2.0 Greenhouse Gas Emissions Inventories and Emissions Reduction Targets

Greenhouse gas emissions inventories are tools for estimating and documenting the sources of emissions and the relative amount of emissions produced by different activities, referred to as sectors. The inventories direct us toward the actions that will be most effective at reducing emissions for the unique circumstances of Santa Cruz County. Inventories also provide the accurate baseline of emissions that is necessary for setting an emissions reduction target and for measuring progress over time.

Inventories of emissions from County government operations and from community activities were originally prepared for 2005, which is a commonly accepted baseline year in California (California Air Resources Board, 2008). An update of each inventory has been prepared for 2009, the latest year in which a complete data set is available. Preparing the inventories involved close coordination with staff from the County General Services and Public Works Departments, and numerous contacts with other County, regional and state agencies during the data gathering and analysis process.

It must be noted that GHG inventory results should not be considered absolute amounts of emissions, particularly for the community inventory, because the inventories do not include all possible emissions and the emissions that are counted have been estimated to varying degrees of accuracy. Emissions that are not included are those that are very difficult to measure accurately, such as emissions from rural propane use. However, the inventories do give a reasonably accurate picture of the relative amounts of emissions being generated by different activities, in a manner that can be tracked over time to measure trends in overall emissions.

Lastly, it is important to recognize that a large portion of GHGs produced around the world are connected to producing goods for export. Some of those goods are consumed in Santa Cruz County, but the emissions from their production and transport are not captured in our local inventory. It is useful to keep those externalized emissions in mind as we develop our response to climate change as there are strategies, such as encouraging “buy local” principles for consumption of local goods. These involve generally lower GHG emissions associated with production and transport, which can begin to address those external emissions.

2.1 Government Operations Inventory

Table 2-1 and the accompanying graph (Figure 2-1) provide a summary of the GHG emissions inventories for Santa Cruz County government operations in 2005 and 2009. In 2005, total emissions were about 39,000 metric tons of carbon dioxide equivalent (CO_2e), falling to about 34,000 metric tons CO_2e in 2009. Even with an efficient landfill gas collection system, the largest contribution of GHG emissions in the government operations inventory is from the decomposition of solid waste that is releasing methane into the atmosphere as it decomposes in the Buena Vista Landfill and the Ben Lomond Transfer Station. The next three highest sectors, employee commute, buildings and facilities, and vehicle fleet, produce fairly similar levels of emissions. The County, largely through the General Services Department and Department of Public Works, has a number of successful programs in place that are operating to moderate GHG emissions (see Appendix A).

While County government operations are the activities over which the Board of Supervisors has the most direct influence, they represent a very small portion of the overall emissions generated in the unincorporated area. For comparison, approximately four percent of the total community emissions in 2009 were attributable to the

County's own operations. This draws the focus of emissions reduction activity to the community inventory, and particularly to the transportation sector.

Table 2-1: Government Operations Emissions by Sector

Sector	Metric Tons CO_2e Emitted		Percent Change from 2005 Baseline
	Year 2005	Year 2009	
Solid Waste Facilities	20,261	18,335	-10%
Employee Commute	6,928	5,370[(1)]	-22%[(1)]
Buildings and Facilities	5,525	5,847	6%
Vehicle Fleet	5,253	3,673	-30%
Wastewater Treatment Facilities	848	941	11%
Public Lighting	62	69	11%
Water Delivery	24	32	33%
Total	**38,901**	**34,267**	**-12%**

Note:
(1) The reduction in emissions from the employee commute is largely due to a reduction in employees between 2005 and 2009.
Source: County of Santa Cruz, 2012.

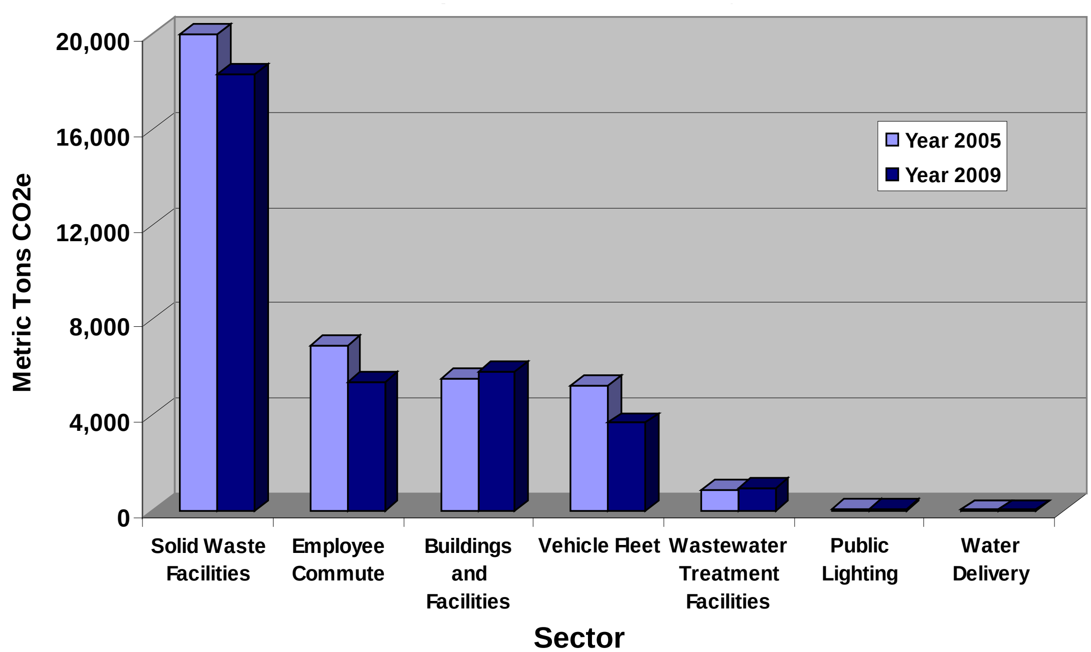

Figure 2-1: Government Operations Emissions by Sector

Source: County of Santa Cruz, 2012.

2.2 Community Inventory

Table 2-2 and the accompanying figure (Figure 2-2) provide a summary of community-wide GHG emissions in 2005 and 2009. The community inventory includes greenhouse gas emissions from the use of electricity and natural gas in residences and businesses in the unincorporated portions of Santa Cruz County. It also includes emissions from vehicles traveling on local roads and state highways in the unincorporated portions of the County. In 2005, Santa Cruz County's total community-wide GHG emissions were about 1.9 million metric tons of CO_2e. Emissions from the Davenport cement plant accounted for about half this total. The 2009 emissions inventory shows a very dramatic reduction in the commercial and industrial sector, which reflects the closure of the cement plant in Davenport. The 2009 inventory shows less dramatic changes in other sectors, including reductions in the transportation and solid waste sectors and an increase in the residential sector.

The 2009 inventory shows the vast majority (60 percent) of community emissions in 2009 come from the transportation sector, which points to fuel use and Vehicle Miles Traveled (VMT) as very significant contributors to our local emissions picture. VMT decreased slightly between 2005 and 2009, probably due to the poor economy and higher fuel prices. According the California Employment Development Department, the annual unemployment rate in Santa Cruz County increased from 6.3 percent in 2005 to 11.3 percent in 2009. The second largest contributor is the residential sector, which indicates that home energy use is also a significant factor. The increase in emissions from residential energy use between 2005 and 2009 is largely attributable to the higher emissions factor of the electrical power supplied by Pacific Gas & Electric (PG&E) in 2009. The emissions factor reflects GHG emissions resulting from generation of electricity delivered by PG&E. A higher emissions factor indicates a power mix (coal, natural gas, nuclear, renewables) with a higher percentage of fossil fuel sources. Even though the emissions factor can have a dramatic effect on the County inventory, it is solely controlled by PG&E.

Lastly, the 28 percent decrease in emissions from the solid waste sector reflects less waste generation, greater waste diversion, decomposition of existing waste, and continued operation of an efficient landfill gas collection system that currently captures 85 percent of landfill gas produced.

Table 2-2: Community Emissions by Sector			
	Metric Tons CO_2e Emitted		Percent Change from 2005 Baseline
Sector	Year 2005	Year 2009	
Transportation	555,458	481,787	-13%
Residential	173,336	189,658	9%
Commercial and Industrial	1,158,119	101,588(1)	-91%(2)
Solid Waste	20,124	18,245	-9%
Total	**1,907,037**	**791,278**	**-59%**

Notes:

(1) This much lower number reflects the cessation of manufacturing at the Davenport cement plant. See emissions inventories in Appendix G.

(2) A complete explanation of the change in the commercial/industrial sector is hampered by an inability to completely subtract the contribution from the cement plant from the 2005 inventory. Almost all of the emissions from the cement plant consisted of stack emissions, with a portion of emissions resulting from electricity use (conveyor belt, etc.), which appears to have been a large amount of electricity relative to other electricity use in this sector. While stack emissions are known and can be eliminated, electricity data in this sector is not detailed enough to effectively eliminate use attributable to the cement plant. However, based on known economic conditions it is assumed that this sector as a whole, not counting the cement plant, still experienced some emission reduction between 2005 and 2009, probably due to the economic downturn.

Source: County of Santa Cruz, 2012.

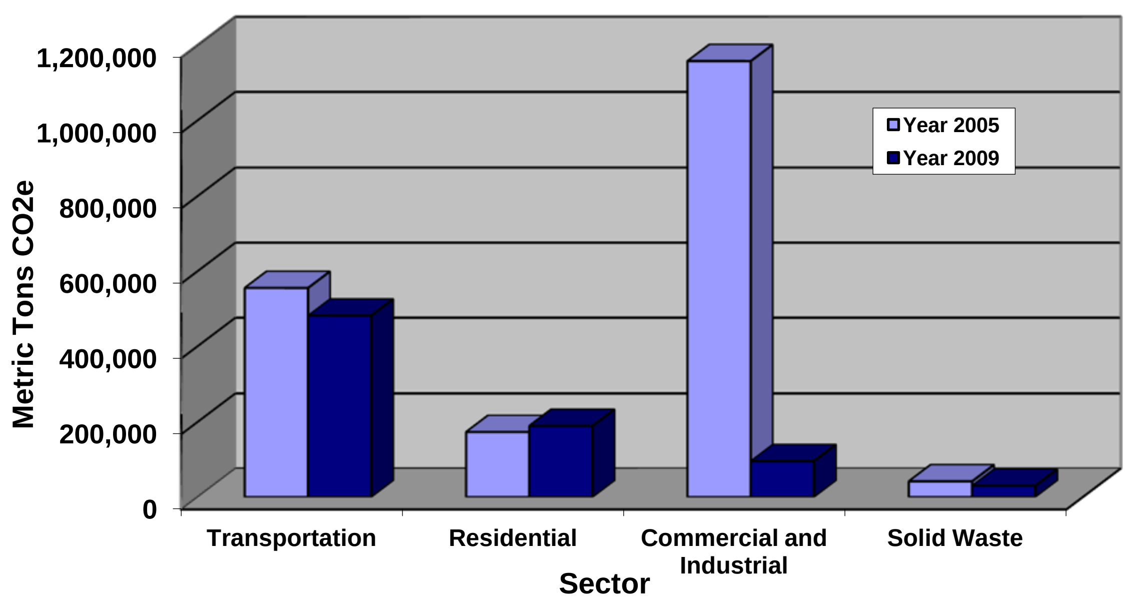

Figure 2-2: Community Emissions by Sector

Source: County of Santa Cruz, 2012.

2.3 Forestry and Agriculture

2.3.1 Forestry

According to the State "Climate Change Scoping Plan" (California Air Resources Board, 2008) California's forests remove approximately 5 million net metric tons of CO_2e from the atmosphere annually. This occurs because there is more CO_2 removed from the air by tree growth than there is emitted by wildfires, wood combustion, wood decomposition, land conversion and other forestry related emissions. This sequestration, or "carbon sink", is a valuable ecosystem service provided by forests. The143,000 acres of redwood and redwood-Douglas fir forests and 19,900 acres of oak woodland in Santa Cruz County (Mackenzie, A., J. McGraw, and M. Freeman, 2011) contribute to this service. Forest lands in the County currently store around 56 million metric tons CO_2e (Mader, Steve, 2007). . State-wide, carbon sequestration by forests is supported by sustainable management practices administered by California's Board of Forestry and Fire Protection as well as initiatives of other state agencies to conserve biodiversity, provide recreation, and promote sustainable forest management. Santa Cruz County is well positioned in terms of local forest practice, rural development policies that conserve timber, and conservation efforts to maintain the carbon sequestration benefits of forest lands in the County. About one quarter of county land area, or about 77,000 acres, is in conservation status and 71,000 acres are reserved timberlands (Mackenzie, A., J. McGraw, and M. Freeman, 2011).

The urban forest provides a diverse array of benefits to human communities. It produces oxygen and removes carbon dioxide, gaseous pollutants, and particulate matter from the air. In addition to improving air and water quality, community trees provide numerous social and economic benefits by providing shade and reducing wind speed. Trees adjacent to buildings reduce air conditioning and heating costs. Urban trees may also reduce the incidence and severity of respiratory disease, asthma, low-level ozone respiratory ailments, and heat-related illnesses (Maas, J., Verheij, R.A., Groenewegen, P.P., de Vries, S., and Spreeuwenberg, P., 2006). Access to parks and green spaces encourages outdoor activity, which can lead to weight loss and reduced health problems associated with obesity. Although urban trees do not sequester nearly as much carbon as our "rural" and mountain forests (McPherson, E. Gregory, Nowak, David J. Rowntree, Rowan A,, 1994) they provide a plethora of major co-benefits. Preserving and encouraging more urban trees during the development permit process is important, and a related action has been included in Strategy E-4.

2.3.2 Agriculture

Santa Cruz County ranks in the top third of California counties for agricultural production. Working farmland, timberland, and rangelands generate over $491 million in annual revenues and employ 8,000 people. Santa Cruz County has some of the most productive cultivated farmland in the state, thanks to a mild Mediterranean climate, exceptionally fertile soil, and consumer demand for high-value crops like berries. The agricultural sector, not including timberland, occupies 8.5 percent of Santa Cruz's land area, or 24,324 acres, and is one of the highest revenue sectors. Figure 2-3 provides crop type in acres for the entire county with the exception of timberland for 2011.

Emissions from agricultural activities come from electricity use for water pumps, fuel for equipment, and excess nitrogen from fertilizer. Electricity use for pumps is already included in the commercial/industrial sector of the community inventory because the PG&E data is aggregated and does not separate out agricultural electricity and natural gas use. Data on agricultural fuel and fertilizer use is not available in a format that can be used in an emissions inventory. Because of a lack of available data there is no baseline or tracking mechanism for total agricultural emissions at this time. For these reason agricultural emissions are addressed separately from the community emissions inventory. However, by using information from published crop reports and studies, rough estimates of emissions from agricultural fuel and fertilizer use have been calculated for many crops, as shown in Table 2-3. These results should only be used for rough comparison to the overall community emissions.

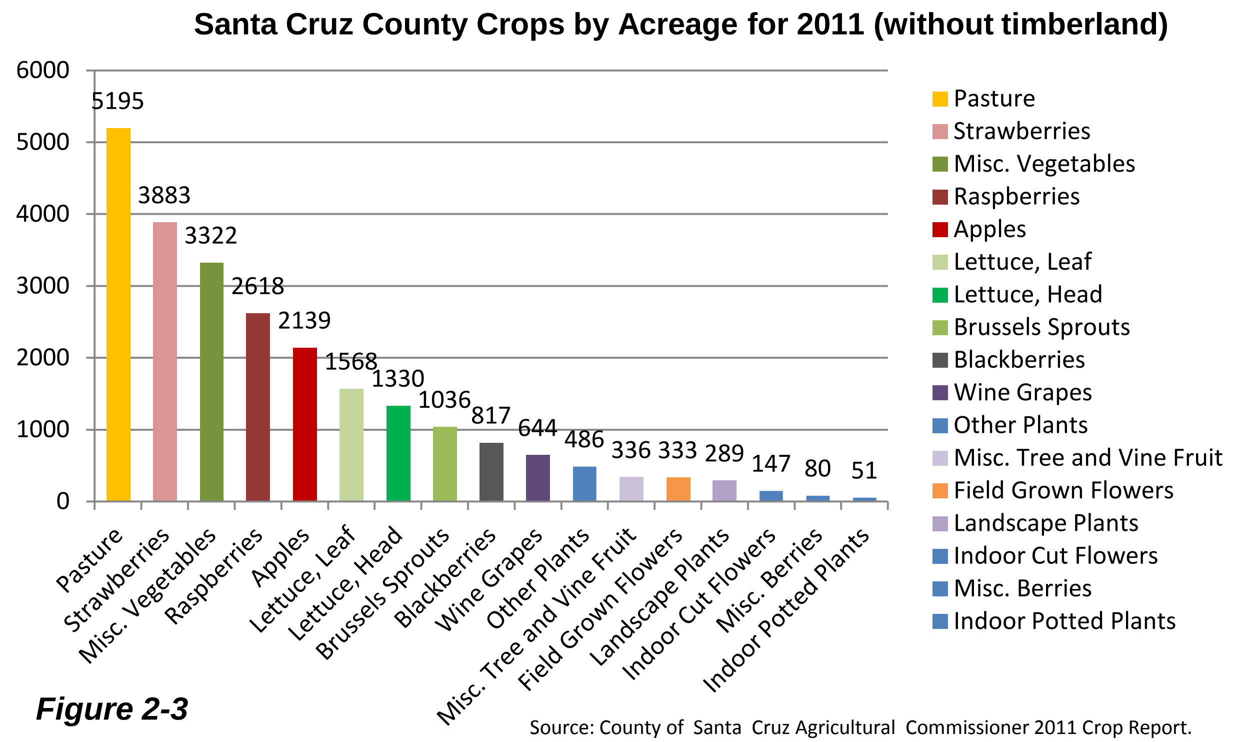

Figure 2-3

Source: County of Santa Cruz Agricultural Commissioner 2011 Crop Report.

Table 2-3: Crop Emissions by Crop Type (in Mt CO_2e/yr)

Crop Category	2005	2009	Percent Change from 2005 Baseline
Pasture	744	703	-6%
Strawberries	4,785	4,576	-5%
Misc. Vegetables	4,007	4,388	8%
Raspberries	657	600	-10%
Apples	1,606	1,388	-16%
Lettuce, Leaf	3,696	1,813	-104%
Lettuce, Head	3,417	1,777	-92%
Brussels Sprouts	1,217	1,145	-6%
Wine Grapes	204	223	8%
Misc. Tree and Vine Fruit	124	177	30%
Total	20,456(1)	16,791(1)	-21%(2)

Notes:

(1) This number does not account for field grown flowers, landscape plants, indoor cut flowers, miscellaneous berries, indoor potted plants, wild hay, and other plants. These unmeasured categories occupy 1,972 acres in 2005 and 1,976 acres in 2009, or approximately eight percent of total cropland. They were not included in the emissions inventory due to insufficient data.

(2) It is important to note that these changes reflect changes in crop patterns, not necessarily changes in practices that have reduced or increased emissions. Though there may have been changes in practices, data does not yet exist for that.

Source: County of Santa Cruz, 2012.

Emissions from agricultural fuel and fertilizer use account for at most two percent of County CO_2e emissions, or approximately 17,000 metric tons. In addition to its relatively low emissions profile, agriculture has the potential to sequester carbon from the air and store it in the soil, and the maintenance of lands for agriculture prevents those lands from being used for far more carbon intensive urban development.

The emissions that do exist from farming, however, can be reduced, and carbon sequestration potential can be enhanced by increasing low or no till practices, using more fuel efficient farm equipment and pumps, eliminating methyl bromide, and reducing surplus nitrogen when fertilizing crops.

Currently, growers are implementing practices to conserve water and are constantly searching for ways to reduce nitrogen usage without reducing crop yields. Higher efficiency farm equipment and pumps are also sought (when funding is available). All of these measures reduce costs for growers while reducing greenhouse gas emissions. The County can play a role by assisting these efforts, encouraging the adoption of lower emission farming practices such as reduced tillage and low input farming, and by encouraging growers and processors to take advantage of the Property Assessed Clean Energy (PACE) program. PACE provides 100 percent financing to commercial and agricultural property owners who increase energy efficiency, with repayment to be repaid through property tax assessments and other favorable terms.

2.4 The “Business as Usual” Forecast

Preparatory to discussion of the CAS specific emissions reductions targets, it is useful to prepare a “business as usual” scenario (BAU) to estimate future emissions. Emissions from agricultural fuel and fertilizer use are not included in the forecast. The BAU forecast assumes no new actions are taken to reduce emissions and the economy grows according to regional projections that assume the economic downturn does not continue to 2020 and beyond. Inherent difficulties in predicting the future notwithstanding, the BAU forecast is a helpful tool that indicates how much reduction must be accomplished in order to reach any given level of emissions by 2020, 2035 or 2050.

The BAU forecast uses data from AMBAG’s 2008 Regional Forecast for population, housing units, and employment, and the Metropolitan Transportation Plan 2008 Supplemental EIR, which estimates future trends in the VMT out to 2035. Trends in housing units and employment can be used to forecast emissions in the residential and commercial/industrial sectors, respectively, and trends in VMT can be used to forecast emissions in the transportation sector.

The BAU forecast (Table 2-4 and Figure 2-4) shows that emissions in 2035 will be 11 percent higher than they were in 2009. This indicates that the emissions reduction strategies in the CAS must be implemented very effectively, as they will be relied upon not only to decrease emissions from current County activities, but to reverse an upward trend. However, the BAU forecast also represents a worst case scenario in that it assumes no mitigation actions to reduce GHG emissions are taken, when in fact actions are already being taken at the state and local level. Three state-wide initiatives that require no local action and which may lead to significant emissions reduction in our community are the Clean Car Standards (Pavely I and II), Low Carbon Fuel Standard, and the Renewable Portfolio Standard known as RPS (California Air Resources Board, 2008). The first two will reduce emissions associated with VMT by reducing the carbon content of fuel and improving fuel efficiency of the fleet. The third will reduce emissions from home and commercial energy use by lowering emissions associated with producing the energy.

The emissions reductions from these programs, as estimated by the California Air Resources Board in the Scoping Plan (California Air Resources Board, 2008) and by various cities and counties in their climate action plans, may reduce 2035 emissions to below 2009 levels. If that occurs, the state initiatives will have accomplished approximately 68 percent of the reduction that is required to meet the Santa Cruz County 2035 and 2050 targets. This does not, however, indicate that the actions in the County of Santa Cruz CAS do not need to be implemented; rather, it indicates that a greater or lesser effort may be required as the context of state regulations and programs evolves, and that the CAS must be flexible, with adjustments made when necessary.

Table 2-4: Community Emissions Growth Projections by Sector				
	Inventory Years		Forecast from 2009 data	
Sector	**2005**	**2009**	**2020**	**2035**
Transportation	555,458	481,787	500,664	527,603
Residential	173,336	189,658	197,089	207,694
Commercial / Industrial	1,158,119	101,588[(1)]	110,652	124,330
Solid Waste	20,124	18,245	18,671	19,268
Total	**1,907,037**	**791,278**	**827,076**	**878,894**

Note:
(1) Figure no longer includes emissions from the Davenport cement plant due to cessation of manufacturing activity.
Source: County of Santa Cruz, 2012.

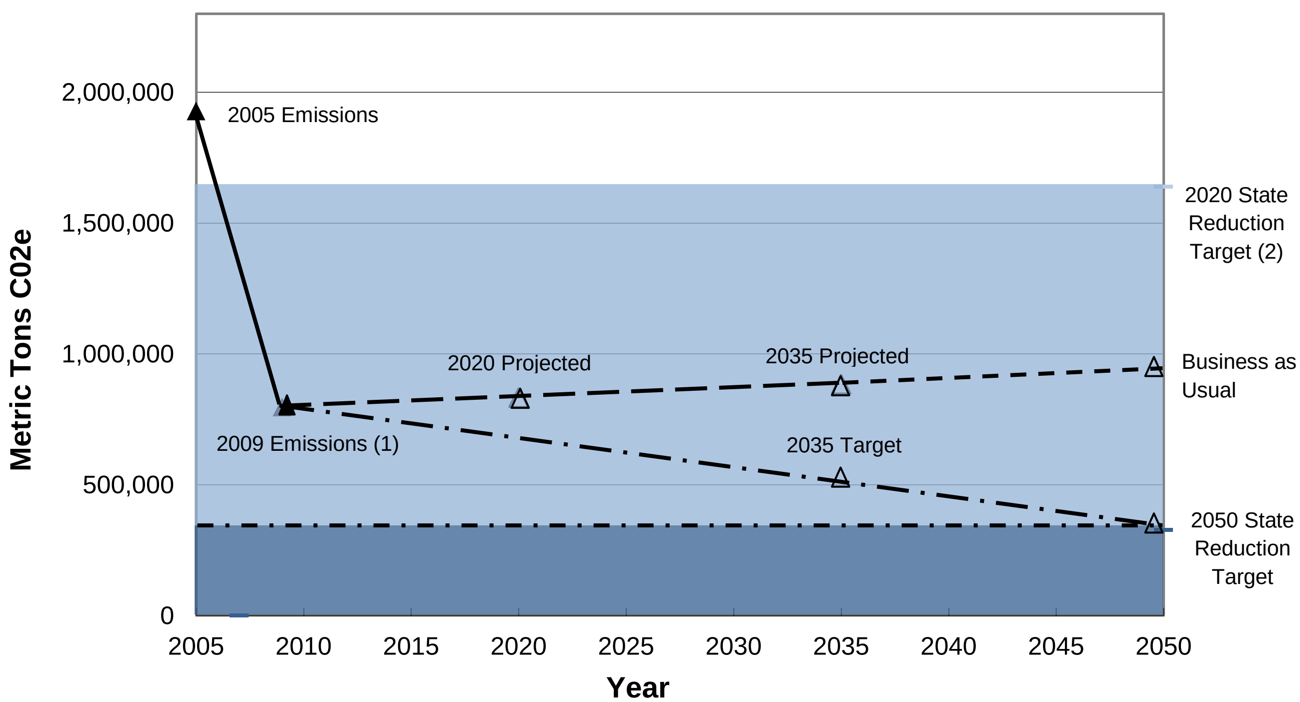

Figure 2-4: Business as Usual Growth Projections and Statewide Reduction Targets

Notes:

(1) The forecast is based on the 2009 inventory year, and not the trend between 2005 and 2009, because of unique circumstances related to the cement plant closing, and the significant downturn in the economy that occurred between 2005 and 2009.

(2) The *Climate Change Scoping Plan* (2008) prepared by the California Air Resources Board to implement the California Global Warming Solutions Act of 2006 (AB 32) recognizes that most local communities will use 2005 as their baseline year for evaluation of greenhouse gas emissions, and provides that a goal of 15% below 2005 levels is considered roughly equivalent to reducing emissions to 1990 levels by 2020, which is the goal established by AB 32.

Source: County of Santa Cruz, 2012.

2.5 Emissions Reduction Targets for 2020, 2035 and 2050

The state has set reductions targets for 2020 and 2050 (California Air Resources Board, 2008)[3]. Local governments are encouraged to adopt parallel goals. As shown in Table 2-4 and the Figure 2-4, in unincorporated Santa Cruz County the state's goal for 2020 has already been met as a result of cessation of manufacturing at the Davenport cement plant. Given that circumstance, it is useful to set an intermediate target in order to have a milestone to work toward on the way to 2050. The year 2035 was chosen as an appropriate intermediate year, because it is the planning horizon for the Regional Sustainable Communities Plan being prepared by the Association of Monterey Bay Governments (AMBAG), the AMBAG housing and employment forecast, the Metropolitan Transportation Plan, and the Regional Transportation Plan.

The lower line on the graph in Figure 2-4 shows the slope of a straight line between County emissions in 2009 and what emissions must be in 2050 if the 2050 target is to be met. Points along the line are milestones that must be achieved to remain on a constant path toward the 2050 goal. In 2035, in order to be on track, emissions must be reduced by 300,000 metric tons, which is a reduction of 38 percent below 2009. This is an appropriate mid-term target and the reduction strategies in the next section have been assembled with it and the 2050 target in mind. Table 2-5 is a summary of the GHG emissions reduction targets.

Table 2-5:
Summary of GHG Emissions Reduction Targets

Reduction	Target Years		
	2020	2035	2050
Reduction below 2009 (metric tons CO_2e)	140,000	300,000	470,000
Percentage reduction relative to 2009 emissions	18%	38%	59%
Reduction below "Business as Usual" projections	170,000	380,000	590,000
Percentage reduction relative to "Business As Usual" projections	21%	43%	64%

Source: County of Santa Cruz, 2012.

[3] The 2020 target consists of a reduction to 1990 levels, which equates to a 15% reduction below 2005. The 2050 target consists of an 80 percent reduction below 1990 levels.