

Appendix E: GHG Emissions Reduction Strategy

1. Purpose & Scope

The Greenhouse Gas Emissions Reduction Strategy developed by the City of San Rafael is designed to meet the requirements of the Bay Area Air Quality Management District's (BAAQMD) criteria for a qualified greenhouse gas reduction strategy as defined in the district's updated California Environmental Quality Act (CEQA) Air Quality Guidelines. The City's Greenhouse Gas Emissions Reduction Strategy is articulated through the City's Climate Change Action Plan (CCAP), which was adopted in May 2009, prior to BAAQMD's release of its updated guidelines.

Since the adoption of the San Rafael Climate Change Action Plan in May 2009, the State Office of Planning and Research was required to update the CEQA guidelines as directed under Senate Bill 97 (SB 97). SB 97 requires all projects subject to CEQA to analyze and mitigate the greenhouse gas emissions that will occur. The new State CEQA guidelines were adopted on December 31, 2009, and became effective in March of 2010. With the release of the updated State CEQA guidelines, BAAQMD also updated its CEQA Air Quality Guidelines for the San Francisco Bay Area Basin.

2. BAAQMD Guidelines

The purpose of the BAAQMD CEQA Air Quality Guidelines is to assist lead agencies in evaluating the air quality impacts of proposed projects and plans within the San Francisco Bay Area Basin. The guidelines were updated to establish

thresholds of significance for impacts related to greenhouse gas emissions to be consistent with the requirements of the California Environmental Quality Act. These thresholds can be used to assess plan-level and project-level impacts and allow a lead agency to determine that a project's impact on GHG emissions is less than significant if it is in compliance with a qualified greenhouse gas reduction strategy.

The City's GHG Emissions Reduction Plan follows both State CEQA Guidelines and BAAQMD's guidelines by incorporating the standard elements of a qualified GHG reduction strategy into the CCAP. The standards elements of a GHG reduction strategy include the following steps:

- Quantify greenhouse gas emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic range.
- Establish a level, based on substantial evidence below which the contribution to greenhouse gas emissions from activities covered by the plan would not be cumulatively considerable.
- Identify and analyze the greenhouse gas emissions resulting from specific actions or categories of actions anticipated within the geographic area.
- Specify measures or a group of measures, including performance standards that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level.
- Monitor the plan's progress.

- Adopt the greenhouse gas reduction strategy in a public process following environmental review.

The remainder of this appendix describes in detail how the City's Climate Change Action Plan has been modified to satisfy the requirements of BAAQMD's guidelines on the standard elements of a qualified GHG reduction strategy and will allow future development projects to determine that a project has a less-than-significant impact on GHG emissions so long as it is in compliance with the City's GHG Emissions Reduction Strategy.

3. GHG Emissions Reduction Strategy

3.1 GHG Emissions Inventory

The first component of a qualified GHG reduction strategy is to complete an inventory of all GHG emissions within a specific geographic boundary. San Rafael's GHG inventory uses a baseline year of 2005 and inventories carbon dioxide (CO₂), nitrous oxide (N₂O), and methane (CH₄) emissions from activities within the jurisdictional boundary of the City of San Rafael. The inventory was prepared by ICLEI, Local Governments for Sustainability (ICLEI), in 2008 following the Local Government Operations Protocol and best management practices for calculating and reporting community-wide and government operations emissions. The emissions sources calculated in the baseline inventory include residential,

commercial, and industrial electricity and natural gas use, on-road transportation, and solid waste by compiling activity data like kilowatt hours of electricity, vehicle miles traveled (VMT) on state and local roads, or tons of waste disposed and converting them into metric tons of carbon dioxide equivalents (MTCO₂e).

This GHG Emissions Reduction Strategy includes revisions to the baseline community-wide GHG inventory to comply with BAAQMD guidance. As part of these revisions, the methodology for calculating VMT and associated emissions on state highways, like U.S. Highway 101 and Interstate 580 which pass through San Rafael, was updated. Methane emissions associated with waste disposal were updated using the California Air Resources Board (CARB) Landfill Emissions Tool¹ to determine the methane emissions that will be released over the next hundred years from the decomposition of waste that was disposed of by San Rafael residents and businesses in 2005. GHG emissions from fuel used to power lawn and garden and construction equipment has also been included in the inventory. GHG emissions from off-road equipment were calculated using CARB's OFFROAD Software and apportioned to the City of San Rafael based on the number of households and construction activity in the City.

GHG emissions from water used by San Rafael residents and businesses have also been included in this updated inventory. Significant amounts of energy are required to pump, treat, deliver, and discharge water. The Marin Municipal Water

¹ California Air Resources Board. 2010
<http://www.arb.ca.gov/cc/landfills/landfills.htm>

District, San Rafael Sanitation District, and Central Marin Sanitation Agency use electricity, natural gas, propane, diesel, and other fuels to deliver and treat water in San Rafael. The Central Marin Sanitation Agency also produces methane and nitrous oxide direct GHG emissions through the wastewater treatment process.

Stationary sources of emissions have also been included in this updated emissions inventory. Stationary sources are defined as any fixed emitter of air pollutants, such as power plants, petroleum refineries, petrochemical plants, food processing plants, and other heavy industrial sources.² San Rafael includes two stationary source emitters (Cal-Pox, Inc. and Central Marin Sanitation Agency) on BAAQMD's list of the top 200 stationary source GHG emitters in the San Francisco Bay Area Basin, emitting a total of 7,468 MTCO₂e in 2007.³ These emissions sources likely generate the majority of stationary emissions in San Rafael and while there are likely other smaller stationary sources of emissions, these sources were not available at the time of this inventory revision.

These emissions are included in the GHG Emissions Reduction Strategy for informational purposes only, as stationary source emissions are regulated by BAAQMD or through federal and state programs. The baseline inventory is

intended to guide future local policy decisions that relate to emissions within the City's control; therefore, stationary source emissions are excluded from further discussions of the inventory for the purpose of setting accurate emissions reduction targets.

In 2005, the city's GHG Emissions Inventory totaled 426,468 MTCO₂e from the residential, commercial, transportation, waste, water, and off-road sectors. As shown in **Figure 1** and **Table 1**, emissions from on-road transportation are the largest contributor to San Rafael's GHG emissions at 42% of all emissions, or 177,689 MTCO₂e. Residential and commercial GHG emissions are roughly equivalent at 91,099 and 87,670 MTCO₂e, respectively, while waste emissions make up 13% of total emissions with 56,346 MTCO₂e. Off-Road Equipment makes up 2% of total emissions while water is the remaining 1% or 3,182 MTCO₂e.

² U.S. Environmental Protection Agency, Civil Enforcement.
<http://www.epa.gov/oecaerth/caa/caaenfprog.html>

³ Bay Area Air Quality Management District, December 2007, Source Inventory of Bay Area Greenhouse Gas Emissions.
http://hank.baaqmd.gov/pln/documents/regionalinventory2007_003_000_000_000.pdf

Figure 1: Community-Wide GHG Emissions, 2005

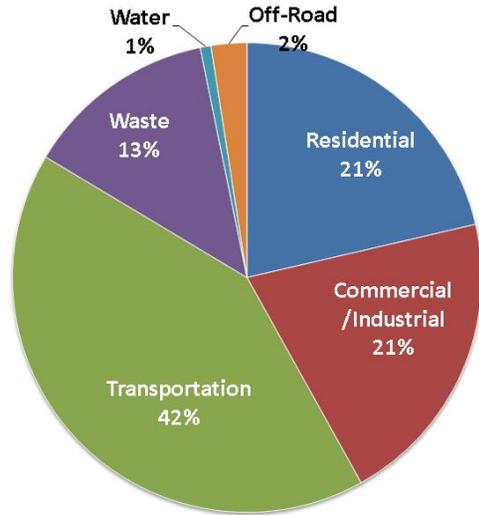


Table 1: Community-Wide GHG Emissions, 2005

Sector	2005 Emissions (MTCO ₂ e)
Residential	91,099
Commercial/Industrial	87,670
Transportation	177,689
Waste	56,346
Water	3,182
Off-Road	10,482
Total	426,468

GHG Emissions Projections

In addition to completing an inventory of GHG emissions, the City has projected how these emissions will continue to grow if community activities do not change, but the city’s population, housing, employment, and vehicle miles traveled (VMT) continue to grow. These emissions have been projected for each sector out to the years 2020 and 2035 to be consistent with the target years set in Assembly Bill (AB) 32 and SB 375, respectively. Projecting these emissions out to 2020 and 2035 relies on the Association of Bay Area Governments (ABAG) projections of housing, population, and employment within the city by 2020 and 2035, and the Metropolitan Transportation Commission’s (MTC) county-specific growth estimates of VMT for Marin County.

Table 2: San Rafael Growth Projections

Growth Indicator	Source	2005	2020	2035
Service Population	ABAG	102,140	107,420	115,240
Households	ABAG	22,930	23,860	25,800
Daily VMT (Marin County)	MTC Travel Forecast Data	6,314,910	7,015,781	8,071,230
Employment	ABAG	45,140	47,520	51,340

These growth projections are then applied to each emissions sector to determine future emissions levels under a business-as-usual scenario. Business-as-usual refers to a continuation of

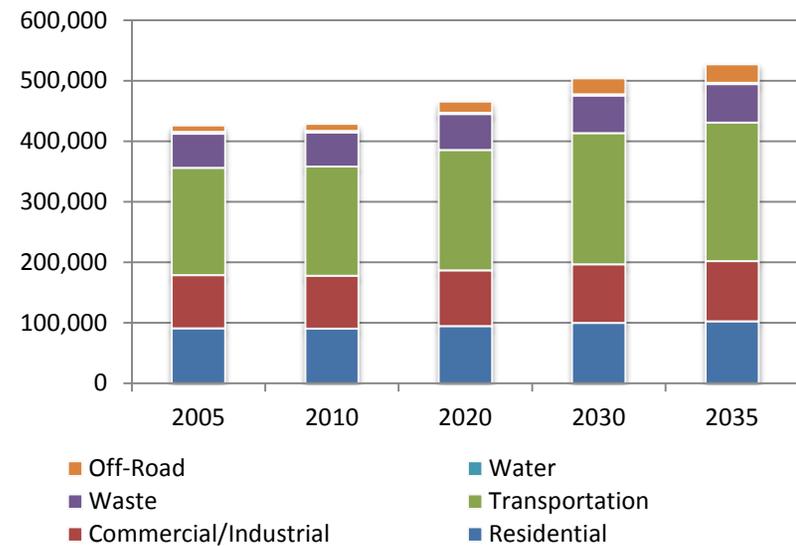
growth in population, jobs, and housing in the same manner that growth has occurred in the past without programs to reduce emissions. If current emissions trends continue to grow under a business-as-usual growth scenario, San Rafael's GHG emissions will reach 465,561 MTCO₂e by 2020 and 527,361 MTCO₂e by 2035.

Table 3: Community-Wide Emissions Forecast

		2005	2010	2020	2035
Residential	Electricity	31,037	30,834	32,296	34,922
	Natural Gas	60,062	59,669	62,498	67,580
Commercial / Industrial	Electricity	57,419	57,317	60,446	65,306
	Natural Gas	30,251	30,197	31,846	34,406
Transportation		177,689	180,281	198,900	229,038
Solid Waste		56,346	56,192	59,259	63,573
Water*		3,182	3,114	2,343	2,040
Off-Road	Lawn and Garden	1,758	1,746	1,829	1,978
	Construction	8,724	9,394	24,394	28,520
TOTAL		426,468	428,745	465,561	527,361
% Change from 2005		0.0%	0.5%	9.2%	23.7%

* GHG emissions from water will decrease overtime as purchased electricity from Marin Energy Authority comes from additional renewable resources.

Figure 2: Business as Usual Forecast, 2005–2035



3.2 GHG Emissions Reduction Target

Included in the GHG emissions inventory of community-wide activities is the identification of an emissions reduction target. San Rafael has adopted an emissions reduction target of 25 percent below baseline levels by 2020. This reduction target exceeds the State-recommended reduction target of 15 percent below baseline levels by 2020, as described in Assembly Bill 32. Reaching the reduction target of 25 percent below baseline levels by 2020 will be achieved through a combination of local, regional, state, and federal actions and programs, including programs that have not yet been

developed. Achieving the reduction target will also rely on community participation and engagement in these programs.

In addition to AB 32, California has adopted and started to implement several state-level programs that will impact local GHG emissions. In order to effectively determine the emissions reductions that will need to be implemented at the local level to meet the City’s emissions reduction target, the impact of state-level programs has been incorporated into an adjusted business-as-usual forecast. The state-level programs included in this adjusted forecast include the Renewable Portfolio Standard (RPS), updates to Title 24 Energy Efficiency Standards, California Solar Initiative Rebates, and the implementation of AB 1493, the motor vehicle fuel efficiency standard, referred to as the Pavley Standard.

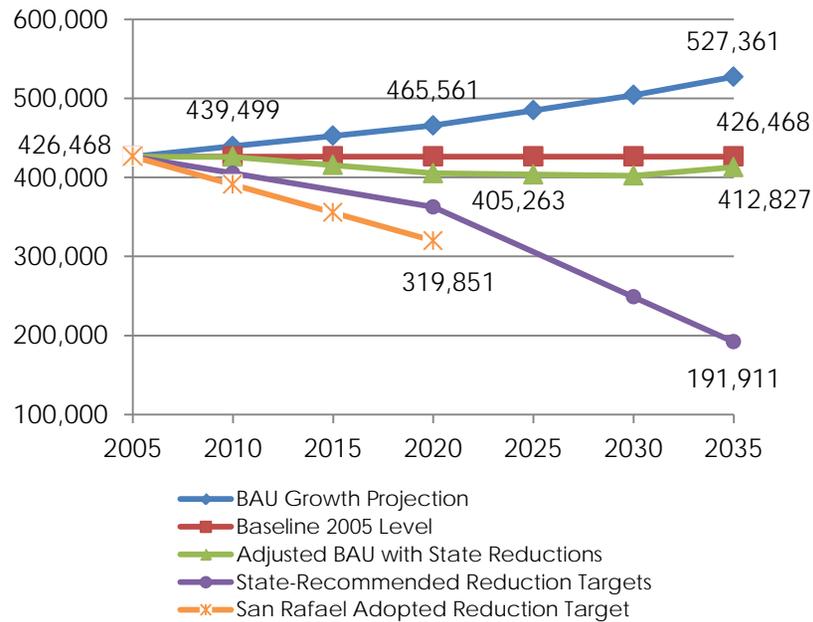
The City has agreed to participate in the newly formed Marin Clean Energy (MCE), set to provide electricity customers in San Rafael with a higher percentage of electricity from renewable resources. Launched in 2010, MCE is providing “Light Green” electricity customers with at least 25 percent of the electricity from renewable resources and the option to select the “Deep Green” choice to purchase 100 percent of their electricity from renewable resources. The increase in renewable energy provided to MCE customers will significantly reduce the emissions associated with electricity use in San Rafael.

Table 4: State Programs Emissions Reductions (MTCO₂e)

	2005	2010	2020	2035
Growth Projection	426,468	428,745	465,561	527,361
Pavley I	n/a	n/a	-29,174	-55,269
Marin Clean Energy	n/a	n/a	-26,836	-51,757
RPS	n/a	-2,380	-2,652	-4,671
California Solar	n/a	-410	-599	-460
Title 24	n/a	n/a	-701	-1,902
Total Reductions	n/a	-2,380	-59,364	-113,599
Adjusted Growth Projection	n/a	425,872	405,263	412,827

The impact of these state and regional programs will play a critical role in helping San Rafael to achieve the emissions reduction target. An adjusted business-as-usual forecast that includes state reductions is shown in **Figure 3** and demonstrates that an additional 85,412 MTCO₂e will need to be reduced from local actions to achieve the 25 percent reduction target by 2020.

Figure 3: Emissions Forecast and Reduction Targets



3.3 Measure Quantification

This GHG Emissions Reduction Strategy demonstrates how the City will achieve its GHG emissions reduction target through the implementation of the CCAP strategies. It should be noted that the methodologies used in this strategy are limited by the scope of the City’s inventory. Some of the measures included in the CCAP were omitted from this analysis for one of two reasons: the related sources of emissions were not included in the City’s baseline inventory or the measure lacked sufficient details or research to provide an

accurate estimate of the potential reduction in GHG emissions. The GHG Emissions Reduction Strategy quantifies the policies included in the CCAP to demonstrate the City’s progress toward achieving the adopted emissions reduction targets. The measures quantified as part of the CCAP are organized in the following manner:

- Our Lifestyles
- Our Buildings
- Our Environment
- Our Economy
- Our Community

Emissions reductions were quantified for three different years: 2010, 2020, and 2035. Emissions reductions for 2010 have been quantified to demonstrate the *actual* emissions reduction progress that the City has already made in implementing measures within the CCAP, while the 2020 and 2035 emissions reductions are the *potential* reductions that will be achieved through the implementation of these measures over the next several years.

Our Lifestyles

This section includes emissions reduction measures ranging from improved land use decisions and transportation choices including alternative fuel vehicles, transit, biking, and walking, to improved waste disposal methods. With transportation emissions making up a significant portion of the city’s emissions, it is important that the City make alternatives to

driving more accessible by providing the necessary infrastructure or incorporating higher densities and mixed land uses within neighborhoods located near transit or in TODs.

Transit-Oriented Development (TOD)

Reduction Measure:

Implement General Plan policies to increase residential and commercial densities within walking distance of high frequency transit centers and corridors.

Action Items:

Consider land use and transportation alternatives (better bicycle and pedestrian access and increase transit feeder service) to best use the future Civic Center SMART Station.
 Determine areas in need of sidewalk improvements, land use changes, or modified transit stops to create walkable neighborhoods.

2010 Reductions:	0
2020 Reductions:	-595
2035 Reductions:	-2,239

Assumptions:

- Reductions from TOD assume that 50% of all new housing units will be built in TOD areas by 2020, 68% by 2030, and 70% by 2035.
- VMT per household is based on total VMT for city divided by the number of housing units.
- TOD housing units can achieve a 12–30% reduction in VMT based on density and context.
- Mixed-use units outside of TODs will account for 10% of new

housing by 2020, 15% by 2030, and 20% by 2035.
 - VMT reduction potential per mixed-use unit is 9–30%. For this calculation, assume 9%.

Sources:

California Air Pollution Control Officers Association. 2010. Quantifying Greenhouse Gas Mitigation Measures. <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>

Bike Sharing

Reduction Measure:

Facilitate the creation of a bike share program, particularly in the Downtown area.

Action Items:

Conduct a feasibility study to determine the appropriate program scale, costs, and locations for bike-sharing stations.
 If bike sharing program is determined to be feasible, require new mixed-use and commercial developments to provide space for locating future bike sharing stations.

2010 Reductions:	0
2020 Reductions:	-107
2035 Reductions:	-167

Assumptions:

- Bike fleet will start with 150 bikes by 2020 and expand to 300 bikes by 2035 (CCAP calculations).
- Average number of trips per bike per day is 10.

- Average trip length of bike users is 2.0 miles.
- 20% of bike trips will replace car trips.

Sources:

Region Link British Columbia. 2010. Bike Sharing and Types of Trips Replaced.

SMART

Reduction Measure:

Encourage the continued funding and development of Sonoma-Marín Area Rail Transit, which will provide residents and employees of San Rafael an additional transportation alternative to single-occupant vehicles.

2010 Reductions:	0
2020 Reductions:	-207
2035 Reductions:	-261

Assumptions:

- Assumed SMART station is located near downtown SMART EIR transportation model predicts 614 daily trips would be taken using the commuter rail under the Cloverdale to Larkspur scenario.
- 80% of trips taken on SMART would be a replacement from single-occupant vehicle use.
- Average VMT reduction would be 3.5 miles per trip based on the distance between the transit center and city limits.

Sources:

- Cambridge Systematics. 2009. Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions. Technical Appendices. Prepared for the Urban Land Institute. http://www.movingcooler.info/Library/Documents/Moving%20Cooler_Appendices_Complete_102209.pdf
- Sonoma-Marín Area Rail Transit. 2006. Final Environmental Impact Report. <http://www.sonomamarintrain.org/index.php/docs/eir/>
- U.S. Census Bureau. American Communities Survey 2006–2008. <http://factfinder.census.gov>

Transit Service

Reduction Measure:

Support Marin Transit and other regional transit providers in the planning, funding, and implementation of additional transit services that are cost effective and responsive to existing and future transit demand.

2010 Reductions:	0
2020 Reductions:	-38
2035 Reductions:	-113

Assumptions:

- Marin County Transit District does not expect to see an increase in revenue hours before 2018.
- Assumes an increase in transit service of 3% by 2020, 8% by 2030, and 10% by 2035.
- 22% of all transit system trips are on San Rafael routes.

Sources:

Marin County Transit District. 2009. MCTD Short Range Transit Plan. <http://www.marintransit.org/pdf/>

[Marin%20Transit%20Final%20FY2008-2009%20SRTP.pdf](http://www.cityofsanrafael.org/Assets/Public+Works/Traffic/SRMarin%20Transit%20Final%20FY2008-2009%20SRTP.pdf)

City of San Rafael. 2008. San Rafael Bike Plan.

<http://www.cityofsanrafael.org/Assets/Public+Works/Traffic/SRBikePlan2008Final.pdf>

Safe Routes to School

Reduction Measure:

Continue to implement sidewalk and street improvements for the Safe Routes to School program. Encourage the school districts, Marin Transit, and the Transportation Authority of Marin to increase funding for school busing programs, promote carpooling, and limit vehicle idling.

2010 Reductions:	-100
2020 Reductions:	-172
2035 Reductions:	-305

Assumptions:

- 5,664 school-aged children in 2005 in San Rafael.
- 29% of students currently utilize non-motorized transportation to get to or from school.
- Average daily VMT per student using motorized transit is 5 miles.
- 180 school days per year.
- Assumes 5% of students switched from single-child drop-off to carpool, bus, bike, or walk by 2010, and 10% will switch by 2020.

Sources:

Transportation Authority of Marin. 2005.

<http://www.saferoutestoschools.org/pdfs/SR2SProgramEvaluation.pdf>

U.S. Census Bureau. 2008. American Communities Survey. Population Characteristics. <http://factfinder.census.gov>

Bicycle and Pedestrian Travel

Reduction Measure:

Continue to implement the adopted Bicycle and Pedestrian Master Plan.

2010 Reductions:	-216
2020 Reductions:	-1,391
2035 Reductions:	-1,332

Assumptions:

- Reduction in VMT from implementation of Bicycle and Pedestrian Master Plan based on the potential VMT reduction of 3,556,544 and achievement of a 20% mode share.
- VMT reduction is based on the percentage of the full bike plan implemented by each target year: 2010 is actual mileage installed since baseline; 2020 assumes all short-term and mid-term lanes will be installed; 2030 and 2035 assume full implementation of bike plan.

Sources:

City of San Rafael. 2001. Bicycle Master Plan.

<http://www.walkbikemarin.org/documents/SRBikePedPlan.pdf>

City of San Rafael. 2008. Bicycle Master Plan.

<http://www.cityofsanrafael.org/Assets/Public+Works/Traffic/SR BikePlan2008Final.pdf>

Alternative and Fuel Efficient Vehicles

Reduction Measure:

Promote the use of alternative fuel and fuel-efficient vehicles.

Action Items:

Install charging stations for plug-in electric vehicles in City garages and parking lots.

Revise requirements for private parking facilities to facilitate installation of charging stations for plug-in electric vehicles.

Support regional efforts to encourage widespread availability of charging stations.

Revise parking requirements for public and new commercial developments to include designated stalls for low-emitting, fuel-efficient vehicles and carpool/vanpool vehicles for a minimum of 8% of total parking capacity and to pre-wire stalls for future electric vehicle charging stations for 2% of total parking capacity.

2010 Reductions:	-2
2020 Reductions:	-179
2035 Reductions:	-374

Assumptions:

- Assumes that stations will be installed through civic and private development at the rate of 10 per year.
- Calculated assuming parking spaces were used for commuting: 5 days/week, 48 weeks/year, and 9.8 miles each way.
- trip length 2,298 billion miles/235 billion trips = 9.8 miles/trip.
- Kwh used = 11.1*gallons of gasoline saved. Based on a comparison of miles/gallon and Kwh/mile of 1999 Ford Ranger, 1998 Chevy S-10, and 1998 Toyota RAV.
- Marin County has received funding to install a pilot electric vehicle charging station program.

Sources:

North Bay Business Journal. October 7, 2010. Marin to Receive Free Charging Stations.
<http://www.northbaybusinessjournal.com/25647/marin-to-receive-free-charging-stations-for-electric-vehicles/>
 National Household Travel Survey, 2001.
 U.S. Department of Energy. 2010. <http://fueleconomy.gov>
 Idaho National Laboratory. 2006. Full Size Electric Vehicles.
<http://avt.inel.gov>

Zero Waste

Reduction Measure:

Adopt a Zero Waste goal and implement programs to achieve the goal in San Rafael.

Action Items:

Facilitate a composting program to assist and educate residents in home-composting and create facilities to convert organic waste (e.g., vegetative or food waste) to energy.

Adopt a construction debris recycling and reuse ordinance.

Assist in the development of additional reuse facilities (resale shops, refilling stations, repair shops, and resource recovery yards).

2010 Reductions:	0
2020 Reductions:	-33,715
2035 Reductions:	-47,125

Assumptions:

Diversion rate was 75% in 2005 based on Marin County Integrated Waste Management Authority's CalRecycle Approved Diversion Rate.

Diversion rate will reach 85% by 2020 and 94% based on goals of Marin County Waste JPA in the Draft Zero Waste Feasibility Study.

Sources:

Marin County Integrated Waste Management Authority. 2010.

Draft Zero Waste Feasibility Study.

http://www.marinrecycles.org/Docs/Final_Draft_Zero_Waste_Feasibility_Study_012710.pdf

Our Buildings

The measures included in this section seek to reduce GHG emissions associated with energy use and the built environment. Reducing energy use and utilizing cleaner sources of energy can be achieved through adopting new and existing building standards and encouraging the development of both small- and commercial-scale renewable energy systems.

Renewable Energy Financing

Reduction Measure:

Create or participate in an assessment district bond financing program to fund installation of renewable energy systems and energy efficiency measures.

Action Items:

Adopt zoning allowances and fee reductions for the location of solar collectors and small wind generators in residential zones.

Adopt zoning allowances for solar farms and wind turbines in large commercial parking lots and rooftops of large buildings.

2010 Reductions:	0
2020 Reductions:	-3,134
2035 Reductions:	-5,792

Assumptions:

- Program will only include existing housing units and commercial space.
- 54% of the city's housing stock is single-family homes, 44% is multi-family, per the City's Housing Element.
- 75% of single-family homes are owner-occupied and 25% of multi-family homes are owner-occupied, per the City's Housing Element.
- 15% of households will participate by 2020, 20% by 2030, and 25% by 2035.
- 10% electricity savings and 25% natural gas savings will occur before any renewable energy is installed.
- 90% of households participating in Property Assessed Clean Energy (PACE) will install renewable energy, which will cover 80% of their electricity consumption (based on Berkeley first program pilot evaluation).
- 14,276,000 square feet of commercial space.
- Assumes retrofitting of all commercial space as follows: 5% by 2020 and 12% by 2035.
- 50% of retrofitted commercial space will install renewable energy.

Sources:

Natural Resource Defense Council. 2010. Property Assessed Clean Energy Programs White Paper. <http://pacenow.org/documents/PACE%20White%20Paper%20May%203%20update.pdf>

City of Berkeley. 2010. Berkeley First Initial Evaluation. [http://www.ci.berkeley.ca.us/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/Berkeley%20FIRST%20Initial%20%20Evaluation%20%20final%20\(2\).pdf](http://www.ci.berkeley.ca.us/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/Berkeley%20FIRST%20Initial%20%20Evaluation%20%20final%20(2).pdf)

Green Building Ordinance

Reduction Measure:

Require new construction and remodel projects to comply with the adopted green building regulations.

2010 Reductions:	0
2020 Reductions:	-3,784
2035 Reductions:	-13,183

Assumptions:

- Every 1% increase over Title 24 requirements will result in a 0.2% decrease in electricity use and 1% decrease in natural gas use.
- Assume that all business-as-usual increases in energy emissions come from new construction and remodels.
- Average exceedance of Title 24 will be 15% (since smaller remodels and some new construction does not need to exceed Title 24 by a certain amount).
- Non-residential alterations accounted for in this analysis include lighting retrofits and roof resurfacing that will be compliant with current Title 24 standards and a replaced at a rate of once every 20 years.

Sources:

City of San Rafael. 2010. Green Building Ordinance.

California Energy Commission. 2007. Title 24 2008 Impact Analysis. http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PDF

Water Conservation

Reduction Measure:

Continue to implement the City’s Green Building Ordinance requiring water conservation measures in new and remodeled buildings, to coordinate with and support the Marin Municipal Water District in implementation and enforcement of the Water Efficient Landscape Ordinance and to encourage water conservation in existing homes and businesses through the Resilient Neighborhoods and Resilient Businesses programs, with a goal of reducing water use by 30% by the year 2020.

2010 Reductions:	-156
2020 Reductions:	-703
2035 Reductions:	-714

Assumptions:

- 5% reduction in water use from green building ordinance, water efficient landscape ordinance, and resilient neighborhoods and businesses programs achieved by 2010. 30% by 2020 and 35% by 2035.
- Reduced water use in San Rafael will decrease the energy used by Marin Municipal Water District, San Rafael Sanitation District, and Central Marin Sanitation Authority.
- GHG per acre foot of water will decrease over time based on increased renewable energy use from Marin Energy Authority purchased electricity.

Sources:

Dow, Jason. 2011. Central Marin Sanitation Agency. Email Correspondence. July, 15.

Helliker, Paul. 2011. Marin Municipal Water District. Email Correspondence. July, 20.

Smith, Matt. 2011. San Rafael Sanitation District. Email Correspondence. July, 18.

Construction Equipment

Reduction Measure:

Reduce emissions from heavy-duty construction equipment by limiting idling and utilizing cleaner fuels, equipment, and vehicles.

Action Items:

- Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]), or less. Clear signage shall be provided at all access points to remind construction workers of idling restrictions. Construction equipment shall be maintained per manufacturer’s specifications. Planning and Building Staff will work with project applicants to limit GHG emissions from construction equipment by selecting one of the following measures, at a minimum, as appropriate to the construction project:
- a. Substitute electrified equipment shall for diesel- and gasoline-powered equipment where practical.
 - b. Use alternatively-fueled construction equipment on-site, where feasible, such as compressed natural gas (CNG), liquefied natural gas (LNG), propane or biodiesel.
 - c. Avoid the use on on-site generators by connecting to grid

electricity or utilizing solar powered equipment.
 d. Limit heavy-duty equipment idling time to a period of three minutes or less, exceeding CARB regulation minimum requirements of 5 minutes.

2010 Reductions:	0
2020 Reductions:	-320
2035 Reductions:	-570

Assumptions:

- 5% of construction emissions from idling.
- 40% reduction in idling related emissions by limiting idling times from 5 minutes to 3 minutes.

Sources:

California Air Resources Board. 2007. Off-Road Software.

California Air Pollution Control Officers Association. "Quantifying Greenhouse Gas Mitigation Measures." August 2010.

Our Environment

The emissions reduction measure included in this section will increase carbon sequestration through enhancement of the urban forest. While there are other measures included in this section of the CCAP, they are primarily adaptation measures that will help the community to prepare for a changing climate.

Increase Tree Plantings

Reduction Measure:

Plant new and retain existing trees to maximize energy conservation and carbon sequestration benefits.

Action Items:

Adopt ordinances to regulate the removal and replacement of significant trees.

Update zoning regulations for parking lot landscaping to increase shading and reduce thermal gain.

Establish a local carbon offset program to support tree planting and maintenance.

2010 Reductions:	0
2020 Reductions:	-16
2035 Reductions:	-41

Assumptions:

-50 trees per year added through Marin ReLeaf Program.

Sources:

Marin ReLeaf. 2010. <http://www.marinreleaf.org/>

McPherson, et. al. 2000. The Potential of Urban Tree Plantings To Be Cost Effective in a Carbon Market.

Our Economy

One of the major components of supporting the local economy is to provide housing opportunities for the city's workforce. San Rafael's affordable housing program has been providing

families with affordable places to live within the city since the 1980s, which reduces transportation emissions by locating employees closer to their jobs and shortening the length of their daily commute.

Provide Affordable Housing

Reduction Measure:

Maintain San Rafael’s jobs/ housing ratio and seek to achieve sufficient employment opportunities in San Rafael.

Action Items:

Continue to promote new green business opportunities.

Support and encourage green business opportunities in conjunction with Marin County Green Business Program.

Support the creation of environmentally beneficial jobs, particularly for low-income residents.

2010 Reductions:	-23
2020 Reductions:	-97
2035 Reductions:	-223

Assumptions:

- 72 very low-, low-, or moderate-income households built or approved between 2007 and 2009 (Housing Element).
- Assumes that 25% of all future housing will be affordable to very low-, low-, and moderate-income households.
- URBEMIS provides a 4% reduction in vehicle trips for each deed-restricted BMR unit. Thus, the total reduction is as follows: trip reduction = % units that are BMR * 0.04.

Sources:

City of San Rafael. 2010. City of San Rafael Draft Housing Element.

Our Community

Community engagement and support for sustainability efforts and healthier lifestyles through outreach, community gardens, and farmers markets is an integral component to the successful implementation of the CCAP. Additionally, the City will play a leadership role in supporting a sustainable community by upgrading the vehicle fleet, completing lighting retrofits, and making environmentally preferable purchases.

Energy Efficiency Outreach

Reduction Measure:

Continue to inform businesses and residents of programs and rebates to conserve energy.

Action Items:

Use the City’s website and City publications and work with community organizations to promote sustainability efforts to both residents and businesses.

Partner with other agencies and organizations to hold an annual “Green Festival” to promote sustainability efforts.

2010 Reductions:	-176
2020 Reductions:	-143
2035 Reductions:	-144

Assumptions:

- Assumes 1% of local population would reduce their energy use by 10%.
- This measure is based on empirical data from a public education campaign designed to reduce emissions of criteria air pollutants in the Sacramento region (i.e., the Spare the Air program). This is one of the few public outreach campaigns that conducted an analysis of the effectiveness of the program as it relates to emissions reduction. Although this outreach campaign is transportation and not energy related, we use its findings for market penetration. The analysis confirmed that approximately 1% of people changed their behavior (e.g., took fewer vehicle trips on Spare the Air days) as a result of the Spare the Air campaign. For the City’s public education campaign, it was assumed that approximately 1% of people would reduce their emissions from all sectors (e.g., transportation, electricity, natural gas, waste, water) by about 10%.

Sources:

Sacramento Metropolitan Air Quality Management District (SMAQMD). 2009. Spare the Air Control Measure Program; Revision to State Implementation Plan Staff Report. <http://www.airquality.org/notices/CAPUpdate/STA-revisiontoSIP-StaffRpt23April2009.pdf>

Resilient Neighborhoods & Businesses

Reduction Measure:

Implement the Resilient Neighborhoods and Businesses program to encourage behavioral changes to reduce carbon emissions through effective education and peer group support.

Action Items:

Groups of households and businesses will be created to work through a structured curriculum and offer households and small businesses opportunities to improve energy and resource use, to reduce waste generation, and to make more informed purchasing decisions.

2010 Reductions:	-113
2020 Reductions:	-13,528
2035 Reductions:	-14,628

Assumptions:

- The resilient neighborhoods program will begin with a group of 100 households.
- The City's goal is to reach 50% of the households in San Rafael by 2020.

- Each household will commit to reducing household emissions by at least 5,000 pounds (or 2.27 metric tons).
- To avoid double-counting emissions from other actions already quantified in other measures through out the CCAP, it was determined that approximately 50% of the emissions from this program would be included in this measure.

Sources:

Gershon, David. 2006. Low Carbon Diet: A 30-day program to lose 5,000 pounds.

City Commute Incentives

Reduction Measure:

Provide transit and carpool incentives to City employees.

Action Items:

Provide alternate work schedules and telecommuting opportunities.

2010 Reductions:	0
2020 Reductions:	-306
2035 Reductions:	-306

Assumptions:

-According to the Victoria Transport Policy Institute, with a \$2 per day parking subsidy in a travel mode neutral activity center setting, a 16.4% decrease in annual VMT attributed to employee commute is achieved.

Sources:

Victoria Transport Policy Institute. 2010.
<http://www.vtppi.org/tdm/tdm8.htm>

Environmental Purchasing Policy

Reduction Measure:

Modify the City’s purchasing practices and policies to become a model for other businesses and organizations.

2010 Reductions:	-2
2020 Reductions:	-7
2035 Reductions:	-7

Assumptions:

- Environmental purchasing policy would increase the recyclable content of waste and reduce municipal waste from the fire stations, Corporation Yard, City Hall, and the Police Department.
- A total of 31 tons of waste were sent to the landfill from the above facilities.
- These facilities will achieve a 94% diversion rate by 2020.

Sources:

Cal Recycle. 2006. San Rafael Diversion Rate.
[http://www.calrecycle.ca.gov/LGCentral/Tools/PARIS/jurpgmsu.a
 sp](http://www.calrecycle.ca.gov/LGCentral/Tools/PARIS/jurpgmsu.asp)

Facility Energy Audit

Reduction Measure:

Complete an energy audit of major City facilities and implement audit recommendations for energy efficiency and renewable energy potential.

2010 Reductions:	0
2020 Reductions:	-91
2035 Reductions:	-126

Assumptions:

- Measure accounts for a 15% energy reduction in all City facility energy use (except City Hall).
- City Hall energy use reduction from HVAC retrofit assumes that 30% of the buildings energy use goes toward HVAC.
- HVAC replacements based on the City's EECBG project narrative that each piece replaced will reduce energy use by the following amounts:
 Fan:65%
 Chiller:40%
 Cooling Tower:20%
 Pumps:5%

Sources:

Energy Star. n.d. Energy Star Building Manual, Heating and Cooling System Upgrades. http://www.energystar.gov/ia/business/BUM_heat_cool.pdf
 Haq, Zahurul. n.d. Short Course on Energy Efficiency, Energy Saving through HVAC System Improvements. http://www.lged-rein.org/archive_file/books/ces/Energy_Sav_HVAC_System.pdf
 Landis, Richard. 2010. City of San Rafael. Personal communication, November 5.
 City of San Rafael. 2009. EECBG Project Narrative.

City Alternative & Fuel-Efficient Vehicles

Reduction Measure:

Continue to implement existing City policy to purchase alternative fuel vehicles and increase the efficiency of the vehicle fleet.

2010 Reductions:	8
2020 Reductions:	14
2035 Reductions:	28

Assumptions:

- Fleet currently uses 1,800 gallons of bio-diesel.
- Assume an increase to 7,000 gallons by 2020.
- Seven hybrid vehicles currently in fleet (assume that each hybrid vehicle has an average fuel economy of 39.1 MPG and is replacing vehicles that had an average fuel economy of 23.6 MPG).
- Police patrol boat used 900 gallons of diesel fuel in 2005 and has achieved a 30% decrease in fuel consumption by replacing the engine.

Sources:

Hulbert, Dave. 2010. E-mail, November 15.
 City of San Rafael. 2008. San Rafael Greenhouse Gas Emissions Inventory.
 U.S. Department of Energy. 2010.. <http://www.fueleconomy.gov>

City Electricity – Marin Energy Authority

Reduction Measure:

Participate in the Marin Energy Authority Clean Energy (MCE) Program by switching all City accounts over to the Light Green option in 2010 and the Deep Green option by 2020.

2010 Reductions:	-172
2020 Reductions:	-561
2035 Reductions:	-736

Assumptions:

- Applies to all City electricity accounts: facilities, traffic signals, streetlights, and holiday lighting.
- While all City accounts were switched to MCE in 2010, the total annual energy/emissions savings shown for 2010 will not be achieved until 2011.
- Marin Energy Authority has secured 26.5% renewable resources for the Light Green Option and will achieve 60% renewable energy no later than 2020.
- Assumes that City accounts will remain at Light Green option. Switching to the Deep Green option immediately would result in additional savings of over 600 MTCO₂e per year by 2020.

Sources:

Marin Energy Authority. 2008. Community Choice Aggregation Business Plan. <http://www.marinenergyauthority.org/PDF/CCABusinessPlan.pdf> (accessed October 19, 2010).
 Marin Energy Authority. 2009. MEA Implementation Plan. http://www.marinenergyauthority.org/PDF/MEA_Implementation_Plan.pdf (accessed October 19, 2010).
 Marin Energy Authority. 2010. Frequently Asked Questions.

<http://marincleanenergy.info/pdf/QuestionsAnswers.pdf> (accessed October 19, 2010).

Holiday Lights

Reduction Measure:

Replace holiday streetlights with LED lighting.

Action Items:

The City of San Rafael has replaced all holiday/event lighting along city streets with LED lighting in the past 5 years.

2010 Reductions:	-11
2020 Reductions:	-6
2035 Reductions:	-5

Assumptions:

According to Energystar.gov, LED string lights consume over 70% less energy than conventional incandescent bulbs.

Sources:

US EPA. 2006. Proposal for Decorative Light Strings Inclusion as part of the ENERGY STAR Program. http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/Prog_Dev_Criteria_for_SLEDs.pdf

Streetlights & Traffic Signals

Reduction Measure:

Pursue funding to complete the retrofit of yellow bulb City traffic signals with LED lighting and retrofit streetlights with LED fixtures.

2010 Reductions:	0
2020 Reductions:	-156
2035 Reductions:	-142

Assumptions:

- All red and green bulbs on traffic signals have been replaced with LED fixtures and approximately 40% of yellow light fixtures have been replaced.
- Replacing yellow signal lights saves an average 989 kWh annually.
- City-maintained streetlights replaced with LED fixtures have been found to reduce energy use between 50% and 70% depending on the type of fixture (PG&E Lighting Study).
- 60% energy savings per fixture based on PG&E study.
- Measure assumes that 75% of all streetlights will be replaced by 2020.

Sources:

City of Little Rock. 2003. Conventional VS LED Traffic Signals. http://www.cce1.org/gov/led/little_rock.pdf
 US Department of Energy, Pacific Gas & Electric. 2008. LED Street lighting. http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/gateway_sf-streetlighting.pdf

Emissions Reduction Summary

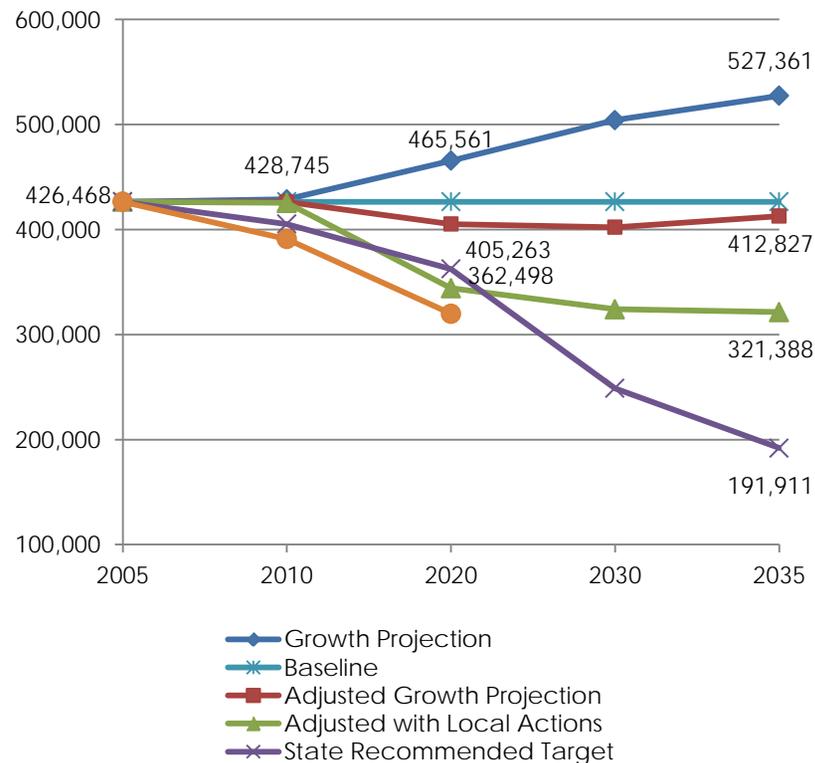
In total, the CCAP strategies have already reduced San Rafael’s emissions by over 800 MTCO₂e annually and will reduce the city’s emissions by over 60,000 MTCO₂e annually by 2020 (see **Table 5**). The emissions reductions that will be

achieved through the implementation of the CCAP will allow the City to exceed the State-recommended emissions reduction target of 15 percent below baseline levels by 2020 as shown in **Figure 4**. When combined with state and regional programs that will reduce emissions in San Rafael, the city’s emissions are anticipated to be reduced by over 120,000 MTCO₂e annually, putting the City within reach of achieving a 25 percent reduction from baseline emissions levels by 2020. While the emissions reductions from the CCAP strategies are not currently predicted to reach the target emissions reduction for 2035, it is anticipated that new technologies will be developed and additional emissions reduction opportunities will be incorporated into the CCAP as they become technologically and economically feasible.

Table 5: Emissions Reductions Summary by Topic

	2010	2020	2035
Our Lifestyles	-318	-38,332	-53,926
Our Buildings	-156	-7,941	-21,185
Our Environment	0	-16	-41
Our Economy	-23	-97	-223
Our Community	-353	-14,785	-16,065
Total	-849	-61,172	-91,449

Figure 4: Emissions Reduction Summary and Reduction Target



Applicability to New Development Projects

In addition to quantifying the emissions reductions associated with each strategy in the CCAP, BAAQMD guidelines recommended that the City clearly specify the measures within the CCAP that new construction projects must implement to demonstrate compliance with the City’s GHG Emissions Reduction Strategy and determine that the project’s operational GHG emissions are less than significant by complying with a qualified GHG emissions reduction strategy. To ensure that each new construction project complies with the City’s GHG Emissions Reduction Strategy, a checklist has been developed by the City to be submitted by the project applicant in addition to the already required Green Building Compliance Form and Construction and Demolition Waste Management Form.

3.4 Implementation and Monitoring

The CCAP, adopted in 2009, includes an implementation matrix identifying the potential startup and ongoing costs of implementing each measure, potential funding sources, staff time, and the indicators that will be used to measure progress. The GHG Emissions Reduction Strategy has expanded the implementation matrix into an Excel-based tool that will serve as the primary instrument in measuring the City’s progress toward achieving emissions reduction targets and to ensure timely implementation occurs. The monitoring and reporting spreadsheet is an intuitive tool that identifies the major implementation milestones and the necessary actions that are needed to implement each measure. The tool enables the City to quickly update the GHG emissions inventory and streamline the reporting of CCAP implementation on an annual basis. The

monitoring tool also outlines the necessary procedures to update the inventory and reduction measures every 3–5 years.

In addition to the annual CCAP reports that will be submitted to the City Council and Planning Commission, the City also updates the community on CCAP progress through a series of quarterly meetings.

The City has already made significant progress in implementing and updating several reduction measures and is in the process of securing funding to implement additional measures. In 2010, the City updated the requirements that must be met by new and remodeled residential and commercial building projects under the Green Building Ordinance. Residential buildings must now achieve a certain number of points on the Green Point rating system of Build It Green, depending on the size of the new building or addition, while nonresidential buildings will follow the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) Guidelines.

As San Rafael continues to implement additional programs that reduce GHG emissions, the GHG Emissions Reduction Strategy will be updated accordingly. Should the City's monitoring efforts find that the Plan is falling short of its goals; the City will add additional voluntary and mandatory measures to the Plan in order to meet the Plan's GHG reduction target. Additionally, as new technologies are developed and more thorough research on the effectiveness of certain emissions

reduction measures is released, the potential emissions reductions to be achieved for each measure will be revised.

3.5 Public Process and Environmental Review

The final requirement of a qualified GHG emissions reduction strategy is to adopt the plan through a public hearing process following environmental review. The City has involved numerous stakeholders throughout the development of the CCAP and has undergone environmental review as part of the public hearing and adoption process.

Public Participation

Community participation has been an integral component in developing the CCAP. In 2008, the City Council appointed 14 community members to a Green Ribbon Committee and an additional 13 volunteers to provide technical assistance as part of four Green Teams. Additionally, the City engaged the larger community in a workshop where a vision statement and over 300 ideas on how the City can reduce GHG emissions were generated. Following the workshop, these measures were analyzed by the Green Teams, City staff, and experts from other regional agencies. The proposed plan was presented by the Green Ribbon Committee to the Planning Commission and City Council in April 2009 and adopted in May 2009.

Environmental Review

In order to operate effectively as a programmatic tiering document, the California State Attorney General's (AG's)

Office and BAAQMD both recommend integration of components of the GHG Emissions Reduction Strategy into the General Plan. This integration will identify how the GHG Emissions Reduction Strategy operates as a stand-alone policy and implementation document that is updated on a regular basis to respond to updates to science, technology, and policy. The GHG Emissions Reduction Strategy will contribute to the General Plan's policies and will serve as mitigation for the City's GHG emissions.

4. Conclusion

The City of San Rafael's GHG Emissions Reduction Strategy will serve as a guide to the actions City officials, project developers, and the community-at-large can take to reduce San Rafael's GHG emissions and work toward a more sustainable community. This strategy is a living document that will be updated on a regular basis to incorporate new programs and emissions reduction strategies as they are developed and as technological advancements are made.