub>2</sub> community wide in 2005. The residents, businesses and municipal operations emitted a combined total of 182,053 metric tons of CO<sub>2</sub>, and an additional 157,559 metric tons were emitted by vehicles (Table 2). The residential and business sectors emitted relatively similar percentages of the total (Figure 2).

**Table 2 2005 Community Energy Use / Metric Tons CO<sub>2</sub>e Emissions**

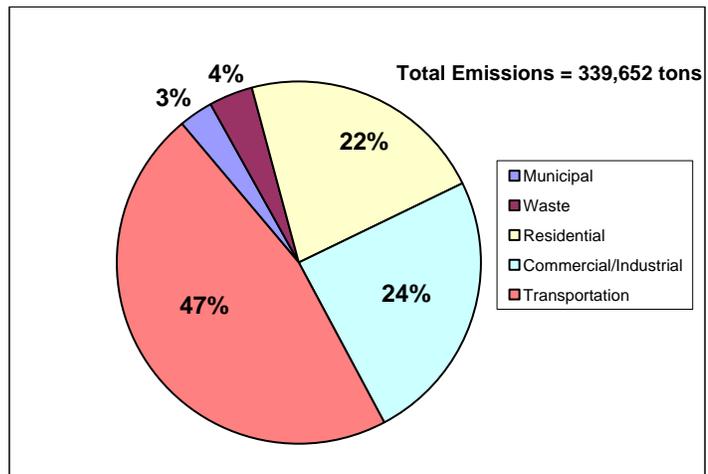
2005 Community Wide Energy Use							
Sector	kWh	Therms	Gallons	Million BTUs	Tonnes CO <sub>2</sub> e	Tonnes Avoided	Cost
<b>Municipal</b>	25,785,092	1,652,484	282,302	250,846	12,017	24,928	\$2,716,700
<b>Residential</b>	103,653,246	8,448,830		1,198,648	74,769		
<b>Commercial/Industry</b>	127,575,975	8,823,893		1,317,802	82,812		
<b>Transportation</b>	-	-	18,248,305		157,599		
<b>Waste</b>	-	-	-	-	12,455	45,668	
<b>Total</b>	<b>257,014,313</b>	<b>18,925,207</b>	<b>282,302</b>	<b>2,767,296</b>	<b>339,652</b>	<b>70,596</b>	<b>2,716,700</b>

### Transportation

The Transportation emissions sector is one that has continued to increase since 1990 and currently comprises 47% of the community-wide GHG emissions. A recent City survey of residents estimated that 10,000 automobiles commute over the Santa Cruz Mountains every day for work, emitting 71,448 tons of CO<sub>2</sub> annually.

### Residential

Residential emissions were estimated to be 74,769 metric tons in 2005, equaling 3.5 tons per residence. This number is below previous estimates of 4.19 metric tons per household in 2000 and 4.6 metric tons in 1996. While these numbers are estimates, the data suggests increased efficiency and conservation in Santa Cruz homes.



**Figure 2. Community-wide Emission by Sector**

## **Business and Industry**

Business and Industry emissions estimates were 82,812 tons in 2005 down from previous estimates of 90,522 tons in 2000 and 167,689 tons in 1996. Most of the reductions since 1996 are from a 50% decline in electricity use between 1996 and 2000, most likely due to the change in industry from manufacturing (closing of large industry including Lipton, Wrigley, and Salz Tannery) to high-tech (Mary Arman, Pers. Com.). Efficiency upgrades since 2000 by local Santa Cruz businesses has resulted in considerable GHG reductions (9%) and energy cost savings.

## **1990 Baseline Emissions for Santa Cruz**

### *Introduction*

The year 1990 was set as a worldwide baseline for greenhouse gas emissions and codified in policy by the Kyoto Protocol of 1997. The State of California also set reduction goals based on 1990 levels (AB32) and has quantified state wide emissions for 1990 at 427 million metric tons of CO<sub>2</sub>e. Fortunately, Santa Cruz has reliable municipal energy use numbers for 1993 and has used these numbers to set a benchmark from which to plan reductions. For residential and business emissions numbers, Santa Cruz has adopted a similar approach to Berkeley and has extrapolated back to 1990 using previous emissions estimates completed in 1996 and 2000.

### *Municipal Baseline Emissions Values*

Municipal energy use and GHG emissions have risen an average of 2.4% annually (Table 3), with emissions 15% higher in 2005 than 1993. This estimate integrates energy use increases from water services and reductions from energy efficiency improvements in buildings and fleet. Conservation and efficiency upgrades in buildings, fleet vehicles, and street lights have resulted in a 31% reduction in emissions for those sectors since 1993. Energy use in municipal buildings is similar to 1993 values despite the increases in city services, infrastructure and staff. Significant increases in emissions from the wastewater sector are the direct result of improvements in treatment (from primary to advanced secondary).

**Table 3.** City greenhouse gas emissions for multiple years by sector.

Sector	1993 CO2e	1996 CO2e	2000 CO2e	2005 CO2e
Buildings	1,850	2,049	1,591	1,893
Fleet	4,562	4,562	2,272	2,684
Streetlights	1,383	921	1,483	833
Water	1,606	1,571	2,400	2,119
Wastewater	771	1,496	3,307	4,488
<b>Energy Emissions</b>	<b>10,172</b>	<b>10,599</b>	<b>11,053</b>	<b>12,017</b>
Waste	29,323	25,277	17,866	12,455
Total	38,626	35,876	28,919	24,472

## 1.2 GHG Reduction Benchmarks

The City of Santa Cruz has selected the year 1993 as its municipal benchmark from which to set reduction goals and evaluate program success. The 1993 year was chosen as a surrogate for 1990 not only because data are limited prior to 1993 but also because 1990 values are not representative of normal emissions for that period due to the unprecedented city and community impacts from the 1989 Loma Prieta earthquake. The estimated municipal GHG emissions for 1993, totaling 10,172 tons CO2e, will be used as the historic benchmark from which to set future reduction goals.

**To meet City Climate Reduction Goals, acceptable GHG emissions levels for the municipality are set at 7,120 metric tons for 2020 (down from 12,017 tons) and 2,034 metric tons for 2050.**

Reaching this target represents a 40% reduction from 2005 emissions values by 2020 and will require significant actions from all sectors (Table 3). While the energy emissions have risen overtime, several sectors of energy use have remained steady or been reduced, even with growth in staff and services. Other sectors have risen significantly. If the reductions from landfill fugitive emissions are included in the total municipal benchmark, due to increased recycling efforts, the overall 2005 municipal emissions are 37% below 1993 levels. While this is an important consideration, the City of Santa Cruz Climate Action Program staff has interpreted the City Climate Reduction Goals to represent emissions reductions from energy used by the City, and not to take advantage of methane decline and capture as the primary reduction strategy for the city. Relying on landfill program success will not prepare the city to meet it's 2050 reduction goals nor take full advantage of conservation and efficiency opportunities.

## Community Emissions Baseline

Having historic data on community wide energy use has helped to establish reduction goals as well as understand how previous conservation efforts have performed. Available data on city wide energy use by sector suggests that GHG emissions have been reduced significantly since 1996 (Table 5). Available data suggest that residential emissions have declined 24% since 1996 and commercial/industrial emissions have been reduced 9% since 2000 and 44% since 1996. The reduction in industry emissions between 1996 and 2000 is most likely due to the closure of several large manufacturing facilities in the late 1990s. Since loss of industry is not a prudent climate reduction strategy, industry benchmarks have been set at year 2000 values, intent to focus on the current industry composition.

**Table 5. Community Wide GHG Emissions (Metric Tons)**

Community Sector	1996	2000	2005	% change from 1996	2020 Emissions Objective
<b>Municipal</b>	10172*	11,755	12,017	<b>29%</b>	7,120
<b>Residential</b>	98,705	80,719	74,769	<b>-24%</b>	69,094
<b>Commercial/Industrial</b>	167,689	90,522	82,812	<b>-9%</b>	63,365
<b>Transportation</b>	148,506	153,755	157,599	<b>6%</b>	103,954
<b>Waste</b>	32,931	17,866	12,455	<b>-62%</b>	12455 <sup>#</sup>
<b>Total</b>	<b>447,831</b>	<b>354,617</b>	<b>339,652</b>	<b>-11%</b>	<b>266,585</b>

\* municipal emissions values are from 1993

<sup>#</sup> 2020 waste emissions objectives are equal to 2005. Other sectors can take advantage of the large reductions from this sector if unable to meet their specific 2020 objective.

Total community wide emissions have declined 11% since 1996 (since year 2000 for industry), bringing us one third of the way towards our 2020 reduction goals. Since 1996, some community sectors emissions have increased (municipal and transportation) and others have been reduced (residential, commercial and waste).

The community wide reduction goals have been set at 266,585 tons of CO<sub>2</sub>e. Therefore, annual emissions from the Santa Cruz community need to be reduced an additional 73,068 tons by 2020. State reduction goals, defined by AB32, are set at 1990 levels. Available yearly county wide emissions suggest that between 1990 and 1996 average emissions grew by 3%. Extrapolating back to 1990 using this growth rate sets the AB32 reduction goal for the Community of Santa Cruz to be 434,396 tons annually by 2020; a value higher than 2005 emissions. By adopting more aggressive reduction goals the City of Santa Cruz will continue to demonstrate success and be a leader in greenhouse gas reductions by far surpassing state reduction goals.

## Necessary Emissions Reductions Through 2020 - Climate Action Plan

Achieving a comprehensive 30% reduction in GHG emissions cannot happen immediately without causing significant impacts to the local economy, residents'

lifestyles and the availability of City services. Santa Cruz's proposed strategy is to start immediately and continue a sustained effort over the next 12 years to meet the reduction goals. Success to date has positioned Santa Cruz for success. Next steps are to empower residents and businesses to continue current reductions and begin new actions. The City has initiated a Climate Action Pledge that advocates for everyone in the community to develop a strategy to reduce their GHG emissions 10% during the current year and then make small additional reductions each year there after. This will promote immediate conservation and efficiency measures and, over time, establish additional small changes by all within the community.

The prioritization of which actions should be implemented first and which actions have the greatest potential for success will be addressed within the Santa Cruz Climate Action Plan. The Climate Action Plan will investigate feasible opportunities and innovative options to meet the 2020 goals. Emission reductions must be made within all sectors (Fig 3) but may not be accomplished equitably. Many opportunities are already available and have been implemented with success within this and other communities. Conclusions - Creating a Sustainable Santa Cruz

The community of Santa Cruz has been a leader in addressing Climate Change both through words and actions. Continued support of these partnerships is necessary and efforts must be made to reach out to others to do more.

The 2005 Emissions inventory provides the necessary data on city emissions to complete a City of Santa Cruz Climate Action Plan which will prioritize options, provide specific information on possible methods to meet the City goals and will take advantage of local opportunities and public interest. The Climate Action Plan will document how Santa Cruz can make a significant contribution to how the world responds to this environmental threat, and in doing so; build a better, more sustainable community.

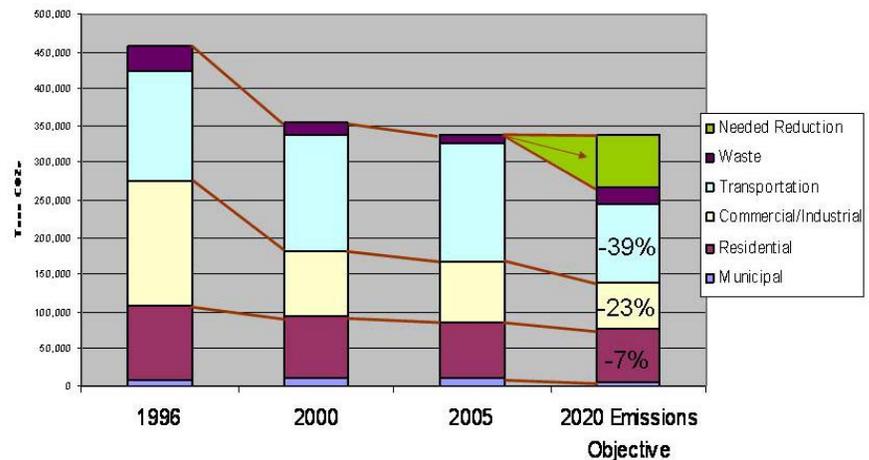


Figure 3. Future reductions needed

