



Appendix D

Estimating the Potential Emissions Reduction of Individual Reduction Strategies



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Appendix D

Estimating the Potential Emissions Reduction of Individual Reduction Strategies

This material in this appendix expands on the information in Chapter 4.0 about the calculation of potential emissions reductions that can be expected from each emissions reduction strategy. Calculations were performed using the Climate Action Planning Assistant (CAPA) software tool developed by the Statewide Energy Efficiency Collaborative (SEEC). SEEC is a collaboration among three statewide non-profit organizations and California's four investor-owned utilities to provide support to cities and counties to help them reduce greenhouse gas emissions and save energy. With the assistance of the CAPA tool we were able to evaluate the potential for our Climate Action Strategy to achieve our long term community emissions reduction targets.

The CAPA tool uses calculator work sheets that address each major source of emissions to help estimate the emissions reduction potential of a wide variety of actions, and then to combine the estimates to show the potential GHG emissions reduction overall. This tool gives us the ability to create a more sophisticated action plan that incorporates the dynamic nature of the emissions generating processes and our efforts to improve them. Most critically, the concept of time and change over time can be incorporated into action planning. This is an absolute necessity for putting the scope of the challenge into focus and demonstrating the need for continuous improvement in our efforts.

The worksheets for reduction strategies that affect electricity use incorporate an "RPS Adjustment Factor". This field adjusts the emissions reduction associated with measures that are set to apply in the future. This correction is necessary because we have incorporated the effect of the State Renewable Portfolio Standard (RPS) as a separate reduction strategy. The adjustment accounts for the fact that the RPS will reduce emissions associated with electricity use in the future and, therefore, the calculated reductions must be reduced by a proportional amount to prevent the calculation from overestimating the potential emissions impact of measures that will operate in the distant future.

The reduction estimates are calculated for the period of 2005 – 2035. Emissions are expressed in metric tons of CO₂ (MT CO₂). The following table documents the assumptions that were made to complete the worksheets for each strategy, and the source of the information on which the assumption is based. Note that some of the sources are reports that are in draft or public review draft form at this time. This reflects the rapidly evolving character of the available data, and is one of the many ways in which the CAPA results are an estimate only.

All totals are rounded to the nearest 10 MT CO₂.



Statewide Initiatives

Clean Car Standards (Pavely I & II) and Low Carbon Fuel Standard (LCFS)

The Clean Car Standards call for the reduction of greenhouse gas emissions from light duty vehicles and the Low Carbon Fuel Standard (LCFS) calls for a reduction in the carbon intensity of California's transportation fuels by 2020. It is estimate that these standards will result in an overall 30 percent reduction in greenhouse gas emissions in the transportation sector in 2035.

Source: AMBAG, Draft Supplemental Environmental Impact Report, 2010 Monterey Bay Area Metropolitan Transportation Plan, Appendix F Greenhouse Gas Analysis.

Total Emissions Reduction: 186,450 MT CO₂e

Renewable Portfolio Standard (RPS)

The Renewable Portfolio Standard requires all of the state's electricity retailers to meet a 33 percent renewable energy target by 2020. It should be noted that percent renewable content does not always mean carbon-free content because some generation sources that are considered renewable, such as biogas, do produce some greenhouse gas emissions. For this calculation we assumed the 33 percent renewable target is achieved, and by 2035 further renewable energy development would result in a 50 percent carbon free portfolio for PG&E power. Using the emissions represented by the use of electricity in the 2009 inventory and the forecast emissions for 2035 a simple calculation was performed to estimate the emissions reduction represented by increasing the carbon-free renewable content of electricity generation in 2035 to 50 percent. The emissions reductions estimates from the RPS for our local area will vary depending on whether or not a CCA program is implemented. With no CCA program the reduction is estimated by applying the 50 percent carbon free portfolio to the entire projected electricity load in 2035. With a CCA program the reduction is estimated by applying a 50 percent carbon free portfolio to half of the project electricity load (PG&E customers), and a 100 percent carbon free portfolio to the remaining half of the projected electricity load (CCA customers) in 2035. The reductions reported here are for the RPS only. The reductions from a CCA program are reported separately

Total Emissions Reduction: 50% Load RPS: 34,820 MT CO₂e

Full Load RPS: 69,650 MT CO₂e

Total Emissions Reductions from Pavely I & II, LCFS, RPS: 221,270 MT CO₂e

256,100 MT CO₂e



Santa Cruz County Climate Action Strategy

Energy

Reduction Strategy: Community Choice Aggregation Program (50% Participation, 100% Carbon-Free)

Using the emissions from the use of electricity in the 2009 inventory and the forecast emissions for 2035 as inputs, the emissions reduction represented by increasing the renewable, carbon-free content to 100 percent for 50 percent of the projected electricity load in 2035 was estimated. This effectively eliminates emissions from 50 percent of the total projected load as a result of a CCA program.

50 percent participation was chosen randomly as a conservative estimate. The goal of a successful program would be closer to 100 percent participation by 2035 with a portfolio of 100 percent carbon free sources.

Total Emissions Reduction: 83,320 MT CO₂e

Reduction Strategy: Weatherization Programs

Weatherization programs that focus on low income residences provide simple repairs such as sealing cracks around windows and doors, adding insulation, and sometimes replacing inefficient appliances, thereby reducing energy-use-related GHG emissions and lowering utility bills. Santa Cruz County is served by Central Coast Energy Services (CCES) (<http://www.energyservices.org/>), which provides low and no cost weatherization and other energy services for low income residences. This calculator works by estimating the total number of homes that may receive weatherization services 2013 through 2035, using average electricity and gas savings from published data.

Average annual number of weatherizations completed: 213 homes

Source: CCES data 2005 through 2012

Electricity Savings per Home: 271 kWh/home

Source: California Energy Commission (CEC) "Options for Energy Efficiency in Existing Buildings", CEC-400-2005-039-CMF, CEC, 2005.

Annual Electricity Savings: 57,723 kWh per year

Electricity Emission Coefficient: 0.000288 MT CO₂ per kWh

RPS Adjustment Factor: 0.75

Annual Electric Emission Savings: 12 MT CO₂ per year

Gas Savings per Home: 72 therms/home

From CEC "Options for Energy Efficiency in Existing Buildings", CEC-400-2005-039-CMF, CEC, 2005.

Annual Gas Savings: 15,336 therms per year

Gas Emission Coefficient: 0.0053435 MT CO₂e per therm

Annual Gas Emission Savings: 82 MT CO₂ per year

Total Annual Emission Savings: 94 MT CO₂ per year

Implement cumulatively by increasing implementation by the above amount every year.



Reduction Strategy: Weatherization Programs

Number of years after installation that the measure is expected to continue to provide emission reductions: 22 years

Total Emission Reduction: 2,070 MT CO₂e

Reduction Strategy: AMBAG Energy Watch Projects (2006 to Q2 of 2012)

AMBAG Energy Watch municipal, non-profit, hospitality, residential and PowerSave programs

PG&E data provided by AMBAG

Electricity Savings: 5,569,138.8 kWh

Electricity Emission coefficient: 0.000288 MT CO₂ per kWh

RPS adjustment factor: 0.75

Total Emissions Reduction: 1,200 MT CO₂

Reduction Strategy: AMBAG Energy Watch Projects (Current and Pending)

PG&E data provided by AMBAG

Electricity Savings: 422,358 kWh

Electricity Emissions Coefficient: 0.000288 MT CO₂ per kWh

RPS Adjustment factor: 0.75

Electricity Emissions Savings: 91 MT CO₂

Natural Gas Savings: 40,874 therms

Gas emissions coefficient: 0.005316611 MT CO₂ per therm

Gas Emissions Savings: 217 MT CO₂

Total Emission Reduction: 310 MT CO₂

Reduction Strategy: AMBAG Energy Watch Projects (Future)

Annualized average projection based on historical participation rates. Assumes similar participation rates to the 2006-Q2 of 2012 in future years.

Emissions Reduction 2006 thru Q2 of 2012: 1,203 MT CO₂

Annualized emissions: 185 MT CO₂ per year

1203 / 26 (number of quarters 2006-Q2 of 2012) x 4 (number of quarters per year)

Implement cumulatively by increasing implementation by the above amount every year.

Number of years after installation that the measure is expected to continue to provide emission reductions: 20 years

Total Emission Reduction: 3,700 MT CO₂



Reduction Strategy: PG&E Energy Efficiency Programs

PG&E Programs (55)
 PG&E data provided by AMBAG
 Electricity Savings: 17,123,063.2 kWh
 Electricity Emission factor: 0.000288 MT CO₂ per kWh
 RPS Adjustment: 0.75
 Electricity Emissions Reduction: 3,699 MT CO₂e
 Natural Gas Savings: 40,432 therms
 Natural Gas Emissions factor: 0.005316611 MT CO₂ pertherm
 Gas Emissions Reduction: 215 MT CO₂e

Total Emissions Reduction: 3,910 MT CO₂

Reduction Strategy: PG&E Energy Efficiency Programs (Future)

Annualized Average projection based on historical participation rates. Assumes similar participation rates to the 2006-Q2 of 2012 in future years.

Emissions Reduction 2006 thru Q2 of 2012: 3,914 MT CO₂

Annualized Emissions: 602 MT CO₂ per Year

$3,914 / 26$ (number of quarters 2006-Q2 of 2012) \times 4 (number of quarters per year)

Implement cumulatively by increasing implementation by the above amount every year.

Number of years after installation that the measure is expected to continue to provide emission reductions: 20 years

Total Emission Reduction: 12,040 MT CO₂

Reduction Strategy: Restaurant Retrofit Program

AMBAG Energy Watch Program

Projections provided by AMBAG Energy Watch Program

Typical Emissions Reductions (per unit replaced/upgraded)

- Combination Electric Oven (F100) = 18,432 kWh/unit (5.3 MT CO₂e)
- Pressureless Steamer (F108) - 11,166 kWh/unit (3.2 MT CO₂e)
- Grill-to-order Line (F144) - 15,167 kWh/unit (4.3 MT CO₂e)
- PRINCE CASTLE DHB4SS-20 UNIT - 18HRS (F147) - 31,631 kWh/unit (9.1 MT CO₂e)
- HIGH EFFICIENCY GAS STEAMER (F109)- 2,084 therms/unit (11 MT CO₂e)
- COMMERCIAL RACK OVEN SINGLE (F141)- 1,034 therms/unit (5.5 MT CO₂e)
- FLEXIBLE BATCH BROILER (F152)- 1089 therms/unit (5.7 MT CO₂e)



Reduction Strategy: Restaurant Retrofit Program

Average Emissions Reduction per restaurant: 10 MT CO₂e

Number of restaurants retrofitted: 10 per year

Total Annual Emission Reduction: 100 MT CO₂ per year

Implement cumulatively by increasing implementation by the above amount every year.

Number of years after installation that the measure is expected to continue to provide emission reductions: 20 years

Total Emission Savings: 2,000 MT CO₂

Reduction Strategy: Right Lights (2006 to Q2 of 2012)

A program of Ecology Action affecting commercial buildings

PG&E data provided by AMBAG Energy Watch Program

Electricity Savings: 5,640,083 kWh

Electricity Emission factor: 0.000288 MT CO₂e per kWh

RPS Adjustment: 0.75

Total Emissions Reduction: 1,220 MT CO₂e

Reduction Strategy: Right Lights (Future)

Annualized Average projection based on historical participation rates. Assumes similar participation rates to the 2006-Q2 of 2012 in future years.

Emissions Reduction 2006 thru Q2 of 2012: 1,218 MT CO₂e

Annual Emissions Reduction: 187 MT CO₂e/yr

$1,218 / 26$ (number of quarters 2006-Q2 of 2012) $\times 4$ (number of quarters per year)

Implement cumulatively by increasing implementation by the above amount every year.

Number of years after installation that the measure is expected to continue to provide emission reductions: 20 years.

Total Emission Reduction: 3,740 metric tons

Reduction Strategy: Energy Retrofits at Time of Sale

Ensure implementation of improvements to existing buildings by requiring improvements when renovations are made or when buildings are sold. There were 1,026 residential real estate transactions in unincorporated Santa Cruz County in 2011 (Santa Cruz Association of Realtors (SCCAR)).

Annual number of inspections and tune ups: 1,026 homes

Source: 1,026 homes sold in 2011 (SCCAR website)

Electricity Savings per Home: 535 kWh per home



Reduction Strategy: Energy Retrofits at Time of Sale

Source: "Options for Energy Efficiency in Existing Buildings", CEC-400-2005-039-CM, CEC, 2005.

Annual Electricity Savings: 548,910 kWh per year

Electricity Emission Coefficient: 0.000288 MT CO₂ per kWh

RPS Adjustment Factor: 0.75

Annual Electric Emission Savings: 119 MT CO₂ per year

Gas Savings per Home: 26 therms per home

From CEC. 2005. Options for Energy Efficiency in Existing Buildings. CEC-400-2005-039-CMF.

Annual Gas Savings: 26,676 therms per year

Gas Emission Coefficient: 0.0053435 MT CO₂e per therm

Annual Gas Emission Savings: 143 MT CO₂ per year

Total Annual Emission Savings: 262 MT CO₂ per year

Implement Cumulatively by increasing implementation by the above amount every year.

Number of years after installation that the measure is expected to continue to provide emission reductions: 20 years

Total Emission Reduction: 5,240 MT CO₂

Reduction Strategy: Green Business Program (Certified Prior to 2013)

128,886 lbs/year per business = 58.4 MT CO₂e/year per business

Source: Jo Fleming, Regional Green Business Program Coordinator, personal communication

Total Emission Savings: 610 metric tons

Reduction Strategy: Green Business Program (Growth/Expansion)

128,886 lbs/year per business = 58.4 MT CO₂e/year per business

Source: Jo Fleming, Regional Green Business Program Coordinator, personal communication.

Degree of implementation: 10 new businesses per year

Annual emissions savings: 584 MT CO₂e per year

Implement cumulatively by increasing implementation by the above amount every year.

Number of years after installation that the measure is expected to continue to provide emission reductions: 20 years.

Total Emission Savings: 11,680 MT CO₂

Reduction Strategy: Solar Photovoltaics

California Solar Initiative (CSI) - rebates and other incentives for renewable energy systems



Reduction Strategy: Solar Photovoltaics

Total installed capacity 2007 to 2011: 1,515 kW

Source: CSI website, data for small commercial <10kW and residential

Generation Potential: 1,643 kWh/kW

Adapted from Table AE-2.1 of “Quantifying Greenhouse Gas Mitigation Measures”, CAPCOA, August 2010. <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>

Electricity Produced: 2,489,145 kWh

Electricity Emission Coefficient: 0.000288 MT CO₂ per kWh

RPS Adjustment Factor: 0.75

Emission Reduction: 540 MT CO₂

Reduction Strategy: Solar Photovoltaics (Growth)

Annualized average projection based on historical participation rates. Assumes similar participation rates to the 2007 to 2011 annual rates in future years.

Average annual emission reduction 2007 to 2011: 108 MT CO₂

Implement cumulatively by increasing implementation by the above amount every year.

Number of years after installation that the measure is expected to continue to provide emission reductions: 20 years

Total Emission Reduction: 2,160 MT CO₂

Reduction Strategy: Solar Water Heaters

California Solar Initiative Thermal – rebates and other incentives for solar thermal installation. The number of solar thermal systems installed is estimated due to a lack of specific data. Energy saved is based on published data.

Systems Installed: 136

Estimate: Number of PV systems installed 2007 to 2011 (272) reduced by half.

Percent Electric Water Heaters: 10 percent

Source: California Residential Appliance Saturation Survey (California Energy Commission, 2009)

Electricity Savings per System: 2,889 kWh/system

Source: Average performance values by Climate Zone, obtained from the Solar Rating and Certification Corporation Rating Directory. The SRCC is a non-profit corporation that develops and implements national rating standards and certification programs for solar energy equipment.

Electricity Savings: 29,290 kWh

Electricity Emission Coefficient: 0.000288 MT CO₂ per kWh

RPS Adjustment Factor: 0.75



Reduction Strategy: Solar Water Heaters

Electric Emission Savings: 8 MT CO₂
 Percent Gas Water Heaters: 90 percent
 Calculated as the remainder from the percent electric water heaters
 Gas Savings per System: 137 therms/system
 Average performance values by climate zone, obtained from the Solar Rating and Certification Corporation Rating Directory. The SRCC is a non-profit corporation that develops and implements national rating standards and certification programs for solar energy equipment.
 Gas Savings: 16,769 therms
 Gas Emission Coefficient: 0.0053435 MT CO₂ per therm
 Gas Emission Savings: 90 MT CO₂

Total Emission Reduction: 100 MT CO₂

Reduction Strategy: Solar Water Heaters (Growth)

Annualized average projection based on historical participation rates. Assumes similar participation rates to the 2007 to 2011 annual rates in future years.
 Average annual emission reduction 2007 to 2011: 20 MT CO₂
 Implement cumulatively by increasing implementation by the above amount every year.
 Number of years after installation that the measure is expected to continue to provide emission reductions: 20 years

Total Emission Savings by 2035: 400 MT CO₂

Reduction Strategy: Wind Power

Based on a lack of data and apparent low level of wind power generation in the County it was assumed that one typical system per year is installed.
 Annual installed capacity: 50 kW
 Small wind turbines have a rated output of less than 100 kW, and produce enough energy to power a home, small business, school or government building.
 Generation Potential: 1,520 kWh/kW Installed per year
 The value of 1520 kWh/kW of Capacity was derived from data from the California electronic Wind Performance Reporting System (eWPRS). Figure represents the average of the average performance of 43 installations ranging in capacity from 13 - 13,000 kW.
 Annual Electricity Produced: 76,000 kWh per year
 Electricity Emission Coefficient: 0.000288 metric tons per kWh
 RPS Adjustment Factor: 0.75
 Annual Electric Emission Savings: 16 metric tons per year
 Implement cumulatively by increasing implementation by the above amount every year.



Number of years after installation that the measure is expected to continue to provide emission reductions: 20 years.

Total Emission Reduction: 320 MT CO₂

Reduction Strategy: Education - Residential

One of the most effective ways of communicating about energy use is through an energy audit. This calculator works by estimating the number of homes per year that are made more efficient by owners with knowledge (various programs) on how they are using power and how to efficiently cut back.

Annual number of inspections (Whole-House Diagnostic Audits) and tune ups: 50 homes

Electricity Savings per Home: 1,650 kWh per home

From CEC. 2005. Options for Energy Efficiency in Existing Buildings. CEC-400-2005-039-CMF.

Annual Electricity Savings: 82,500 kWh per year

Electricity Emission Coefficient: 0.000288 MT CO₂ per kWh

RPS Adjustment Factor: 0.75

Annual Electric Emission Savings: 18 MT CO₂ per year

Gas Savings per Home: 68 therms/home

From "Options for Energy Efficiency in Existing Buildings", CEC-400-2005-039-CMF, CEC 2005..

Annual Gas Savings: 3,400 therms per year

Gas Emission Coefficient: 0.0053435 MT CO₂e per therm

Annual Gas Emission Savings: 18 metric tons per year

Total Annual Emission Savings: 36 metric tons per year

Implement Cumulatively by increasing implementation by the above amount every year.

Number of years after installation that the measure is expected to continue to provide emission reductions: 20 years

Total Emission Reductions: 720 MT CO₂

Reduction Strategy: Education – Business

As with residences, One of the most effective ways of communicating about energy use to businesses is through an energy audit. This calculator works by estimating the number of businesses per year that are made more efficient by owners with knowledge (Commercial Building Benchmarking) on how they are using power and how to efficiently cut back. "Benchmarking" is a new state law (AB 1103) requiring disclosure of energy information on commercial buildings upon whole-building sale, lease, or refinance.

Annual square feet of building space that will be audited and benchmarked: 100,000 Square Feet

(Due to lack of available data this a gross estimate for Santa Cruz County)

Electricity Savings per Square Foot: 0.13 kWh/square foot

From "Options for Energy Efficiency in Existing Buildings", CEC-400-2005-039-CMF, CEC 2005..

Annual Electricity Savings: 13,000 kWh per year



Reduction Strategy: Education – Business

Electricity Emission Coefficient: 0.000288 MT CO₂ per kWh

RPS Adjustment Factor: 0.75

Annual Electric Emission Savings: 3 MT CO₂ per year

Gas Savings per Square Foot: 0.002 therms per Square Foot

From "Options for Energy Efficiency in Existing Buildings", CEC-400-2005-039-CMF, CEC 2005..

Annual Gas Savings: 200 therms per year

Gas Emission Coefficient: 0.0053435 MT CO₂e per therm

Annual Gas Emission Savings: 1 MT CO₂ per year

Total Annual Emission Savings: 4 metric tons per year

Implement Cumulatively by increasing implementation by the above amount every year.

Number of years after installation that the measure is expected to continue to provide emission reductions: 20 years.

Total Emission Reductions: 80 MT CO₂

Reduction Strategy: Beyond Title 24 Residential

Santa Cruz County has adopted the 2010 California Green Building Standards Code (CALGreen Code), also known as Part 11 of Title 24 of the California Code of Regulations, including all residential and nonresidential mandatory measures. The provisions of the code apply to newly constructed buildings and additions 500 square feet or larger to existing buildings for all new work. For remodels, insulation meeting the mandatory feature requirements in the California Energy Code shall be installed at ceilings, walls, floors and water pipes, when these areas are exposed during remodeling. New appliances installed as part of any remodel, addition or new construction shall be Energy Star appliances. This calculator estimates the additional emissions reduction that could be achieved by adopting stricter standards that would result in 30 percent more energy efficiency. This calculator does not work cumulatively because it only accomplishes a reduced level of emissions from projected growth in emissions from new construction.

Area of building space to be constructed annually under the stricter standard: 288,540 Square Feet

2011 Santa Cruz County data for new homes, accessory dwelling units, duplexes, replacement homes, and additions 500 square feet or larger adjusted to approximate pre-recession levels of building activity.

Planned Percent Improvement over Title 24 2008: 30 percent

Percent of New Construction as Single Family Units: 100 percent

Baseline Electricity Intensity for PG&E service Area: 1.07 kWh per square foot per year

Annual Electric Savings: 92,621 kWh per Year

Electricity Emission Coefficient: 0.000288 MT CO₂ per kWh

RPS Adjustment Factor: 0.75

Annual Emission Savings: 20 MT CO₂ per year

Baseline Gas Use Intensity for PG&E service Area: 0.171465 therms per square foot per year

Annual Gas Savings: 14,842 therms per Year



Reduction Strategy: Beyond Title 24 Residential

Gas Emission Coefficient: 0.0053435 MT CO₂e per therm

Annual Emission Savings: 79 metric tons per year

Total Emission Reduction: 100 MT CO₂

Reduction Strategy: Beyond Title 24 Commercial

Area of building space to be constructed annually under the stricter standard: 102,086

2011 Santa Cruz County records of new commercial square footage adjusted to approximate pre-recession levels of building activity..

Planned Percent Improvement over Title 24 2008: 30 percent

Baseline Electricity Intensity for PG&E service area: 6.9 kWh per Square Foot per Year

Annual Electric Savings: 211,318 kWh per Year

Electricity Emission Coefficient: 0.000288 MT CO₂ per kWh

RPS Adjustment Factor: 0.75

Electricity Emission Reduction: 46 MT CO₂ per Year

Baseline Gas Use Intensity for PG&E service area: 0.104 therms per Square Foot per Year

Annual Gas Savings: 3,185 therms per year

Gas Emission Coefficient: 0.0053435 metric tons per therm

Gas Emission Reduction: 17 MT CO₂ per year

Total Emission Reductions: 60 MT CO₂



Santa Cruz County Climate Action Strategy

Transportation

Reduction Strategy: Reduce Vehicle Miles Traveled through Land Use Planning

This calculator reflects the results of the Rapid Fire modeling tool which calculates results based on empirical data and the latest research on the role of land use and transportation systems on automobile travel; emissions; and land, energy, and water consumption. It is a spreadsheet based tool developed by Vision California, a project funded by the California High Speed Rail Authority in partnership with the California Strategic Growth Council. The Rapid Fire model calculates VMT by applying assumptions about VMT to population growth based on research and empirical evidence. The model works by comparing two different development patterns: One applies the existing per capita VMT to the projected 2035 population assuming the increased population is accommodated by continuation of automobile-oriented development patterns, and the other applies a reduced per capita VMT to the projected 2035 population assuming the increased population is accommodated with a high percentage of mixed use and infill development. The overall reduction in VMT from a compact and urban development scenario corresponds to a reduction in emissions compared to the business as usual scenario. These estimates were calculated for the urban portion of Santa Cruz County.

2035 Projected Average Passenger Fuel Economy: 35 Miles per Gallon

Source: U. S. Energy Information Administration, Annual Energy Outlook 2012, Figure 24.

Current Population (2010): 47,190

Source: BAE Urban Economics, Demographic, Economic and Real Estate Market Existing Conditions Analysis, Transit Corridors Plan for Santa Cruz County, August 24, 2012 (Existing Conditions Report)

Vehicle Miles Traveled per Capita: 7,648 miles/year

Source: Santa Cruz County Community Greenhouse Gas Emissions Inventory, 2009

2035 Projected Population: 52,450

Source: Existing Conditions Report (High Projection)

2035 VMT Per Capita with transportation and land use strategies to reduce VMT: 6,118 miles/year
VMT reduction of 20 percent

Source: Calthorpe Associates (2011) Vision California, Charting Our Future, Statewide Scenarios Report

Total VMT with population increase and no VMT reduction: 401,137,600 miles

Total VMT with increase in population density: 320,889,100 miles

VMT Reduced: 80,248,500 Miles

Fuel Savings: 2,292,814 Gallons

Gasoline Emissions Factor: 8.78 kg CO₂ per Gallon

Total Emission Reduction: 20,130 MT CO₂e



Reduction Strategy: Electric Vehicle (EV) Charging

The effect of EVs on GHG emissions will depend on the source of electricity used and the particular vehicles being compared. If EVs are charged from renewable energy, emissions are zero. For this calculation the number of replacement electric vehicles by 2035 is estimated from state EV goals. Emissions reductions are then estimated by subtracting the emissions associated with vehicle electricity consumption from emissions associated with gasoline consumption for the estimated number of vehicles.

Number of vehicles that will be replaced with an electric powered model 5,525 Vehicles

Santa Cruz County (unincorporated) proportional share by population of State EV Goals according to: "2012 ZEV ACTION PLAN, A Roadmap toward 1.5 Million Zero-emission Vehicles on California Roadways by 2025", Governor's Interagency Working Group on Zero-emission Vehicles, Governor Edmund G. Brown Jr., September 2012 [DRAFT VERSION FOR PUBLIC COMMENT]

Note: Santa Cruz County (unincorporated) proportional share by population of existing EVs: 42

Source: Number of Clean Vehicle Rebate Project (CVRP) rebate by vehicle type (FY 2009-2013)", Clean Vehicle Rebate Project website

Average annual miles traveled for all vehicles included in this calculation: 11,000 Miles

2035 Projected average vehicle fuel economy for all vehicles included in this calculation: 35 MPG

Gasoline Consumption Reduced: 1,723,229 Gallons per Year

Gasoline Emissions coefficient: 0.00878 MT CO₂ per gallon

CO₂ reduced from reduced gasoline consumption: 15,130 MT CO₂ per year

Fuel economy for the replacement electric vehicle: 105 MPGe (Miles per Gallon Gasoline Equivalent)

Note: Electric vehicle fuel economy numbers are reported in terms of MPGe. Values for a variety of models are available at www.FuelEconomy.gov

Equivalent Gallons of Gasoline Consumed: 574,410 Gallons

Energy conversion factor: 1 Gasoline Gallon = 36.6 kWh

Increased Electricity Consumption: 21,023,406 kWh

Electricity Emission Coefficient: 0.000288 MT CO₂ per kWh

RPS Adjustment Factor: 0.75

CO₂ Produced from electric vehicle charging: 4,541 MT CO₂

Net Emissions Reduction: 10,590 MT CO₂

Reduction Strategy: Carpooling

The carpool calculator works by accounting for the emissions reductions produced by increased numbers of commuter carpools and lower overall vehicle miles traveled as a result. Fuel efficiency and commute distances are projected for the 2035 scenario.

Commuters in the unincorporated areas of County that drove alone to work: 65,332 (2010 Census)

Commuters that carpool or took public transit: 12,537 (2010 Census)

Drive alone in 2035: 68,850

Source: Existing number of commuters that drive alone projected out to 2035 using a population growth rate of



Reduction Strategy: Carpooling

0.21 percent (AMBAG)

Estimate percent additional participation in carpools? in 2035: 8 percent

Source: Update In Process to Regional Transportation Plan: Goal 1: Target 1D: Decrease single occupancy vehicle mode share compared to the baseline condition between 2 to 8 percent by 2035.

Additional participants in 2035: 5,508

Average Daily Vehicle Miles Traveled: 22.5 Miles

Sources: 2035 projected average vehicle speed = 26.3 (2010 RTP Appendix H). Average travel time to work = 25.7 minutes (2010 Census). Assume constant average travel time to work. $(26.3 \times (25.7/60)) \times 2 = 22.5$

Working Days per Year: 240 Days

Total VMT: = 29,743,200 Miles

Average Vehicle Occupancy of Carpool Participants: 2

Vehicle Miles Reduced: = 14,871,600 Miles

Projected fuel economy in 2035: 35 MPG

Source: U. S. Energy Information Administration, Annual Energy Outlook 2012, Figure 24.

Gasoline Consumption Reduced: 424,903 Gallons per Year
(14,871,600/35)

Gasoline Emissions Factor: 8.78 kg CO₂ per Gallon

Total Emissions Reduction: 3,730 MT CO₂e



Santa Cruz County Climate Action Strategy

Solid Waste

Reduction Strategy: Landfill Gas to Energy

This calculator estimates the amount of existing electricity emissions could be offset if the electric power produced by landfill gas at the Buena Vista landfill were credited to the County of Santa Cruz instead of the current scenario in which the electricity production is purchase by another jurisdiction.

Annual Landfill Gas Emissions: 108, 748 MT CO₂e per year

Methane generation from landfill gas recovery in 2010

Source: "Applicability Review and Greenhouse Gas Emission Modeling for the Federal Mandatory Reporting Rule for Buena Vista Landfill", SCS Engineers , January 15, 2010.

Gas Collection Efficiency: 85 percent

Total Annual Methane Captured: 4,402 MT CH₄

Generator Efficiency: 35 percent

Typical values for various generator types: Microturbine: 25 percent, Combustion Turbine: 32 percent, Reciprocating Engine: 35 percent

Capacity Factor: 85 percent

Capacity factors account for system downtime and operational losses for the generator

Annual Electricity Produced: 17,462,640 kWh

Conversion of methane from mass to volume to energy units

Electricity Emission Coefficient: 0.000288 MT CO₂e per kWh

RPS Adjustment Factor: 0.75

Total Clean Energy Emissions Benefits: 3,770 MT CO₂e