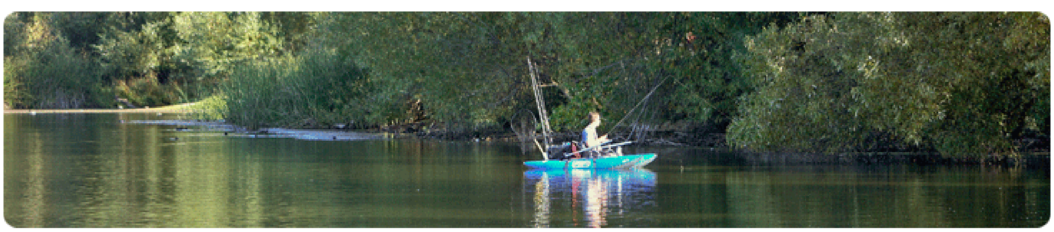
MUNICIPAL OPERATIONS CLIMATE ACTION PLAN

CITY OF SANTA ROSA

August 6, 2013



City of Santa Rosa

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U.S. DEPARTMENT OF ENERGY

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CONSULTANT TEAM

Kenwood Energy
Tim Holmes
P.O. Box 692
Kenwood, CA 95452
Timholmes@kenwoodenergy.com

CITY OF SANTA ROSA

City Council
Scott P. Bartley, Mayor
Erin Carlstrom, Vice Mayor
Julie Combs
Ernesto Olivares
Jake Ours
Robin Swinth
Gary Wysocky

Board of Public Utilities
Stephen Gale, Chair
Dan Galvin, Vice Chair
Michael Carney
Richard Dowd
Leonard Holt
Megan Kaun
George Steffensen

Community Development Department
Chuck Regalia, Director
Lisa Kranz, Supervising Planner

Utilities Department
David Guhin, Director
Dell Tredinnick, Project Development Manager
Colin Close, Research and Program Coordinator

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EXECUTIVE SUMMARY

The City of Santa Rosa is the county seat of Sonoma County, California. With a population of 167,815,[1] it is the largest city in the North Bay, the fifth most populated city in the San Francisco Bay Area (after San Jose, San Francisco, Oakland, and Fremont) and the twenty-sixth most populated city in California.

In 2011 the City Council formally adopted a number of City Council goals for 2011-2016, including "Goal 3: Provide Leadership for Environmental Initiatives." In 2013 the Council reaffirmed its commitment to Goal 3 and adopted strategic objectives in support of this goal for 2013-2015. City Council Goal 3 reflects the City's long-standing commitment to environmental stewardship and leadership. Since the early 1990s, the City worked to protect and sustain the environment, implement conservation programs and projects, and reduce greenhouse gas (GHG) emissions.

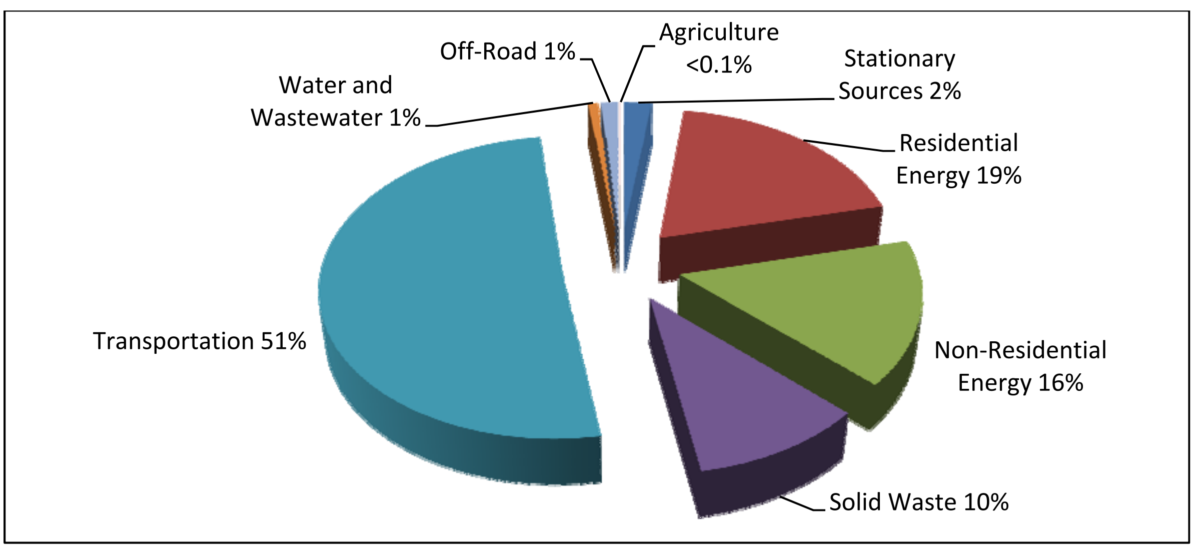
In June 2012, City Council adopted the Community Climate Action Plan (CCAP). The CCAP examines community-wide sources of GHG emissions and outlines strategies for reducing these emissions. Following the CCAP, this Municipal Climate Action Plan (MCAP) has been developed as a companion document to address GHG emissions from the City's municipal operations. The MCAP identifies projects, practices, and programs that will enable the City to cost-effectively and efficiently reduce greenhouse gas (GHG) emissions from municipal operations and activities.

BASELINE INVENTORY OF GHG EMISSIONS

As documented in the CCAP, Santa Rosa's community-wide GHG emissions totaled 1,349,690 metric tons of carbon dioxide equivalents (abbreviated as $MTCO_2e$) in 2007. GHG emissions are generated by activities in sectors such as transportation, residential, commercial, government, and solid waste.

Figure ES 1: 2007 Community-wide GHG Emissions by Sector

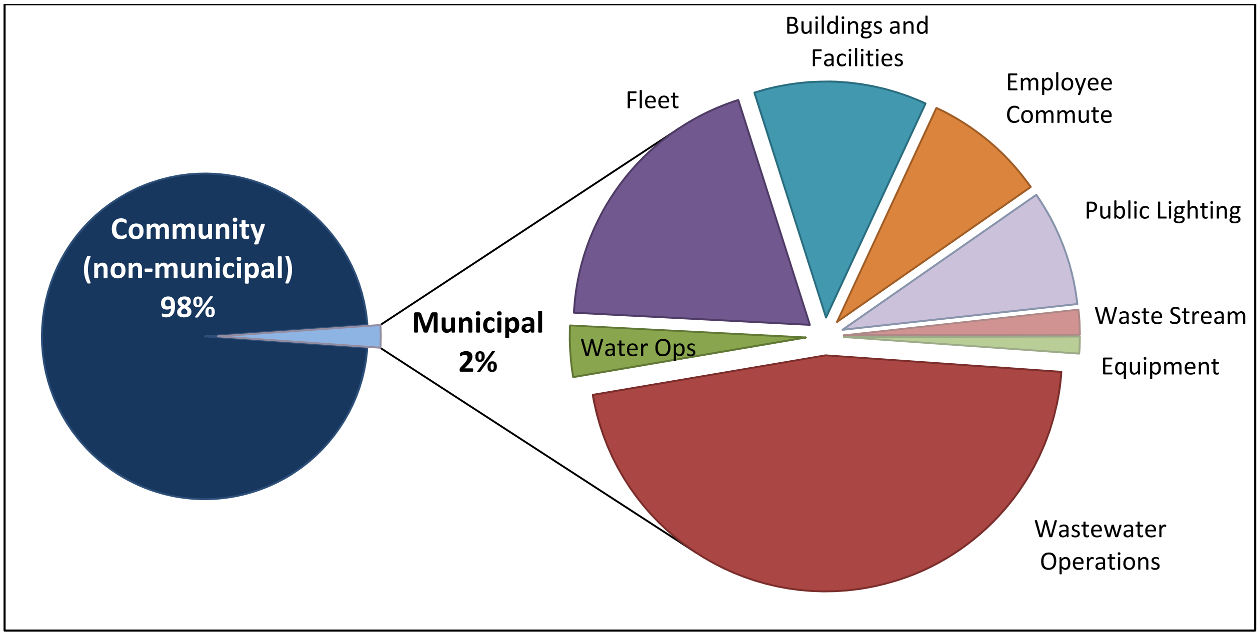
1,349,690 metric tons of CO_2 equivalents ($MTCO_2e$) (includes stationary sources)



[1] 2010 US Census

In 2007, the GHG emissions generated by the City's municipal operations constituted 2% (29,436 $MTCO_2e$) of the total communitywide emissions. The relationship between the City's municipal GHG emissions and the community-wide emissions are illustrated in Figure ES 2. Although municipal GHG emissions constitute a small portion of the total in Santa Rosa, the City's ongoing efforts to identify and implement cost-effective and innovative approaches to tracking and reducing GHG emissions align with the City Council's goal to provide leadership in environmental initiatives.

Figure ES 2: 2007 GHG Inventory for Santa Rosa
Non-Municipal and Municipal Sources



GHG REDUCTION TARGETS

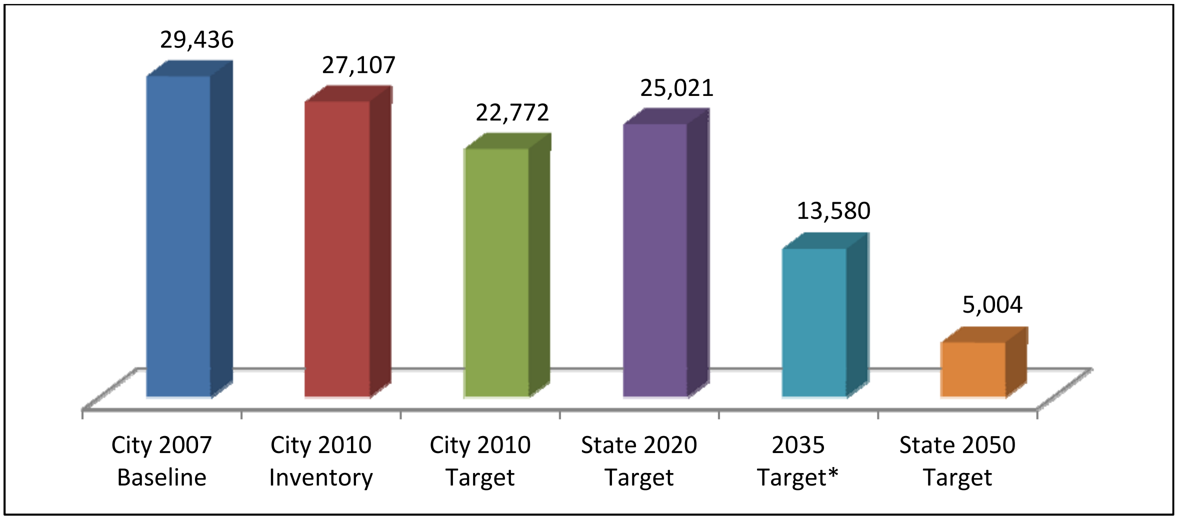
In 2005 the City set a municipal GHG reduction target of 20% below 2000 levels by 2010. This is a voluntary target. The State of California's targets are (1) return to 1990 levels by 2020 and (2) reduce to 80% below 1990 emissions levels by 2050. While these targets are mandated by the State, the State has not yet established penalties for noncompliance.

Because the State recognizes that accurate GHG data is not available as far back as 1990, the State developed an equivalent measure for setting a baseline. The State interprets "returning to 1990 levels" as achieving 15% below a baseline year between 2005 and 2008 (inclusive). The City of Santa Rosa chose 2007 as its baseline because data was readily available for this year.

The following Figure ES3 shows the City's 2007 baseline GHG emissions and the 2010 inventory of emissions. These are compared against the City's 2010 target emission reductions, the State's 2020 and 2050 GHG targets, and an interpolated 2035 midpoint that will help the City determine if it is on track to achieve the 2050 target. As the figure shows, progress has already been made between 2007 and 2010. The targets, baseline data, GHG inventories, and reduction amounts needed are discussed in more detail in Chapter 2.

Figure ES 3: GHG Baseline, Inventory, and Targets

(Metric tons of CO_2 equivalents)



** The 2035 Target is an interpolation based on the State 2050 Target*

Seven factors serve to support the City's efforts to achieve its municipal goals and provide leadership for community-wide efforts to reduce GHGs. These factors are:

1. State mandates and local objectives set challenging goals that encourage innovation and collaboration.
2. The City has a track record of adopting climate-friendly policies and completing projects that increase energy efficiency, generate renewable energy, and reduce energy costs.
3. Santa Rosa's climate is conducive to generating solar energy, having an average of 243 sunny days per year.
4. The City participates in a regional electric vehicle charging network that provides a growing infrastructure to support cleaner transportation options.
5. CityBus provides public transportation options that allow motor vehicle commuters an alternative to driving private passenger vehicles, thereby reducing their GHG emissions. Additionally, regional public transit operators and the upcoming Sonoma-Marin Area Rail Transit (SMART) system can serve to augment the City's public transportation infrastructure.
6. The City is participating in efforts to ensure that cleaner electricity (from lower GHG emission sources) becomes available at competitive prices from PG&E and/or another entity. Having cleaner energy options will contribute significantly to achieving City and community GHG reduction targets.
7. Close collaboration with other local governmental, nonprofit, and private sector partners has been institutionalized by the creation of the Regional Climate Protection Authority (RCPA) in 2007. RCPA is a valuable clearinghouse and catalyst for collective effort and regional solutions. The City of Santa Rosa was a driver for its establishment and continues to support the RCPA efforts and goals.

MCAP OVERVIEW

The MCAP includes six chapters and five appendices.

CHAPTER 1 provides a brief introduction to the MCAP's purpose and its relationship to the CCAP and General Plan.

CHAPTER 2 provides detailed GHG emission data for multiple years, outlines the local and state reduction targets, and discusses the GHG emission forecast (emission levels if no steps are taken to reduce GHGs).

CHAPTER 3 identifies nearly 100 potential GHG reduction opportunities. These projects will need to be vetted further and assessed for operational requirements and implications prior to implementation. (Appendix 3 provides additional project detail and Chapter 5 groups the projects into bundles for cost effectiveness.)

CHAPTER 4 discusses a number of funding options for projects. (Appendix 4 provides a sample financial analysis and Appendix 5 includes a sensitivity analysis for the financial analysis.)

CHAPTER 5 proposes bundling (or grouping) projects for efficiency and cost effectiveness and explains how implementation of these project groups will allow the City to achieve local and State GHG reduction targets.

CHAPTER 6 outlines the action plan for implementation. It calls for the establishment of a team of staff members to oversee the development and timely implementation of a project plan for achieving GHG reductions that meet local and State GHG targets. Chapter 6 also discusses the need to track and report progress annually, update the GHG inventory data periodically, and revise the MCAP every five years to guide ongoing efforts and achieve long term reduction targets.

APPENDIX 1 contains a glossary of acronyms used in the document.

APPENDIX 2 lists the GHG coefficients and conversion calculations used in the analysis.

APPENDIX 3 provides project descriptions, cost estimates, and GHG emission reduction data.

APPENDIX 4 outlines a sample financial analysis based on implementing projects in bundles.

APPENDIX 5 provides a sensitivity analysis for the sample financial analysis (in Appendix 4). The sensitivity analysis considers a number of variables for three scenarios: realistic outcome, conservative outcome, and very conservative outcome.

In order to achieve local and State GHG reduction targets, the City of Santa Rosa will need to implement a range of projects, programs, and policies. With this MCAP as a road map, the City will be able to do so in a timely and cost effective manner. Because the City's municipal operations will continue to change as a result of growth and technology development, the City will need to update its emission baseline and implementation strategy on a regular basis. Furthermore, the MCAP will need to be revised every five years to ensure it remains current and to help the City remain on track to achieve the State's 2050 GHG emission reduction target.

CHAPTER 1 - INTRODUCTION

1.1. PURPOSE AND SCOPE

The City of Santa Rosa has a long-standing commitment to implementing environmental programs and proactively working to reduce greenhouse gas (GHG) emissions. The Municipal Climate Action Plan (MCAP) has been developed to identify strategies and projects that can be used by the City to meet GHG emissions reduction targets established by the City and the State. The MCAP outlines an approach to reducing GHG emissions that will stimulate the local economy while reducing the City's energy budget.

Some of the key strategies identified in this document include:

- ❖ Bundling projects and appropriate funding options for cost-effective GHG reductions
- ❖ Establishing replacement schedules that update older buses, vehicles, equipment, and fixtures with higher efficiency models
- ❖ Participating in efforts to ensure that cleaner electricity (from lower GHG emission sources) becomes available at competitive prices from PG&E and/or another entity
- ❖ Emphasizing innovation, cooperation, and collaboration
- ❖ Establishing a project implementation team to shepherd the process going forward

On October 8, 2011, City Council established a series of goals for 2011-2016, including "Goal 3: Provide Leadership on Environmental Initiatives" with the adoption of Resolution Number 27995. On May 21, 2013, the Council reaffirmed its commitment to Goal 3 and adopted strategic objectives in support of this goal for 2013-2015 with the adoption of Resolution Number 28282.

<u>City Council Goal 3: Provide Leadership on Environmental Initiatives</u>

Strategic Objectives:

1. Improve our transportation network to reduce vehicle miles traveled and promote multi-modal transportation.
2. Establish Santa Rosa as a leader in resource recovery.
3. Review urban open space plans and improve creeks and other watersheds.
4. Develop a target for energy independence and GHG reduction.
5. Support green waste collection for multi-family dwellings.

1.2. RELATIONSHIP TO COMMUNITY-WIDE CLIMATE ACTION PLAN (CCAP)

In line with City Council Goal 3, Council adopted the Community Climate Action plan (CCAP) in June 2012. The CCAP examines community-wide sources of GHG emissions and outlines strategies for reducing emissions. The Municipal Climate Action Plan (MCAP) has been developed as a companion document to the CCAP. The MCAP focuses on GHG emissions from the City's municipal operations. The MCAP identifies projects, practices, and programs that will enable the City to cost-effectively and efficiently reduce greenhouse gas (GHG) emissions from municipal operations and activities.

The CCAP follows the California Environmental Quality Act (CEQA) guidelines and meets Bay Area Air Quality Management District expectations for a Qualified GHG Reduction Strategy. The CCAP identifies measures to reduce GHG emissions throughout the community, meet state and local reduction targets, and allow the City to streamline future environmental review of development projects in Santa Rosa that are consistent with the CCAP.

The CCAP provides a baseline inventory of the 2007 community-wide GHG emissions. It also provides a baseline inventory of the 2007 municipal operations GHG emissions from sources owned, operated, and/or under the influence of the City of Santa Rosa. Using specific coefficients listed in Appendix 2, these greenhouse gases are converted to carbon dioxide equivalents[2] (CO_2e) in order to compare emissions from water and wastewater operations, fleet vehicles, buildings, facilities, employee commute, public lighting, waste, and equipment. In the CCAP, municipal operations in 2007 resulted in GHG emissions of approximately two percent of the community-wide GHG emissions in 2007. While the City's municipal operation is a relatively small portion of the community's GHG emissions, the City is a leader in the community and as such has the ability to leverage its efforts into greater community action. This MCAP focuses on the City's municipal emissions and provides strategies for reducing them.

1.3. CLIMATE PROTECTION EFFORTS THROUGH 2010

The City began implementing GHG reduction projects in the early 1990s. The basis of these efforts has been to cost effectively reduce energy costs. The City has also adopted an Environmentally Preferable Purchasing Policy and other initiatives that result in GHG emissions reductions. The City's 2010 inventory of greenhouse gas emissions (completed for the Community Climate Action Plan) included activities through 2010, and this MCAP uses that summary for its analysis. Therefore, the summary below highlights notable GHG reduction efforts through 2010. Future GHG inventories will include any work accomplished since 2010.

- **Energy Conservation**: The City began conservation projects in 1992. As of 2009, the City had implemented dozens of energy efficiency projects. For example, the City has replaced older, inefficient motors with high efficiency motors and Variable Frequency Drive technology for water pumping. The City has also upgraded many of its buildings with cool roofs, more efficient lighting, energy efficient office equipment, and higher efficiency HVAC systems. According to the City's PG&E use data, energy efficiency projects have reduced annual electricity use by 23% and natural gas use by 28%, resulting in GHG reductions of more than 767 $MTCO_2e$ per year.
- **Cogeneration**: The City's first renewable energy project was the installation of a cogeneration system at the Laguna Treatment Plant in 1976. The cogeneration system utilizes methane created by the plant's digesters to generate an average of 775 kilowatts (kW) of power, and uses the waste heat from the generator to supply the heat needed by the digester. Currently, the cogeneration system reduces GHG emissions by more than 3,700 $MTCO_2e$ per year.

[2] Greenhouse gases include carbon dioxide, methane, fluorocarbons, etc., which have differing impacts on the greenhouse effect in the atmosphere. All gases are converted to Carbon Dioxide Equivalents (CO2e) to simplify the discussion and quantification of GHGs.

- **Solar Photovoltaic Arrays**: The City installed its first solar energy system in 2004. Since that time the City has installed nine additional systems which collectively generate approximately 750,000 kWh of electricity each year and reduce GHG emissions about 326 $MTCO_2e$ per year.
- **Fleet Changes**: The City purchased its first hybrid gasoline vehicle in 2002 and added 61 passenger and 8 bus hybrid vehicles by 2010, resulting in GHG reductions of approximately 41 $MTCO_2e$ per year.
- **Street Light Reduction Program**: As directed by City Council in 2008, staff began de-energizing street lights and installing programmable photocells (that reduce energy use by 50%) in 2008. Because this is a multi-year process, the GHG reductions will be captured in future inventories.
- **Commute Reduction Policies**: The City has implemented several strategies to reduce employee commute miles. These include the 9/80 work schedule, telecommute policy and the Free-Ride Trip Reduction Incentive Program. City employees ride CityBus free with a City identification card. Furthermore, employees are encouraged to use CityBus when traveling to meetings during their work hours. Although it is likely that these programs have resulted in GHG reductions, it is difficult to confirm and quantify GHG reductions which may have resulted from individual employee commute decisions.
- **Santa Rosa CalGreen Tier 1**: Santa Rosa adopted the California Building Code CalGreen Tier 1 standard for new construction in 2011. Tier 1 Standards go beyond the basic CalGreen standards and promote environmental protection through building and remodeling with a more sustainable approach. This follows previous City of Santa Rosa building standards that included Build it Green, which was adopted by Santa Rosa City Council as a voluntary program in 2004 and incorporated mandatory green building guidelines for all new construction in 2007. The adopted standards are more stringent than those in California's Title 24 energy efficiency requirements.
- **Water Use Efficiency**: The City has implemented citywide measures that save over 1.46 billion gallons of water every year, reducing the power needed to pump water and treat wastewater.
- **Geysers Recharge Project**: In November 2003, in a novel approach to water reuse, the Geysers Recharge Project began pumping 13 million gallons per day of highly treated wastewater from the Laguna Treatment Plant to The Geysers steam fields high in the Mayacama Mountains. The City has increased the volume of wastewater delivered to the Geysers, which helps to generate enough electricity for 100,000 households in Sonoma and other North Bay counties.
- **Solar America Cities**: Santa Rosa was named one of the "Solar America Cities" by the U.S. Department of Energy and received grant funding to create Solar Sonoma County, a countywide solar project to increase and accelerate local solar energy production. Santa Rosa is one of 25 cities now recognized as "Solar America Cities" partners committed to solar technology adoption at the local level.

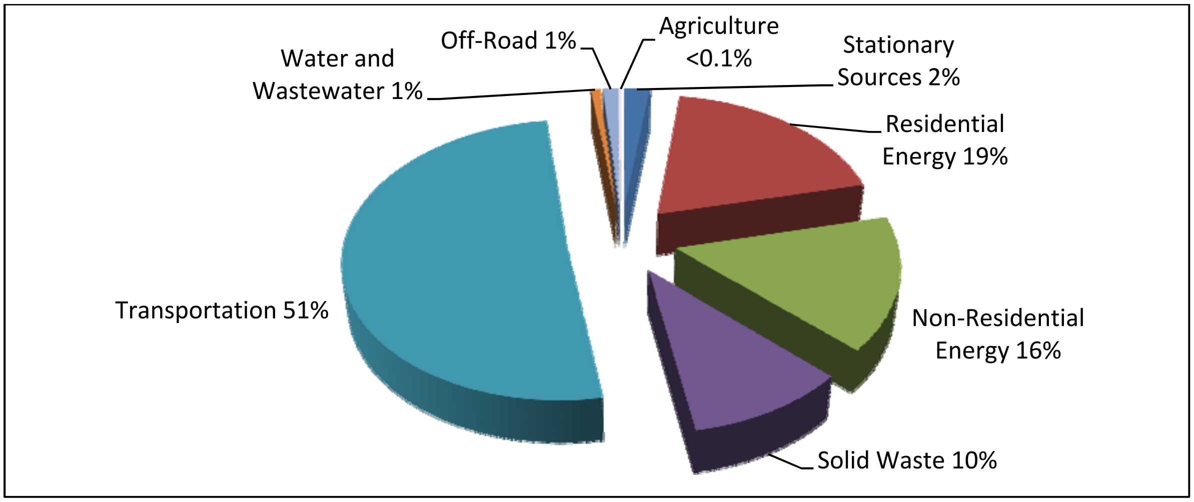
CHAPTER 2 - GHG INVENTORY AND TARGETS

2.1. UPDATED MUNICIPAL GHG EMISSIONS

As documented in the CCAP, the community-wide GHG emissions in Santa Rosa in 2007 totaled 1,349,690 metric tons of carbon dioxide equivalents (abbreviated as MCO_2e). Figure 1 (below) shows that over half (51%) of these emissions were generated by transportation activities.

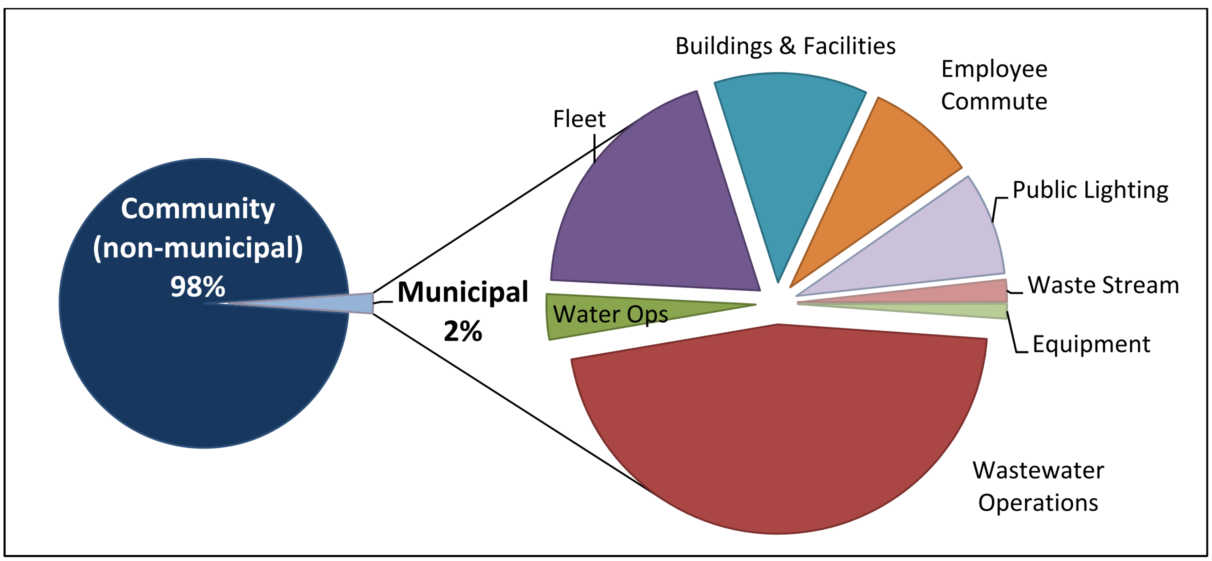
Figure 1: 2007 Community-wide GHG Emissions by Sector

1,349,690 metric tons of CO_2 equivalents ($MTCO_2e$) (includes stationary sources)



As seen in Figure 2 (below), the City's emissions from its municipal operations constituted 2% of the total GHG emissions for Santa Rosa community in 2007.

Figure 2: 2007 Emissions from Non-Municipal and Municipal Sources

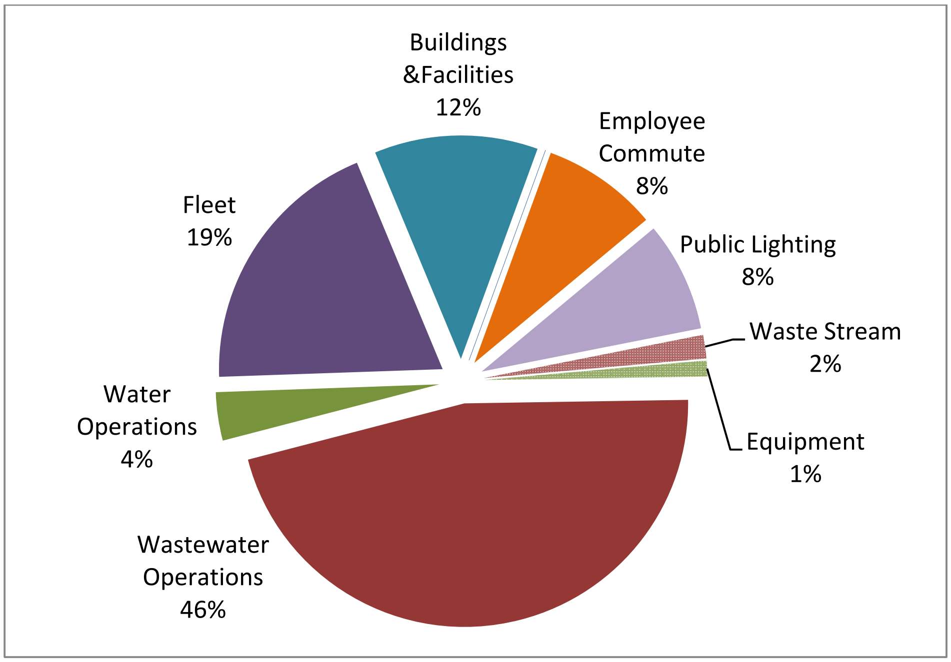


While reviewing the City's 2007 baseline GHG data published in the CCAP, updated information for the City's fleet in 2007 was identified; this data has been incorporated into the 2007 baseline for this MCAP. In summary, the CCAP reported a 2007 baseline of 27,820 $MTCO_2e$, with 4,060 $MTCO_2e$ resulting from the City's fleet. The updated 2007 mileage data shows GHG emissions from the fleet at 5,676 $MTCO_2e$, bringing the City's total 2007 GHG emissions to 29,436 $MTCO_2e$.

Figure 3 shows the updated inventory of major sources of municipal GHG emissions, including wastewater operations, fleet operations, buildings and facilities, employee commute, public lighting, water operations, waste stream, and equipment operation.

Figure 3: 2007 GHG Emissions By Municipal Operations Sector

29,436 metric tons of CO_2 equivalents ($MTCO_2e$) (includes stationary sources)



As illustrated in Figure 3 (above), half of the City's municipal emissions resulted from wastewater operations (46%) and water operations (4%). The remaining emissions resulted from fleet operations (19%), buildings and facilities (12%), employee commute (8%), public lighting (8%), waste stream (2%), and equipment (1%).

The City's GHG emissions result from a number of activities within each of these sectors, such as the use of electricity, natural gas, gasoline, diesel, and decomposition of waste. Table 1 (next page) lists the City's municipal GHG emissions by sector and by type of activity within each sector.

Table 1: 2007 Municipal Operations GHG Emissions Inventory by Sector
(Metric tons of CO_2 equivalents = $MTCO_2e$)

Sector	Type	Unit	Amount	Emissions $MTCO_2e$/yr*	Sector Total $MTCO_2e$/yr
1. Wastewater Operations	Direct process emissions	$MTCO_2e$	2,050	2,050	
	Electricity	kWh	23,990,200	6,910	
	Natural Gas	Therms	36,100	190	
	Cogeneration Gas	Therms	835,860	4,450	13,600
2. Fleet	Compressed Natural Gas	Gallons	14,610	84	
	Diesel	Gallons	397,035	4,055	
	Gasoline	Gallons	169,884	1,510	
	Propane	Gallons	4,432	28	5,676
3. Buildings & Facilities	Electricity	kWh	7,443,900	2,160	
	Natural Gas	Therms	248,100	1,320	3,480
4. Employee Commute	Vehicle miles traveled	Miles	5,557,600	2,470	2,470
5. Public Lighting	Streetlights	kWh	6,823,000	1,980	
	Traffic Signals	kWh	757,300	220	
	Other Lighting	kWh	479,100	140	2,340
6. Water Operations	Irrigation Controls	kWh	88,050	30	
	Water Operations	kWh	3,448,740	1,000	1,030
7. Waste Stream	Tons Disposed	Tons	720	500	500
8. Equipment	Compressed Natural Gas	Gallons	330	3	
	Diesel	Gallons	14,070	140	
	Electric	kWh	30	0	
	Gasoline	Gallons	21,360	190	
	Propane	Gallons	620	7	340
TOTAL $MTCO_2e$				29,436	29,436

** Appendix 2 provides the GHG coefficients and conversion calculations used in the analysis.*

2.2. MUNICIPAL OPERATIONS GHG EMISSIONS IN 2000, 2007, and 2010

As seen in Table 2 (below), municipal GHG emissions have decreased by approximately 5% between 2000 and 2010 and by 8% between 2007 and 2010[3].

Table 2: Municipal Operations Emissions for 2000, 2007, and 2010

(Metric tons of CO_2 equivalents = $MTCO_2e$)

Sector	2000	2007	2010	2000 to 2007 % Change	2007 to 2010 % Change	2000 to 2010 % Change
Wastewater Ops*	13,320	13,600	13,160	2%	-3%	-1%
Fleet	5,625	5,676	5,727	1%	1%	2%
Buildings & facilities*	3,290	3,480	3,150	6%	-9%	-4%
Employee Commute	2,350	2,470	1,910	5%	-23%	-19%
Public Lighting*	2,260	2,340	1,860	4%	-21%	-18%
Water Operations	820	1,030	750	26%	-27%	-9%
Waste Stream*	480	500	510	4%	2%	6%
Equipment	320	340	40	6%	-88%	-88%
TOTAL $MTCO_2e$	**28,465**	**29,436**	**27,107**	**3%**	**-8%**	**-5%**

**Sectors with electricity or natural gas use are based on 2003 information rather than 2000 as 2003 is the earliest year PG&E could provide data. Estimated emissions factors for electricity in 2000 were applied to the 2003 electricity data.*

There are a number of items in this table that are notable.

- Emissions increased by 3% from 2000 to 2007.
- Emissions decreased by 5% from 2000 to 2010.
- Emissions decreased by 8% from 2007 to 2010.
- In some sectors, emissions reductions from 2007 to 2010 appear to be related to changes in the economy.
  - Reductions in water purchases by residential and commercial customers reduced GHG emissions related to the City's water operations.
  - Turning off streetlights reduced GHGs due to public lighting.
  - Outsourcing park and landscape maintenance work reduced the City's share of GHGs from equipment but did not reduce GHG emissions that occurred within Santa Rosa.
  - Reductions in staff levels and cleaner vehicles reduced emissions from commutes.

It is also important to note that, even though the City's emissions are currently below the 2007 level, it is likely that municipal GHG emissions will increase as the economy recovers and the City once again begins to grow.

[3] The CCAP provided an inventory of municipal GHG emissions for the years 2000, 2007, and 2010. As discussed above, corrected information related to fleet mileage for 2007 has been identified and incorporated into the analysis. This update of 2007 mileage data caused a closer examination of 2000 fleet data, which has been adjusted to reflect a more reasonable scenario based on a linear extrapolation of the more reliable 2007 and 2010 data.

2.3. MUNICIPAL GHG REDUCTION TARGETS

Locally Adopted 2010 Municipal GHG Reduction Target

In 2005, City Council established a municipal operations GHG emissions reduction target with the adoption of Resolution Number 26341. The municipal target is 20% below 2000 levels by 2010. Strategies for achieving this goal are included in this MCAP. (In that same Resolution, City Council established a community-wide GHG emissions reduction target which is discussed in the CCAP.) Table 3 (below) shows the City's 2010 target, the 2010 inventory of City GHG emissions, and the amount of reduction needed to hit the City's 2010 target.

Table 3: City 2010 GHG Reduction Target

(Metric tons of CO_2 equivalents = $MTCO_2e$)

City 2010 Target	$MTCO_2e$
20% below 2000 baseline	22,772
2010 Inventory	27,107
Reduction needed to hit target	4,335

State Reduction Targets for 2020, 2035, and 2050

With the adoption of Assembly Bill 32 (AB 32), California established a statewide GHG reduction target of returning GHG emissions to 1990 levels by 2020. The GHG emissions reduction target for local governments is identified in California's Scoping Plan for AB 32. The Scoping Plan identifies local governments as "essential partners" in achieving the statewide target and establishes 15% below current (2005-2008) levels as the local government equivalent of 1990 GHG emissions levels. To meet the AB 32 Scoping Plan target, the City would need to achieve a 15% reduction in municipal GHG emissions below 2007 levels by the year 2020. While these targets are mandated by the State, the State has not yet established penalties for noncompliance.

Table 4 (below) shows the State's 2020 target, the 2010 inventory of City GHG emissions, and the amount of reduction needed to hit the State's 2020 target.

Table 4: State 2020 GHG Reduction Target

(Metric tons of CO_2 equivalents = $MTCO_2e$)

State 2020 Target	$MTCO_2e$
15% below 2007 baseline	25,020
2010 Inventory	27,107
Reduction needed to hit target	2,087

In addition, the State's Executive Order S-3-05 reiterated the goal of reducing GHG emissions to 1990 levels by 2020 and set a target of achieving reductions of 80% below 1990 levels by 2050.

Table 5 (below) shows the State's 2050 target, the 2010 inventory of City GHG emissions, and the amount of reduction needed to hit the State 2050 target.

Table 5: State 2050 GHG Reduction Target

(Metric tons of CO_2 equivalents = $MTCO_2e$)

State 2050 Target	$MTCO_2e$
80% below 1990 levels (83% below 2007 baseline)	5,004
2010 Inventory	27,107
Reduction needed to hit target	22,103

In order to be on a trajectory to achieving the State's 2050 target, the City will need to reduce municipal emissions to less than 50% of 2007 levels by 2035 (the horizon year of the City's current General Plan). Table 6 (below) shows this intermediate 2035 target, the 2010 inventory of City GHG emissions, and the amount of reduction needed to hit the 2035 target.

Table 6: 2035 GHG Reduction Target*

(Metric tons of CO_2 equivalents = $MTCO_2e$)

2035 Target*	$MTCO_2e$
50% below 2007 Baseline	13,580
2010 Inventory	27,107
Reduction needed to hit target	13,527

** 2035 Target was interpolated from the 2050 State Target*

Summary of GHG Emissions Targets

Table 7 summarizes the City and State targets discussed above.

Table 7: Summary of Targets

(Metric tons of CO_2 equivalents = $MTCO_2e$)

Target	$MTCO_2e$	Reduction Needed*
City 2010	22,772	4,335
State 2020	25,020	2,087
Interpolated 2035	13,580	13,527
State 2050	5,004	22,103

** Based on 2010 inventory of City GHG emissions*

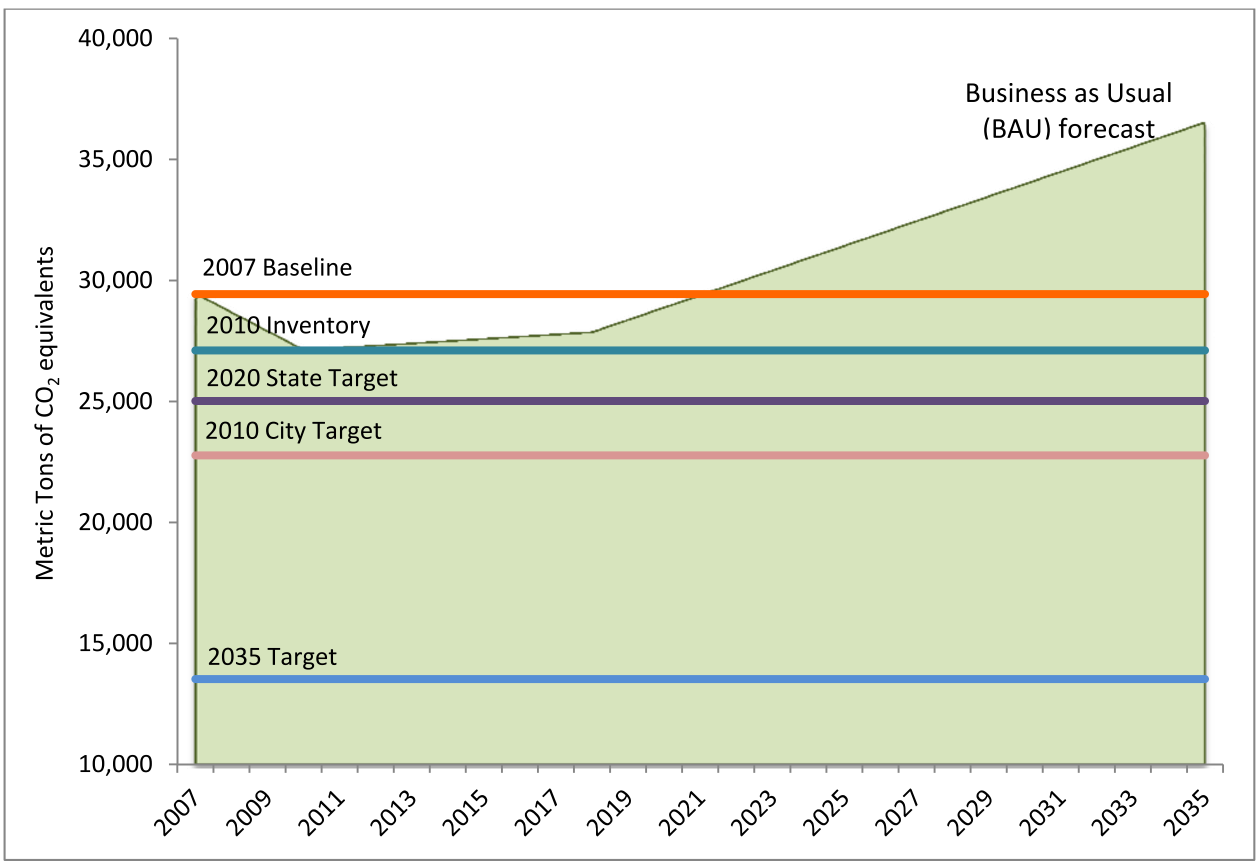
2.4. MUNICIPAL GHG FORECAST

The Santa Rosa 2035 General Plan addresses issues related to physical development, growth management, transportation, public facilities, community design, energy efficiency, greenhouse gas reduction strategies, and conservation of resources. Both the CCAP and this MCAP use the General Plan growth projections to develop forecasts of future GHG emissions. Based on economic conditions in 2012, these plans assume relatively slow growth until 2018 and an increased rate thereafter until assumed build-out in 2035.

As discussed earlier, the City has implemented numerous strategies over the years to reduce GHG emissions and operating costs. While some of the resulting GHG reductions have been offset by operation changes that increased emissions, the overall effect has been a 5% reduction in GHG emissions from 2000 to 2010. However, if the City does nothing further to reduce GHG emissions, the City's growth will lead to increased emissions over time.

Figure 4 illustrates this "business as usual" (BAU) forecast, showing that municipal GHG emissions are projected to increase over time due to growth if no additional reduction efforts are made beyond those implemented through 2010.

Figure 4: Municipal GHG Forecast and Reduction Targets



CHAPTER 3 - GHG REDUCTION OPPORTUNITIES

To achieve the reduction targets discussed in Chapter 2, the City will need to implement a range of projects, programs, and policies. Nearly 100 GHG reduction opportunities have been identified, but the MCAP project list is neither exhaustive nor mandated with the adoption of the MCAP. The potential projects have been organized in Table 8 by emissions sectors and include potential GHG reductions.

Table 8: Potential GHG Reductions from Project Options Identified to Date

(Metric tons of CO_2 equivalents = $MTCO_2e$)

Sector	Potential $MTCO_2e$ Reduction
Wastewater operations	4,823
Fleet	3,113
Buildings and Facilities	1,508
Employee Commute	Not determined
Public Lighting	1,163
Water Operations	211
Waste Stream	Not determined
Equipment	Not determined
TOTAL	10,818

The GHG reductions shown above include all potential projects (that are not mutually exclusive) that were identified during the preparation of this MCAP. These projects will need to be analyzed further and assessed for operational requirements and implications prior to implementation. As some projects will prove to be undesirable or infeasible, the resulting GHG reductions are expected to be less. For example, Wastewater Operations project "WW 9" (next page) involves the replacement of the existing UV disinfection system at LTP with new UV system. However, the new system is projected to have a 22-year payback period and require significantly higher maintenance costs. It is not likely to be implemented.

More information about the projects is provided in Appendix 3, which includes project descriptions, cost estimates, and GHG emission estimates. Chapter 5 proposes grouping (or bundling) the most probable projects to achieve cost effectiveness. Appendix 4 outlines a sample financial analysis based on implementing the projects in the outlined groups. Appendix 5 provides a sensitivity analysis for the financial analysis that considers a number of variables for three scenarios for the financial analysis (realistic outcome, conservative outcome, and very conservative outcome).

One of the options identified below for some sectors is the purchase of cleaner power (electricity from lower GHG emission sources) from PG&E and /or another entity. This is not a capital project, but it has the potential to substantially reduce GHG emissions for all operations that use electricity.

3.1. WASTEWATER OPERATIONS (WW)

Santa Rosa collects, treats, reclaims, reuses, and discharges wastewater from homes, businesses, and industry located within the Santa Rosa Sub-regional Water Reuse System. The Subregional area includes the South Park Sanitation District and the cities of Santa Rosa, Rohnert Park, Sebastopol and Cotati. Over 500 miles of underground pipes bring wastewater to the Laguna Treatment Plant (LTP) where the wastewater undergoes three stages of treatment prior to disinfection, storage, and reclamation. Since its inception in 1968, the LTP facility has increased its treatment capacity from 2 million gallons a day to 21 million gallons per day for average dry weather flow. The recycled water that leaves the Laguna Treatment Plant is high-quality, tertiary-treated water that is safe for many reuse options.

Wastewater operations account for 46% of municipal GHG emissions annually. Over the years, staff members have worked diligently to maximize energy efficiency throughout wastewater operations. In 2012 BASE Energy, Inc. completed a comprehensive Integrated Energy Audit of LTP, which assessed all energy uses at the plant and concluded that the LTP was one of the most efficiently operated plants audited by Base Energy to date. The report also identified energy generation (i.e. solar photovoltaic arrays) as the most logical method for controlling future energy costs, stabilizing rates, and reducing GHG emissions. Staff has also identified some additional renewable energy projects for consideration.

Wastewater Operations (WW) Options	**Potential $MTCO_2e$ Reduction**
WW 1: Eliminate operation of Natural Gas fired cogeneration systems at LTP (in process)	95
WW 2: Install a new, more efficient methane fired cogeneration system. (in process)	313
WW 3: Install a 40 Hp variable-frequency-drive (VFD) air compressor in the digester gallery.	9
WW 4: Replace the compost facility's exhaust fans with high efficiency fans.	15
WW 5: Replace several high horsepower pumps with more efficient options.	27
WW 6: Program the Supervisory Control and Data Acquisition (SCADA) system to divide the flow equally between the pumps whenever the flow requires more than one pump.	10
WW 7: Install lighting controls in numerous areas to ensure that lights do not operate when the rooms are unoccupied.	12
WW 8: Install high efficiency lighting in various areas.	39
WW 9: Replace the existing high intensity ultraviolet (UV) disinfection system with a new low-pressure UV system.	1,436
WW 10: Install a mechanical digester mixing system in place of existing gas injection systems.	36
WW 11: Replace existing desiccant air dryer for air compressor with new refrigerated air dryer.	2
WW 12: Widen deadband between cooling and heating set points for compost facility offices.	3
WW 13: Replace the two 50 ton air-cooled chillers and one 60 ton chiller that serve the HVAC equipment at Administration building with single high efficiency water cooled chiller.	14
WW 14-A: Install a 1 megawatt (MW) solar photovoltaic (PV) system.	855
WW 14-B: Install a 2 MW solar photovoltaic (PV) system.	1,594*
WW 14-C: Install a 4 MW solar photovoltaic (PV) system.	3,174*
WW 15: Purchase cleaner electricity from PG&E and/or another entity.	1,417
TOTAL	4,823

* *To be conservative, only WW 14-A was included in the total reduction (WW 14-B and WW 14-C were not included).*

3.2. FLEET (FL)

Operation of the City's fleet accounts for 19% of municipal GHG emissions. The fleet includes nearly 650 passenger vehicles and trucks, 37 buses, and 12 para-transit vans that consume gasoline and diesel fuels. Each gallon of fuel consumed by the fleet emits approximately 20 pounds of CO_2.

One approach to decreasing GHG emissions from a fleet is to decrease fuel consumption. There has been a great deal of progress in recent years in vehicle fuel efficiency and the development of hybrid and electric vehicles. Hybrid vehicles can be considered a mainstream option for most passenger vehicle applications. Electric vehicles also reduce carbon-based fuel consumption. They generate 80% fewer GHG emissions per mile than a standard gasoline engine. The City of Santa Rosa and the County of Sonoma have installed a number of charging stations in support of electric vehicle technology. Electric vehicles remain relatively expensive at this time but have made significant steps in market penetration. It is no longer uncommon to see an electric vehicle "fueling" at one of the City Hall charging stations.

Another approach to reducing fleet GHG emissions is to use cleaner burning fuels such as bio-diesel, ethanol, and Compressed Natural Gas (CNG). However, each of these fuels also comes with challenges.

- **Bio-diesel**: Bio-diesel fuel comes in various blends, such as B5 and B20 (5% and 20% bio-diesel, respectively). Current research indicates that B5 and B20 fuels can be utilized by the City's fleet without much concern for vehicle maintenance issues or shortened vehicle life. However, conversion to B100 fuels could require significant upgrades to the fleet to prevent damage to fuel lines and internal engine seals if the fleet vehicles are older. In addition, the California Air Resources Board (CARB) has recently established regulations that mandate fuel and exhaust particulate filtration that may be incompatible with some bio-diesel systems.
- **Ethanol**: Ethanol is another clean burning, high-octane fuel produced from renewable sources. Ethanol is mixed with unleaded gasoline and results in decreases in gasoline cost, increases gasoline octane rating, and decreases harmful emissions. E10 (10% ethanol) is the most common form of ethanol fuel and is approved for all vehicles sold in the U.S., while E85 (85% ethanol) is intended for use in Flexible Fuel Vehicles (FFV) manufactured by all three U.S. auto manufacturers. FFVs run on E85 but can be switched to regular gasoline when E85 is not available. E85 reduces greenhouse gas emissions by 18% to 28%, but California Air Resources Board (CARB) regulations make E85 less accessible in California. Other challenges include the fact that only FFVs are outfitted to use this fuel, its availability is uncertain, the cost is unpredictable, and vehicle operating range is decreased by approximately 20% to 25%.
- **Compressed Natural Gas (CNG):** Finally, CNG is relatively inexpensive and readily available fuel that reduces emissions by 40% to 45%. However, local infrastructure to supply CNG does not currently exist in Sonoma County. If the City wishes to use CNG, it will have to install a CNG station at one of its facilities.

Fleet (FL) Options	Potential $MTCO_2e$ Reduction
FL 1-A: Replace remaining diesel-powered buses with hybrid buses.	3,038
FL 1-B: Use low-carbon fuels in buses (once such fuels have been approved by manufacturers and regulatory agencies). (Infrastructure needed)	365*
FL 1-C: Develop compressed natural gas (CNG) program for buses. (Infrastructure needed)	1,172*
FL 2: Replace 75 "passenger" vehicles at the end of their life with a hybrid equivalent.	75
FL 3: Use low-carbon fuels in City's fleet (once such fuels have been approved by manufacturers and regulatory agencies). (Infrastructure. needed)	54*
TOTAL	3,113

** FL 1-B and FL 1-C and FL 3 require significant infrastructure upgrades and were not included in the total reductions.*

3.3. BUILDINGS AND FACILITIES (BF)

City buildings and facilities account for 12% of municipal GHG emissions. GHG emissions from this sector result from the use of electricity and natural gas to heat and cool buildings, light facilities, and operate all types of office equipment to administer City operations.

Opportunities to reduce GHG emissions include reducing energy use through energy efficiency, energy management control strategies, and onsite generation of renewable energy. The City has been implementing energy efficiency projects and renewable generation projects for more than 20 years.

Buildings and Facilities (BF) Options	Potential $MTCO_2e$ Reduction
BF 1: Install several small solar projects (e.g. at Finley Center, MSCS, and City Hall).	608
BF 2: Install a small cogeneration system at the Finley Swim Center.	117
BF 3: Replace existing outdated roofs with cool roofs.	TBD
BF 4: Install a double-door entry for the City Hall Annex.	TBD
BF 5: Install a high efficiency boiler at the Ridgway Pool Center.	TBD
BF 6: Install a solar hot water heating system at the Finley Swim Center.	99
BF 7: Replace existing HVAC (heating, ventilation, and air conditioning) equipment	TBD
BF 8: Upgrade existing lights at several facilities.	180
BF 9: Upgrade additional lighting fixtures at other facilities.	64
BF10: Purchase cleaner electricity from PG&E and/or another entity.	440
TOTAL PROJECTED $MTCO_2e$ reductions (annual)	1,508

3.4. EMPLOYEE COMMUTE (EC)

Emissions stemming from the vehicle miles traveled (VMT's) through the daily commute of City's employees accounts for approximately 8% of the total emissions from City operations. Therefore, reducing GHG emissions related to employee commute is a key to achieving state and local targets.

However, this may be the most difficult sector in which to achieve and quantify emissions reductions because commuting is based on highly individualized behavior and habits.

To effectively reduce GHG emissions related to employee commute, four components of commuter choice must be addressed: 1. Mode Choice: What method of transportation to use; 2. Time Choice: When to commute; 3. Location Choice: Where to live; and 4. Route Choice: Which way to commute.

Each employee has different needs and commuting characteristics. Although many commuters cannot or will not change how they commute, they can make choices as to when they travel and the route they take. To reduce commute GHG emissions, an employee commute program must address the specific needs and characteristics of the City and its employees.

In some cases successful commute programs include a paid parking component as a disincentive to commute in a single occupant vehicle. Some employers have offset the cost of the parking charge with a stipend that can be retained by the employee should they choose a commute alternative. The stipend provides an incentive to avoid driving alone because the employee can then spend the increase for other needs. The paid parking component creates a disincentive to drive alone due to the relatively high cost of parking. These two attributes of a paid parking program can create a powerful incentive to not drive alone. However, this type of program can create equity and employee relation issues that would require further study.

To be effective in reducing GHG emissions, an employee commute program would need policy prioritization from the City Council, program development and marketing to employees, and consistent program oversight. One common theme of successful commute programs includes the dedication of at least one full time equivalent (FTE) employee to manage the program.

The City has implemented a number of employee commute reduction policies. For example, employees can ride CityBus for free; this provides them an alternative to driving private passenger vehicles, thereby reducing their GHG emissions. Regional public transit operators such as Sonoma County Transit and Golden Gate Transit provide additional options for reducing GHG emissions associated with employee commuting, as will the Sonoma Marin Area Rail Transit (SMART) when it is operating. The City also encourages walking and biking to work and has made efforts to expand and improve pedestrian and bicycle pathways throughout the City.

Employee commute reduction programs have been implemented on a voluntary basis, with implementation left to group / division management needs. The effectiveness of these programs is difficult to quantify, so no cost or savings estimates are included for the following programs.

Employee Commute (EC) Options	**Potential $MTCO_2e$ Reduction**
EC 1: Continue to operate a 9/80 work schedule where appropriate	TBD
EC 2: Continue to allow staff to telework when appropriate	TBD
EC 3: Continue Trip Reduction Program (encourage walking, biking, carpooling, bus use)	TBD
EC 4: Implement a paid employee parking program	TBD
TOTAL	TBD

3.5. PUBLIC LIGHTING (PL)

Public lighting accounts for 8% of the City's municipal GHG emissions. The City of Santa Rosa owns approximately 15,000 light fixtures that provide public night lighting throughout the City. Lighting is provided at all intersections, areas with high nighttime pedestrian traffic to enhance nighttime experience, and in critical areas that have demonstrated a history of traffic issues.

Public Lighting (PL) Options	Potential $MTCO_2e$ Reduction
PL 1: Purchase cleaner electricity from PG&E and/or another entity.	476
PL 2: Retrofit about 10,000 streetlights with induction or LED fixtures.	343
PL 3: Decommission approx. 3,100 streetlights deemed non critical before 2010	445
PL 4: Decommission approx. 1,900 streetlights deemed non critical after 2010	261
PL 5: Re-Illuminate approx. 5,000 decommissioned lights & retrofit w/Induction or LED	(396)
PL 6: Retrofit approximately 800 street lights with induction fixtures (in process)	34
TOTAL	1,163

3.6. WATER OPERATIONS (WO)

The City of Santa Rosa's water system consists of over 600 miles of water mains, over 53,000 water services and meters, more than 7,000 fire hydrants and over 26,000 water valves. The water system includes 20 water booster pump stations and 25 steel reservoirs. The City is responsible for providing approximately 7 billion gallons of water to City residences and businesses each year.

The City's water operations account for 4% of municipal GHG emissions each year. Emissions are virtually 100% from the use of electricity to move water and for the operation of facility offices. Water operations division has implemented a number of energy efficiency and renewable energy projects, and staff intends to continue replacing equipment with the highest efficiency equipment available as the equipment reaches the end of its life.

Water Operations (WO) Options	Potential $MTCO_2e$ Reduction
WO 1: Purchase cleaner electricity from PG&E and/or another entity.	209
WO 2: Replace pump motors with high efficiency motors as they fail or need replacement	2
TOTAL	211

3.7. WASTE STREAM (WS)

The City's solid waste stream accounts for 2% of municipal GHG emissions each year. The City has a variety of policies in place to minimize waste stream in City Operations and construction projects. These are supportive measures which do not have quantifiable emissions reductions.

Waste Stream (WS) Options	Potential $MTCO_2e$ Reduction
WS 1: Continue to implement the City's purchasing policy for recycled content	TBD
WS 2: Continue to implement the City's policies regarding waste reduction and recycling	TBD
TOTAL	TBD

3.8. EQUIPMENT

The City has outsourced nearly all of its landscape maintenance and the associated equipment operations so that it now generates less than 1% of the City's GHG emissions annually. Therefore no reduction programs are included.

CHAPTER 4 - FUNDING STRATEGIES

GHG reduction strategies can be funded in a variety of ways. Complex and/or large projects may need to use a mixture of strategies. The list below provides a brief description of several purchasing and financing strategies. Because financing tools are numerous, variable, and still emerging, it is not possible to discuss all of the options available.

Some GHG reduction projects result in decreases in energy purchases. The associated energy cost savings in many cases will pay for a project within its lifecycle, resulting in neutral or even positive cash flow for the City. In some situations, the money saved in energy costs will be sufficient to offset the cost of financing a project, allowing the City to implement projects with no “cash out of pocket.”

Another key concept is project bundling or grouping. Project bundling involves combining projects together as a package in order to make the overall effort more feasible. For example, a project may not be cost effective on its own but could offer excellent GHG reductions; when combined with more cost effective projects, the first one becomes more feasible. Similarly, a project that has a long payback period may be “bundled” or combined with projects that have short payback periods to create one project package with a medium payback period. In these ways, the savings from projects will mitigate the costs of other projects and provide energy cost savings that make the overall project package more affordable and more effective at reducing GHG emissions.

Potential Funding and Purchasing Options

- **Direct Purchase**: Many GHG reduction strategies pay for themselves within a one or two year cycle and are typically funded using the regular budget process and/or with grant awards.
- **Financing**: Financing options may include low interest loans from the California Energy Commission (CEC), no-interest on-bill financing from PG&E, bonds, and third party financing. Some options are specific to certain strategies and cannot be used for others. For example, PG&E financing can only be used for energy efficiency efforts and not for renewable energy projects.
- **Third Party Ownership**: Third parties that own and operate assets on behalf of local government pass on a portion of the savings to the municipality. For example, some cities have used Power Purchase Agreements (PPAs) to fund renewable energy projects that are owned by a third party but which reduce energy costs for government. These agreements are for a specified period of time, after which the City would have the option of purchasing the asset or having the asset removed from City property.
- **Design-Build Construction:** California General Code 4217 allows public agencies to select contractors to implement projects that pay for themselves via the energy that is saved by implementing the projects. Many public agencies will hire Energy Service Companies (ESCOs) to complete comprehensive design build projects that focus on performance goals in lieu of a pre-engineered project, potentially improving the project’s cash flow. In 2012 the City’s Charter was amended to allow for the use of design-build construction. The City will be able to use this approach once Council has adopted a design-build ordinance that codifies the design-build option.

- **Accumulative Capital Outlay (ACO) Fund**: In addition to these strategies, some public agencies have created an Accumulative Capital Outlay (ACO) Fund for energy and sustainability projects. In this scenario, a municipality establishes a citywide fund for energy efficiency measures and GHG reduction projects and then directs rebates and energy cost savings from completed projects into an ACO to fund additional GHG reduction efforts.
- **Project Bundling**: As previously addressed, this approach combines GHG reduction projects that achieve a very good return on investment with those that do not. Bundling projects allows municipalities to move forward on individual projects that achieve GHG reductions but do not have strong rates of return. For example, the City may wish to replace a heating, ventilation, and air conditioning (HVAC) system at one of its facilities for maintenance purposes and/or to achieve GHG reductions. However, HVAC systems typically have payback periods that exceed the expected life of the equipment. By combining an HVAC project with projects with short payback periods (e.g. lighting projects) the bundled effort can achieve an acceptable payback rate and contribute to achieving GHG reduction targets.

  Project bundling will need to be done with particular attention to the source of funds. Projects that are funded by an Enterprise Fund in one Department (e.g. projects in the Utilities Department) will need to be bundled separately from projects that are funded by other Enterprise Funds or General Funds to comply with Proposition 218, also known as the Right to Vote on Taxes Act. Proposition 218 stipulates that municipalities cannot shift the cost of providing services under its general fund to utility ratepayers.

  Chapter 5 provides further discussion about how the concept of project bundling can be applied to ensure cost effective implementation of the projects outlined in this MCAP.

CHAPTER 5 - PROJECT GROUPS

To demonstrate how GHG emission reduction goals can be met, the GHG reduction projects discussed in Chapter 3 have been bundled (grouped) according to a few criteria such as their status (in progress or not), cost effectiveness (Modified Internal Rate of Return or MIRR[4]), and the type of project. Project bundling involves combining projects together as a package in order to make the overall effort more feasible. Appendix 4 illustrates how the use of project groups allows for a sample financial analysis.

The project bundles include:

- **Group 1**: Projects that are in process or have been completed since 2010
- **Group 2**: Projects that have a Modified Internal Rate of Return (MIRR)[4] higher than 10%
- **Group 3**: Projects that have Modified Internal Rate of Return (MIRR)[4] greater than 5%
- **Group 4**: A one megawatt solar PV project at the Laguna Treatment Plant
- **Group 5**: Upgrading buses to lower emission models and street light fixtures to LED or induction
- **Group 6**: Purchasing cleaner (lower GHG emission) power from PG&E and/or another entity

Group 6 (purchasing cleaner power) is not a capital project. However, buying cleaner power (electricity from lower GHG emission sources) has the potential to substantially reduce GHG emissions for all operations that use electricity. The City is participating in efforts to ensure that cleaner electricity (from lower GHG emission sources) becomes available at competitive prices from PG&E and/or another entity.

Table 9 summarizes the emission reductions of each project group as a percentage of the City's 2010 target and the State's 2035 target and includes the cumulative impacts to show how project groups will complement each other. The GHG reductions in Table 9 are less than those in Table 4 because Table 9 only includes the most likely projects to be implemented. Achieving the City's 2010 target will also accomplish (and exceed) the State's 2020 target; therefore, the State's 2020 target is not listed below.

Table 9: Implementation Components
(Metric tons of CO_2 equivalents = $MTCO_2e$)

Group	Reduction ($MTCO_2e$)	Cumulative	% of 2010 Target	Cumulative	% of 2035 Target	Cumulative
G1: Projects in progress	1,329	1,329	31%	31%	10%	10%
G2: Projects with MIRR >10%	274	1,603	6%	37%	2%	12%
G3: Projects with MIRR > 5%	525	2,127	12%	49%	4%	16%
G4: I MW solar project at LTP	941	3,068	22%	71%	7%	23%
G5: Upgrade buses & light fixtures	1,174	4,242	27%	98%	9%	31%
G6: Cleaner electricity	2,542	6,784	59%	157%	19%	50%

[4] The MIRR represents the annualized return that will be realized from the investment. This metric accounts for maintenance costs, the life of the project, energy escalation rates, reinvestment rates, and inflation/discount rates. This is the best metric for comparing one project to another project with a different expected useful life.

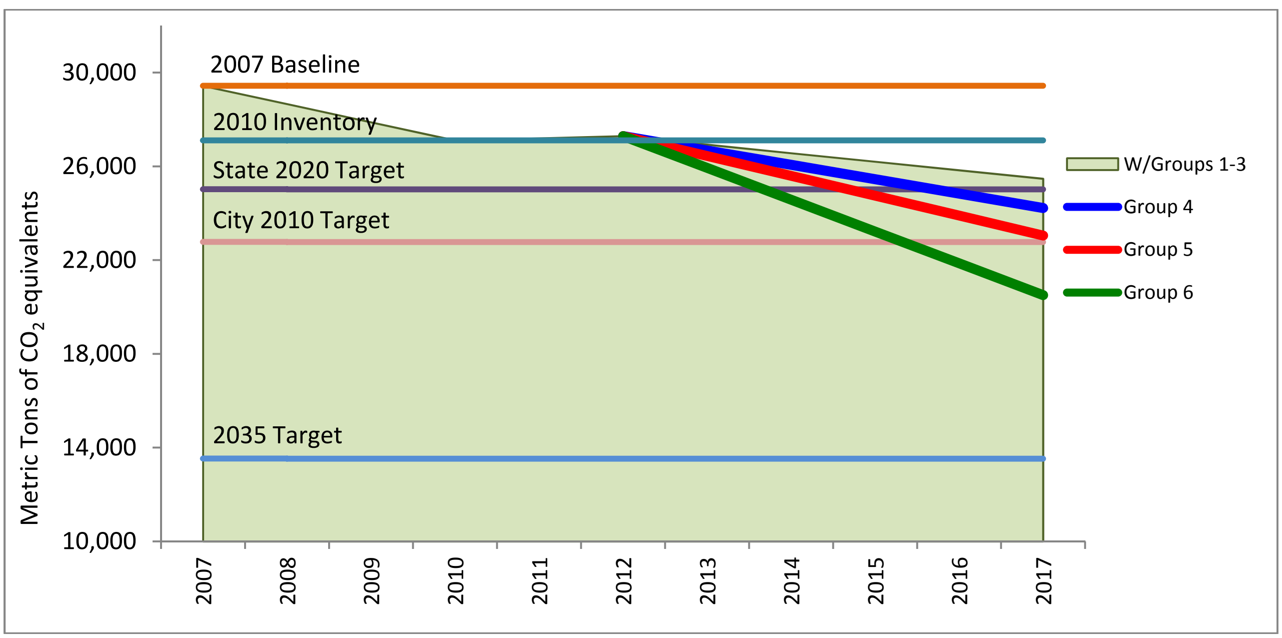
As Table 9 shows, projects that are currently in progress (Group 1) will reduce the City's annual emissions by 1,329 $MTCO_2e$ per year, which is 31% of the way to the 2010 target and 10% of the 2035 target. Completing all of the capital improvement projects (Groups 1 – 4) would achieve 71% of the City's 2010 target and 23% of the State's 2035 target. To reach 98% of the City's 2010 target and 31% of the State's 2035 target, the City will need to make significant progress in converting its bus fleet to more efficient vehicles and retrofit street light fixtures to higher efficiency models (Group 5). Buying cleaner electricity (Group 6) has the potential to significantly reduce City emissions.

Figure 5 (below) projects the GHG reductions from the project groups. The MCAP projects a five year implementation timeline (2012-2017) for these reasons: (a) this time period recognizes that some projects have already begun and others could be accomplished by 2017; (b) the City's growth rate is expected to pick up after 2017; and (c) the City may need a buffer to provide ample time to course correct as needed in order to meet or exceed the State's 2020 GHG reduction target. As discussed in Chapter 6, the MCAP should be revised in five years to ensure it remains current.

Figure 5 shows how the following project groups work together to achieve the local and state targets.

- **Groups 1-3**: Implementing Groups 1 through 3 would nearly meet the State's 2020 target.
- **Group 4**: Implementing Groups 1 through 3 and installing a one megawatt (MW) solar PV system at LTP would achieve the State's 2020 target.
- **Group 5**: Implementing Groups 1 through 4 and replacing diesel buses a the end of their useful lives with compressed natural gas (CNG) buses and retrofitting street lights upon burnout with high efficiency fixtures would bring the City very close to its 2010 reduction target.
- **Group 6**: Implementing Groups 1 through 5 and purchasing cleaner power would achieve the City's 2010 target and put the City on track for achieving the intermediate 2035 goal.

Figure 5: Municipal GHG Reduction Forecast and Targets



There are several notable items in Figure 5.

- Reaching the City's 2010 target will take a considerable effort, requiring the implementation of the projects in Groups 1 through 5 and the purchase of cleaner power.
- Buying cleaner (lower GHG emission) power has the potential to significantly reduce City emissions.
- The City will need to continue working on emission reduction strategies to meet the 2035 target.
- After 2017, emissions will be affected by City growth and ongoing GHG reduction efforts. The City's municipal operations will continue to change as a result of growth and technology development. Therefore, the City will need to revisit its emission baseline and identify new reduction strategies and technologies on a regular basis to ensure that its trend continues to decline.

CHAPTER 6 - IMPLEMENTATION

6.1. IMPLEMENTATION APPROACH

The MCAP has been developed to identify projects, programs, and policies that can be used by the City to meet local and state GHG targets. While nearly 100 GHG reduction opportunities have been identified, this specific project list is neither exhaustive nor mandated with the adoption of the MCAP. This is because the main purpose of the MCAP is to provide a road map for efficient and cost effective implementation. During the implementation phase, projects will be analyzed further and assessed for cost effectiveness, GHG impacts, and operational requirements and implications. In order to accomplish the GHG goals, this Chapter of the MCAP outlines the creation of an Implementation Team to oversee the development and implementation of a carefully designed and organized Project Implementation Plan (Plan) and a Measurement and Verification Plan for tracking and reporting progress.

The Implementation Team (Team) will be comprised of City staff, including a Team Leader identified by the City Manager and Team Members appointed by the Director of each participating Department. The Team will be responsible for developing a Project Implementation Plan that includes analysis and cost estimates (internal and external costs) for projects and project bundles (with Enterprise Fund projects grouped separately); recommendations for integrating implementation activities into Department work plan; recommendations for institutionalizing GHG reduction strategies into ongoing City practices; recommendations for mitigating potential implementation challenges; and recommendations for funding. The Team will also be responsible for developing a Measurement and Verification Plan that outlines how the Team will track and report the City's progress toward achieving GHG targets.

The Project Implementation Plan will be finalized with input from Department Directors and the City Manager. With the City Manager's approval, implementation will begin and projects will be completed in accordance with all standard City practices to ensure consistency with the General Plan, CEQA, the City's budget process, and the City's purchasing and procurement policies and procedures.

The science and technology of GHG emissions management are being updated frequently. In addition, understanding City operations and their impacts on GHG emissions can be challenging. Therefore, the Team will be tasked with striving to remain current on new technologies, policies, procedures, and programs that would help the City achieve its immediate and long range GHG targets.

Throughout the implementation process, the Team will evaluate progress and report annually to the City Manager and City Council. As needed, Utilities Department staff will report to the Board of Public Utilities on progress related to Utilities operations. The Team will revise the Project Implementation Plan as needed and update the MCAP every five years (consistent with the CCAP revision schedule).

As described above, achieving local and State GHG targets will require consistent efforts and should include a focus on integrating GHG reduction projects and activities into existing policies, practices, and procedures. A comprehensive approach will also require the support of the City Council and collaboration between City Departments.

6.2. GUIDING PRINCIPLES

The following principles can be used to guide implementation of the Project Implementation Plan:

- Implement actions in all municipal operations sectors.
- Bundle projects and appropriate funding options for cost-effective GHG reductions.
- Prioritize projects based on the greatest GHG reductions for the least cost.
- Utilize the best available purchasing options and minimize impact on the City's annual cash flow.
- Continue to implement replacement schedules that update older buses, vehicles, equipment, and fixtures with higher efficiency models.
- Participate in programs (PG&E and/or Community Choice Aggregation) that expand cleaner (lower GHG emissions) energy options at competitive prices.
- Emphasize innovation, cooperation, and collaboration with other governmental entities, nonprofits, and the private sector.
- Implement the plan in a timely fashion.
- Evaluate targets and progress annually.

6.3. IMPLEMENTATION STEPS

In order to achieve the GHG reduction targets, the following steps will need to be taken to develop and implement a Project Implementation Plan, which will serve as a road map for achieving local and state GHG reduction targets.

Action 1 - Form an MCAP Implementation Team

Action 1.1 - With direction from the City Manager, an Implementation Team Leader will be identified.

Action 1.2 - With direction from Department Directors, Team Members from each participating City Department will be identified.

Action 2 - Develop the Project Implementation Plan (Plan)

Action 1.3 - The Implementation Team will review and discuss the MCAP and will invite input from key stakeholders and subject-matter experts as needed.

Action 1.4 - The Team will be responsible for:

1. Identifying the lead Department (and lead section/division) for each activity;
2. Finalizing the project analysis and cost estimates, and developing appropriate project bundles for Enterprise Fund project and General Fund projects;
3. Making recommendations for how to integrate Project Implementation Plan activities into each Department's work plan;

4. Making recommendations for how to institutionalize GHG reduction strategies using existing practices and procedures;
5. Identifying potential challenges facing Departments and possible mitigations and solutions;
6. Outlining the best funding and purchasing options for each project and project bundle; and
7. Developing a Measurement and Verification Plan to track and report the City's progress toward achieving GHG reductions.

Action 1.5 - The Team will document the key findings and recommendations in a Draft Project Implementation Plan.

Action 1.6 - Each Team Member will discuss the Draft Plan with their Department Head and seek input. The Team Leader will report to the City Manager and seek input.

Action 1.7 - The Team will finalize the Project Implementation Plan, ask the City Manager for approval to proceed, and provide a copy of the Plan to Department Directors.

Action 3 - Secure Funding

Action 1.8 - The Team will work with staff in each Department to ensure that the most appropriate funding is identified and budgeted for each project and project bundle.

Action 1.9 - The Team will evaluate the funding strategy at regular intervals and update Department Directors and the City Manager.

Action 4 - Implement the Plan

Action 1.10 - Each Team Member will ensure that their Department moves forward with implementing the projects that fall within its purview.

Action 1.11 - Departments will implement projects according to all standard City practices to ensure consistency with the General Plan, CEQA compliance, the budget process, City purchasing and procurement policies, etc.

Action 1.12 - The Team will evaluate progress regularly and update Department Directors, the City Manager, and City Council.

Action 5 – Analyze Future Capital Projects

Action 1.13 - The Team will develop strategies and policies to institutionalize GHG assessments and reduction strategies into future replacement schedules (buses, vehicles, light fixtures, office equipment, etc) and capital improvement projects.

Action 6 - Track Cleaner Energy Options

Action 1.14 - The Team will monitor and track the availability of cleaner energy options from the local utility options.

Action 1.15 - The Team will work with the City Manager as appropriate to ensure the City purchases cleaner energy at competitive prices as it becomes available.

Action 7 - Report Progress

Action 1.16 - The Team will provide an annual written report of progress to Department Directors and the City Manager.

Action 1.17 - The Team will report progress to City Council annually.

Action 1.18 - The Board of Public Utilities (BPU) will be updated periodically about the progress of Utilities Department projects.

Action 1.19 - The Team will adjust the Project Implementation Plan as necessary to ensure success.

Action 8 - Remain Current

Action 1.20 - The Team will investigate new technologies, policies, procedures, and programs which would allow the City to continue to reduce GHG emissions.

Action 1.21 - The Team will revise the Project Implementation Plan as needed.

Action 1.22 - The Team will revise the MCAP every five years, consistent with the CCAP.

6.4. IMPLEMENTATION MILESTONES

To complete the Project Implementation Plan and achieve the local and state GHG reduction targets in a timely manner, the Team will use the following schedule and milestones.

Milestones by Year

- YEAR 1
  - Form the MCAP Implementation Team.
  - Complete the first draft of the Project Implementation Plan for review by Department Directors and the City Manager.
  - Assess available cleaner energy options.
  - Explore and develop a deeper understanding of funding and purchasing options.
  - Report progress to Department Directors and the City Manager annually.
  - Update the BPU periodically about the progress of Utilities Department projects.
  - Report progress to City Council once a year.
- YEAR 2
  - Finalize the Project Implementation Plan.
  - Develop a Measurement and Verification Plan to track progress.
  - Secure project funding.

- Implement projects.
- Continue to assess available cleaner energy options.
- Investigate new technologies, policies, procedures, and programs which would allow the City to continue to reduce GHG emissions.
- Develop procedures and policies to institutionalize GHG emissions assessments and reductions into future replacement schedules (buses, vehicles, light fixtures, office equipment, etc) and capital improvement projects.
- Report progress to Department Directors and the City Manager annually.
- Update the BPU periodically about the progress of Utilities Department projects.
- Report progress to City Council annually.

- YEAR 3
  - Continue to implement the Plan.
  - Continue to assess available cleaner energy options.
  - Continue to investigate new technologies, policies, procedures, and programs.
  - Report progress to Department Directors and the City Manager annually.
  - Update the BPU periodically about the progress of Utilities Department projects.
  - Report progress to City Council annually.
- YEAR 4
  - Continue to implement the Plan.
  - Continue to assess available cleaner energy options.
  - Continue to investigate new technologies, policies, procedures, and programs.
  - Report progress to Department Directors and the City Manager annually.
  - Update the BPU periodically about the progress of Utilities Department projects.
  - Report progress to City Council annually.
- YEAR 5
  - Complete the Project Implementation Plan.
  - Update the GHG inventory.
  - Update the MCAP to guide ongoing efforts toward the 2035 intermediate target.
  - Continue the work of overseeing GHG emissions reductions as needed.
  - Report to Department Directors, City Manager, the BPU (Utilities progress) and City Council.

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Appendices

Appendix 1 – Acronyms

The following acronyms are used in this document.

Abbreviation	Description
AB 32	Assembly Bill 32
ACO	Accumulative Capital Outlay Fund
BAAQMD	Bay Area Air Quality Management District
CARB	California Air Resources Board
CCA	Community Choice Aggregation
CSI	California Solar Initiative
CNG	Compressed Natural Gas
DOE	Department of Energy
IEA	Integrated Energy Audit
kW	Kilowatt (power)
kWh	kilowatt hours (energy)
GHG	Greenhouse gas
LTP	Laguna Wastewater Treatment Plant
MCAP	Municipal Operations Climate Action Plan
MIRR	Modified Internal Rate of Return
$MTCO_2e$	Metric tons of CO_2 equivalents
NPV	Net Present Value
PG&E	Pacific Gas and Electric
PV	Photovoltaic

Appendix 2 – Conversion Coefficients for Calculating GHG Reductions

GHG emissions result from the use of energy and direct releases of GHG gases into the air. The forms of GHG-generating energy sources used by the City of Santa Rosa include electricity, natural gas, gasoline, diesel fuel, propane, and fuel oil. In addition, direct releases of GHG emissions may result from accidental release of refrigerants and wastewater treatment.

In order to compare GHG reduction efforts, each type of greenhouse gas being considered must be converted into a common unit such as "equivalent units of carbon dioxide" (CO_2e). When dealing with large emissions such as those from municipal operations, the measure used is typically metric tons of CO_2e. Table 10 summarizes the coefficients that have been used to convert the City's GHG reduction efforts into metric tons of carbon dioxide equivalents, or $MTCO_2e$.

The coefficient used for assessing GHG reductions related to renewable energy is nearly twice the value used for PG&E electricity. PG&E's energy portfolio includes large hydroelectric energy and nuclear energy, both which do not generate GHG's (although they do present other environmental challenges). In comparison, renewable energy is assumed to offset the construction of new power plants which would presumably be relatively clean burning natural gas fired power plant with GHG emissions that would be higher than PG&E's current profile based on its mix of energy sources.

Table 10: Coefficients for Converting Greenhouse Gas Reductions to $MTCO_2e$

Fuel	Units	$MTCO_2e$ per unit	Source for coefficient
Electricity - PG&E	MWh	0.254	Average for previous 8 years. PG&E, *Greenhouse Gas Emission Factors Info Sheet,* April 8, 2011.
Renewable Electricity	MWh	0.437	California Air Resources Board (CARB), *Climate Change Scoping Plan,* December 2008, (App 2, pp I27 and 128).
Natural Gas	Therm	0.005	CARB, *Local Government Operations Protocol, Version 1.1*, May 2010, (App F, Table G1).
Gasoline	Gallons	0.009	CARB, *Local Government Operations Protocol, Version 1.1*, May 2010, (App F, Table G2).
Diesel	Gallons	0.010	CARB, *Local Government Operations Protocol, Version 1.1*, May 2010, (App F, Table G3).

Appendix 3 – GHG Reduction Project Opportunities

Nearly 100 GHG potential projects have been identified in the MCAP, but the list is not exhaustive or mandated. Before implementation, individual projects will need to be assessed for any potential operational requirements or issues.

The GHG reduction opportunities are organized by the following emissions sectors:

1. Wastewater Operations
2. Fleet
3. Buildings and Facilities
4. Employee Commute
5. Public Lighting
6. Water Operations
7. Waste Stream
8. Equipment

Whenever possible, a life-cycle-cost analysis has been completed for each project. The life cycle cost analysis accounts for all costs and savings over time. Costs will include initial costs, maintenance costs, financing costs, and any other costs that will be incurred over the life of the project. The savings will include energy savings over the life of the project. Where sufficient data for a life-cycle analysis is lacking, the available information, if any, has been provided.

Each project falls into one of six groups (bundles) designed to allow the City to achieve maximum cost effectiveness. Please see Chapter 5 for more detailed definitions of the groups and Appendix 4 for a sample financial analysis using these groups.

- **Group 1**: Projects that are in process or have been completed since 2010
- **Group 2**: Projects that have a modified internal rate of return (MIRR)[5] higher than 10%
- **Group 3**: Projects that have an MIRR[5] greater than 5%
- **Group 4**: A one megawatt solar PV project at the Laguna Treatment Plant (wastewater)
- **Group 5**: Upgrading buses to lower emission models and street light fixtures to LED or induction
- **Group 6**: Purchasing cleaner (lower GHG emission) power from PG&E and/or another entity

Where possible, the probability of implementing each project has been ranked as High, Medium, or Low, as follows:

❖ **High**: projects have a good financial return and have been vetted to the point that it is likely the project will be constructed.

[5] The MIRR represents the annualized return that will be realized from the investment. This metric accounts for maintenance costs, the life of the project, energy escalation rates, and inflation/discount rates. This is the best metric for comparing one project to another project with a different expected useful life.

- **Medium**: projects that need additional effort to fully vet, but appear to have the potential to create a positive return on investment.
- **Low**: projects that have very long paybacks or other barriers to implementation that make them unlikely.

The projects listed in this chapter are not shown in any hierarchal or priority order. While many of these projects will certainly move forward, not all of them will be implemented in the foreseeable future. Some may be financially infeasible. Some may require time for technology to develop or mature. Some may need further analysis. Some are mutually exclusive with another project; projects that are mutually exclusive are designated with a letter after the number. For example, in the Wastewater Operations section, there are three potential solar photovoltaic projects (WW14-A, WW14-B, and WW14-C), but only one would be completed.

1. Wastewater Operations (WW)

Wastewater operations account for 46% of municipal GHG emissions annually. The following list of projects includes wastewater operations GHG measures that are currently being implemented and other strategies that can be considered for future implementation.

WW 1	**Eliminate Natural Gas Cogeneration**		
Eliminate the operation of the Natural Gas fired cogeneration systems. These systems do not have heat recovery and operate at a lower efficiency than PG&E supplied power, resulting in increased GHG emissions (although they generate energy at a lower cost than PG&E). This project is currently under implementation. Staff is working to increase the system efficiency.		kWh Saved	(9,240,000)
		Therms Saved	782,880
		Cost Saved	$(748,176)
		Installed Cost	$-
		Rebate	$-
		Net Cost	$-
		Simple Payback	-
Priority/Probability: High	Group: 1	Annual $MTCO_2e$	95

WW 2	**Upgrade Methane Cogeneration**		
Install a new, more efficient methane fired cogeneration system. This project is currently in process.		kWh Saved	-
		Therms Saved	-
		Cost Saved	$118,711
		Installed Cost	$-
		Rebate	$-
		Net Cost	$-
		Simple Payback	-
Priority/Probability: High	Group: 1	Annual $MTCO_2e$	313

WW 3	**Efficient Air Compressor**		
Install a 40 Hp variable-frequency-drive (VFD) air compressor in the digester gallery.		kWh Saved	45,534
		Therms Saved	-
		Cost Saved	\$3,933
		Installed Cost	\$22,031
		Rebate	\$4,618
		Net Cost	\$17,413
		Simple Payback	4.4
Priority/Probability: High	Group: 2	Annual $MTCO_2e$	9

WW 4	**High Efficiency Fans**		
Replace the compost facility's exhaust fans with high efficiency fans.		kWh Saved	73,757
		Therms Saved	-
		Cost Saved	\$6,370
		Installed Cost	\$188,020
		Rebate	\$7,480
		Net Cost	\$180,540
		Simple Payback	28.3
Priority/Probability: Low	Group: None	Annual $MTCO_2e$	15

WW 5	**High Efficiency Pumps**		
Several of the high horsepower pumps are not the highest efficiency available for the application. Replace the existing pumps with more efficient options.		kWh Saved	133,122
		Therms Saved	-
		Cost Saved	\$11,496
		Installed Cost	\$306,953
		Rebate	\$13,501
		Net Cost	\$293,452
		Simple Payback	25.5
Priority/Probability: Low	Group:	Annual $MTCO_2e$	27

WW 6	**Influent Pump Control**		
Program the Supervisory Control and Data Acquisition (SCADA) system to divide the flow equally between the pumps whenever the flow requires more than one pump.		kWh Saved	48,810
		Therms Saved	-
		Cost Saved	\$4,218
		Installed Cost	\$3,600
		Rebate	\$1,800
		Net Cost	\$1,800
		Simple Payback	0.4
Priority/Probability: Low	Group: None	Annual $MTCO_2e$	10

WW 7	**Lighting Controls**		
Install lighting controls in numerous areas to ensure that lights do not operate when the rooms are unoccupied.		kWh Saved	59,112
		Therms Saved	-
		Cost Saved	$5,149
		Installed Cost	$10,903
		Rebate	$2,931
		Net Cost	$7,972
		Simple Payback	1.5
Priority/Probability: High	Group: 1	Annual $MTCO_2e$	12

WW 8	**Lighting Retrofit**		
Install high efficiency lighting in various areas. Retrofits will include the replacement of high intensity discharge (HID) fixtures and standard fluorescent with high efficiency fluorescent.		kWh Saved	187,336
		Therms Saved	-
		Cost Saved	$17,191
		Installed Cost	$124,711
		Rebate	$14,757
		Net Cost	$109,954
		Simple Payback	6.4
Priority/Probability: High	Group: 1	Annual $MTCO_2e$	39

WW 9	**Low Pressure Sodium UV Disinfectant**		
Replace the existing high intensity ultraviolet (UV) disinfection system with a new low-pressure UV system. This technology has been considered previously and determined to need additional research and development.		kWh Saved	6,982,790
		Therms Saved	-
		Cost Saved	$603,034
		Installed Cost	$14,000,000
		Rebate	$685,000
		Net Cost	$13,315,000
		Simple Payback	22.1
Priority/Probability: Low	Group: None	Annual $MTCO_2e$	1,436

WW 10	**Mechanical Sludge Mixing**		
Install a mechanical digester mixing system in place of the existing gas injection systems.		kWh Saved	175,310
		Therms Saved	$-
		Cost Saved	$15,140
		Installed Cost	$1,000,000
		Rebate	$17,800
		Net Cost	$982,200
		Simple Payback	64.9
Priority/Probability: Low	Group: None	Annual $MTCO_2e$	36

WW 11	**More Efficient Air Dryer**		
Replace the existing desiccant air dryer for the air compressor with a new refrigerated air dryer.		kWh Saved	9,768
		Therms Saved	$-
		Cost Saved	$843
		Installed Cost	$6,822
		Rebate	$989
		Net Cost	$5,833
		Simple Payback	6.9
Priority/Probability: Med	Group: 3	Annual $MTCO_2e$	2

WW 12	**Reset Thermostats**		
Widen the deadband between the cooling and heating setpoints for the compost facility offices.		kWh Saved	12,558
		Therms Saved	$-
		Cost Saved	$943
		Installed Cost	$1
		Rebate	$-
		Net Cost	$1
		Simple Payback	0.0
Priority/Probability: High	Group: 1	Annual $MTCO_2e$	3

WW 13	**Water Cooled Chillers**		
Replace the two 50 ton air-cooled chillers and one 60 ton chiller that serve the HVAC equipment at the Administration building with a single high efficiency water cooled chiller.		kWh Saved	66,913
		Therms Saved	$-
		Cost Saved	$7,027
		Installed Cost	$130,706
		Rebate	$12,066
		Net Cost	$118,640
		Simple Payback	16.9
Priority/Probability: High	Group: None	Annual $MTCO_2e$	14

WW 14-A	**1 megawatt (MW) PV system**		
Install a solar photovoltaic (PV) system. This project has great potential for emission reduction, but the analysis is preliminary and more is needed.		kWh Saved	1,958,408
		Therms Saved	$-
		Cost Saved	$234,382
		Installed Cost	$6,571,153
		Rebate	$994,046
		Net Cost	$5,577,107
		Simple Payback	23.8
Priority/Probability: Med	Group: 4	Annual $MTCO_2e$	855

WW 14-B 2 MW PV system		
Install a solar photovoltaic (PV) system. This project has great potential for emission reduction, but the analysis is preliminary and more is needed.	kWh Saved	3,649,785
	Therms Saved	$-
	Cost Saved	$436,803
	Installed Cost	$12,246,326
	Rebate	$1,358,000
	Net Cost	$10,888,326
	Simple Payback	24.9
Priority/Probability: Med Group: None	Annual $MTCO_2e$	1,594

WW 14-C 4 MW PV system		
Install a solar photovoltaic (PV) system. This project has great potential for emission reduction, but the analysis is preliminary and more is needed.	kWh Saved	7,268,412
	Therms Saved	$-
	Cost Saved	$869,884
	Installed Cost	$24,388,000
	Rebate	$1,358,000
	Net Cost	$23,030,000
	Simple Payback	26.5
Priority/Probability: Med Group: None	Annual $MTCO_2e$	3,174

The following option (Purchase Cleaner Power) is not a capital project. However, buying cleaner (lower GHG emission) power from PG&E and /or another entity has the potential to substantially reduce GHG emissions for all operations that use electricity.

WW 15 Purchase Cleaner Power		
Purchase cleaner energy from PG&E and/or another entity such as a Community Choice Aggregation (CCA) if one becomes operational (and offers competitive prices). The GHG reduction estimate is based on clean energy reaching a mix of 50% renewable energy sources for electricity.		
Priority/Probability: Med to High Group: 6	Annual $MTCO_2e$	1,417

2. Fleet (FL)

Operation of the City's fleet accounts for 19% of municipal GHG emissions. The fleet includes nearly 650 passenger vehicles and trucks, 37 buses, and 12 para-transit vans that consume gasoline and diesel fuels. Each gallon of fuel consumed by the fleet emits approximately 20 pounds of CO_2.

The following list of projects includes fleet-related GHG measures that have been implemented since 2010 and other strategies that can be considered for future implementation.

FL 1-A	**Hybrid Buses**		
Fleet has purchased several hybrid buses over the previous few years. The City currently successfully operates several Hybrid busses that have been provided by several different vendors.			-
		Gallons Saved	300,868
		Cost Saved	$1,203,473
		Installed Cost	$9,200,000
		Rebate	$-
		Net Cost	$9,200,000
		Simple Payback	7.6
Priority/Probability: Med	Group: None	Annual $MTCO_2e$	3,038

FL 1-B	**Low Carbon Fuels - Buses**		
Low carbon fuels such as bio-diesel and ethanol can be used at 100% concentrations or diluted to much lower concentrations with standard fuels. Once such fuels have been approved by manufactures and regulatory agencies, the City would need to develop the infrastructure necessary to support the use of the low carbon fuels.		Gallons Saved	More analysis would be needed before moving forward with this option.
		Cost Saved	
		Installed Cost	
		Rebate	
		Net Cost	
		Simple Payback	
Priority/Probability: Low	Group: None	Annual $MTCO_2e$	365

FL 1-C	**Compressed Natural Gas - Buses**		
Develop a compressed natural gas program that leads to the development of the required infrastructure to support the purchase of compressed natural gas buses. The analysis is based on the incremental cost difference of a standard bus versus a CNG bus.		Gallons Saved	-
		Cost Saved	$250,322
		Installed Cost	$2,300,000
		Rebate	$-
		Net Cost	$2,300,000
		Simple Payback	9.2
Priority/Probability: Med	Group: 5	Annual $MTCO_2e$	1,172

FL 2	**Hybrid Vehicles**		
The Fleet has approximately 75 "passenger" type vehicles that are candidates for replacement with a hybrid equivalent. The analysis assumes that vehicles will be replaced at the end of their life, and the cost is assumed to be the incremental cost difference between a standard vehicle and hybrid vehicle.		Gallons Saved	8,572
		Cost Saved	$34,276
		Installed Cost	$399,202
		Rebate	$-
		Net Cost	$399,202
		Simple Payback	11.6
Priority/Probability: High	Group: 3	Annual $MTCO_2e$	75

FL 3 Low Carbon Fuels – Fleet vehicles		
Low carbon fuels such as bio-diesel and ethanol can be used at 100% concentrations or diluted to much lower concentrations with standard fuels. Once such fuels have been approved by manufactures and regulatory agencies, the City would need to develop the infrastructure necessary to support the use of the low carbon fuels.	Gallons Saved Cost Saved Installed Cost Rebate Net Cost Simple Payback	More analysis would be needed before moving forward with this option.
Priority/Probability: Low Group: None	Annual $MTCO_2e$	54

3. Buildings and Facilities (BG)

City buildings and facilities account for 12% of municipal GHG emissions. GHG emissions from this sector result from the use of electricity and natural gas to heat and cool buildings, light facilities, and operate all types of office equipment to administer City operations. The City has had a number of studies completed by different energy companies that have identified a variety of energy efficiency and solar energy projects. A number of the projects were identified as having potential, but the implementation costs and potential savings were not evaluated with much, or sometimes any, detail. These latter projects could be preferred projects once they have been fully analyzed.

BF 1 Various Solar Projects		
Several small solar photovoltaic projects have been identified at the Finley Center, Municipal Services Centers, and City Hall Facilities. Small solar projects are cost effective, have long lives, and are particularly effective at offsetting GHG emissions because they generate energy during the peak times of the day, when utility energy has the highest GHG content.	kWh Saved	1,392,366
	Therms Saved	-
	Cost Saved	$265,151
	Installed Cost	$4,912,672
	Rebate	$576,821
	Net Cost	$4,335,851
	Simple Payback	16.4
Priority/Probability: High Group: 3 and 4	Annual $MTCO_2e$	608

BF 2 Small Cogeneration at Finley Center		
Public swimming facilities are a particularly good application for small cogeneration systems. The generator is used to generate electricity that offsets utility electric costs, and the waste heat from the generator is used to offset pool water heating costs.	kWh Saved	569,400
	Therms Saved	(10,000)
	Cost Saved	$57,866
	Installed Cost	$297,522
	Rebate	$-
	Net Cost	$297,522
	Simple Payback	5.1
Priority/Probability: High Group: 1	Annual $MTCO_2e$	117

BF 3 Cool Roofs at Finley Center

Replace the existing roof with a Cool Roof. Cool roofs reflect solar heat, reducing facility air conditioning costs. However, the reflected solar heat will also result in increased heating costs. This project needs additional analysis.

kWh Saved	More analysis would be needed before moving forward with this option.
Therms Saved	
Cost Saved	
Installed Cost	
Rebate	
Net Cost	
Simple Payback	
Annual $MTCO_2e$	

Priority/Probability: High Group: None

BF 4 Double Door System at City Hall Annex

Install a double door entry to the City Hall Annex. A great deal of heating and cooling is lost through the opening and closing of doors. A double door system will reduce the amount of heating and cooling lost by limiting the conditioned air to a relatively small space between the door systems. This project needs additional analysis.

Therms Saved	More analysis would be needed before moving forward with this option.
Cost Saved	
Installed Cost	
Rebate	
Net Cost	
Simple Payback	
Annual $MTCO_2e$	

Priority/Probability: Med Group: None

BF 5 High Efficiency Boiler at Ridgway Pool

Pool boilers are typically rated at 80% efficiency when new. New pool boilers can have efficiencies as high as 90% to 95%. This project has good energy savings potential and should be analyzed further.

Therms Saved	More analysis would be needed before moving forward with this option.
Cost Saved	
Installed Cost	
Rebate	
Net Cost	
Simple Payback	
Annual $MTCO_2e$	

Priority/Probability: Med Group: None

BF 6 Solar Thermal Domestic Hot Water At Finley Center

Install a solar hot water heating system to offset natural gas used to heat domestic hot water in restrooms and showers. Further analysis is required.

kWh Saved	-
Therms Saved	18,666
Cost Saved	$13,574
Installed Cost	$46,000
Rebate	$14,933
Net Cost	$31,067
Simple Payback	2.3
Annual $MTCO_2e$	99

Priority/Probability: High Group: None

BF 7	**Various Heating, Ventilation, and Air Conditioning Projects**	
Many of the City's buildings have heating, ventilation, and air conditioning (HVAC) equipment that is nearing the end of its life. Replacing aging infrastructure saves energy, improves comfort, and reduces operating costs. These projects are often considered capital improvements and must be done for maintenance and/or end of life reasons. Specific projects should be selected for inclusion in the MCAP.	Therms Saved Cost Saved Installed Cost Rebate Net Cost Simple Payback	More analysis would be needed before moving forward with this option.
Priority/Probability: Med Group: None	Annual $MTCO_2e$	

BF 8	**Various Lighting Projects**	
Lighting projects have been identified and evaluated at several City facilities. Replacement of existing lighting with energy efficient lighting will save energy, improve light quality, and reduce maintenance costs.	kWh Saved	880,668
	Therms Saved	-
	Cost Saved	$90,734
	Installed Cost	$440,120
	Rebate	$65,448
	Net Cost	$374,672
	Simple Payback	4.1
Priority/Probability: High Group: 2 and 3	Annual $MTCO_2e$	180

BF 9	**Lighting Projects that need more analysis**	
	kWh Saved	310,936
A number of additional lighting projects have been identified, but the feasibility and life-cycle analysis have not yet been completed. More analysis would be needed before moving forward with this option.		
Priority/Probability: Med Group: None	Annual $MTCO_2e$	64

The following option (Purchase Cleaner Power) is not a capital project. However, buying cleaner (lower GHG emission) power from PG&E and /or another entity has the potential to substantially reduce GHG emissions for all operations that use electricity.

BF 10	**Purchase Cleaner Power**	
Purchase cleaner energy from PG&E and/or another entity such as a Community Choice Aggregation (CCA) if one becomes operational (and offers competitive prices). The GHG reduction estimate is based on clean energy reaching a mix of 50% renewable energy sources for electricity.		
Priority/Probability: Med to High Group: 6	Annual $MTCO_2e$	440

4. Employee Commute (EC)

Emissions stemming from the vehicle miles traveled (VMT's) through the daily commute of City's employees accounts for approximately 8% of the total emissions from City operations. The City has implemented a number of commute reduction policies that have been in effect for some time. These programs have been implemented on a voluntary basis, with implementation left to group / division management needs. The effectiveness of these programs is difficult to quantify, so no cost or savings estimates are included for the following programs. The City would need to undergo a formal study to determine the GHG reductions from these efforts.

EC 1 9/80 Work Schedule

The City has been operating under a 9/80 schedule since 2008. Under the schedule, staff works 40 hours over a period of nine days over a two-week period, instead of ten days for eight hours per day. The City closes offices, where practical, at the City Hall, City Hall Annex, and the Municipal Services Center on alternate Fridays, savings energy and reducing commuter miles.

Priority/Probability: High Group: None

EC 2 Telework

Since 2010 the City has allowed staff to telework where it is viable and appropriate. Teleworking can be on a part-time or full-time basis. Teleworking will reduce GHG emissions by reducing the commute mileage.

Priority/Probability: High Group: None

EC 3 Free Trip Reduction Program

The Santa Rosa Free Ride Trip Reduction Incentive Program (www.santarosafreeride.org), is managed by the City for all employers within the Santa Rosa city limits. The program is funded by the Bay Area Air Quality Managements District Transportation Fund for Clean Air. Employers are invited to register their organization and sign up their employees. Participants are required to log-on to the program's website and enter their monthly commute alternative. Incentives include substantially reduced monthly bus passes for both Santa Rosa CityBus and/or Sonoma County Transit. Participants who walk, bike or carpool also log their monthly trips to be entered in a monthly drawing for a $50 gift card. The program also includes a Guaranteed Ride Home in case of an emergency.

Priority/Probability: High Group: None

EC 4 Paid Employee Parking

This option is being studied.

Priority/Probability: Low Group: None

5. Public Lighting (PL)

Public lighting accounts for 8% of the City's municipal GHG emissions. Research and development in recent years has resulted in new methods of reducing energy costs and GHG emissions from public lighting. New and emerging technologies should be continually evaluated.

The first option (Purchase Cleaner Power) is not a capital project. However, buying cleaner (lower GHG emission) power from PG&E and/or another entity has the potential to substantially reduce GHG emissions for all operations that use electricity.

PL 1	**Purchase Cleaner Power**		
Purchase cleaner energy from PG&E and/or another entity such as a Community Choice Aggregation (CCA) if one becomes operational (and offers competitive prices). The GHG reduction estimate is based on clean energy reaching a mix of 50% renewable energy sources for electricity.			
Priority/Probability: Med to High	Group: 6	Annual $MTCO_2e$	476

PL 2	**Retrofit Streetlights with Induction or LED Street Light Fixtures**		
Retrofit approximately 10,000 street lights with LED or Induction street light fixtures. It has been assumed that 80% of the operating street lights would be suitable for retrofit. Additional research and development on street light technologies and products will increase the feasibility of this item.		kWh Saved	1,347,182
		Therms Saved	-
		Cost Saved	$171,406
		Installed Cost	$3,232,640
		Rebate	$-
		Net Cost	$3,232,640
		Simple Payback	18.9
Priority/Probability: Med	Group: None	Annual $MTCO_2e$	343

PL 3	**Turning fixtures Off Pre-2010**		
Decommission light fixtures that have been deemed non critical after 2010 (approximately 1,900 fixtures).		kWh Saved	1,750,324
		Therms Saved	-
		Cost Saved	$222,699
		Installed Cost	$315,000
		Rebate	$-
		Net Cost	$315,000
		Simple Payback	1.4
Priority/Probability: High	Group: 1	Annual $MTCO_2e$	445

PL 4	**Turning fixtures Off Post-2010**		
Decommission light fixtures that have been deemed non critical. In total more than 5,000 existing fixtures will be decommissioned. Approximately 1,900 fixtures remain to be replaced.		kWh Saved	1,027,968
		Therms Saved	-
		Cost Saved	$130,792
		Installed Cost	$185,000
		Rebate	$-
		Net Cost	$185,000
		Simple Payback	1.4
Priority/Probability: High	Group: 1	Annual $MTCO_2e$	261

PL 5	Re-Illuminate decommissioned lights and upgrade with Induction or LED fixtures		
Approximately 5,000 street lights have been taken offline because they have been determined to be non critical. Should the City decide to re-commission these lights, they should be retrofitted with LED or Induction fixtures.		kWh Saved	(1,555,843)
		Therms Saved	-
		Cost Saved	$(197,955)
		Installed Cost	$1,600,000
		Rebate	$-
		Net Cost	$1,600,000
		Simple Payback	(8.1)
Priority/Probability: Low	Group: None	Annual $MTCO_2e$	(396)

PL 6	Retrofit Streetlights with Induction Fixtures		
The City is in the final stages of completing the retrofit of approximately 800 fixtures with Induction fixtures.		kWh Saved	444,527
		Therms Saved	-
		Cost Saved	$16,968
		Installed Cost	$320,000
		Rebate	$-
		Net Cost	$320,000
		Simple Payback	18.9
Priority/Probability: High	Group: 1	Annual $MTCO_2e$	34

6. Water Operations (WO)

The City's water operations account for 4% of municipal GHG emissions each year. Emissions are virtually 100% from the use of electricity to move water and for the operation of facility offices. The following emission reduction strategies are very preliminary estimates of the effect of replacing pumps and motors as they fail.

The first option (Purchase Cleaner Power) is not a capital project. However, buying cleaner (lower GHG emission) power from PG&E and/or another entity has the potential to substantially reduce GHG emissions for all operations that use electricity.

WO 1	Purchase Cleaner Power		
Purchase cleaner energy from PG&E and/or another entity such as a Community Choice Aggregation (CCA) if one becomes operational (and offers competitive prices). The GHG reduction estimate is based on clean energy reaching a mix of 50% renewable energy sources for electricity.			
Priority/Probability: Med to High	Group: 6	Annual $MTCO_2e$	209

WO 2	**Energy Efficient Motors**		
Replace pump motors with high efficiency motors as they fail or need replacement at the end of their projected life. The savings is based on the incremental cost of replacing a 75 Hp motor that operates 4,000 hours per year.		kWh Saved	9,074
		Therms Saved	-
		Cost Saved	$1,361
		Installed Cost	$1,500
		Rebate	$-
		Net Cost	$1,500
		Simple Payback	1.1
Priority/Probability: Med	Group: 5	Annual $MTCO_2e$	2

7. Waste Stream (WS)

The City's solid waste stream accounts for 2% of municipal GHG emissions each year. The City has a variety of policies in place that are designed to minimize waste stream in City Operations and construction projects. These are supportive measures which do not have quantifiable emissions reductions.

WS 1 **Recycled Content**

It is the City's policy, whenever practicable, to purchase functional products which contain, in order of preference: 1) The highest percentage of post-consumer recovered material available in the marketplace; and 2) The highest percentage of secondary waste recovered material available in the market place.

Priority/Probability: High Group: None

WS 2 **Waste Reduction and Recycling**

It is the City's policy that the purchase of materials shall consider the following: 1) The ability of the product and its packaging to be reused, reconditioned for use, or recycled through existing recycling collection programs; and 2) The volume and toxicity of waste and by-product a given product and its packaging generate in their manufacture, use, recycling, and disposal. Products and packaging designed to minimize waste and toxic by-products in their manufacture, use, recycling, and disposal shall be preferred.

Priority/Probability: Med Group: None

8. Equipment (EQ)

The City has outsourced nearly all of its landscape maintenance and the associated equipment operations so that it now generates less than 1% of the City's GHG emissions annually. Therefore no reduction programs are included.

Appendix 4 – Sample Financial Analysis

As the following sample financial analysis shows, the City's GHG reduction projects can be funded and implemented in ways that actually improve the City's annual cash flow. Careful planning and analysis will result in projects that achieve annual energy savings that exceed financing payments, and result in a positive cash flow.

Because numerous purchasing and financing options are available, the City may decide to use different strategies for different groups of projects than the ones illustrated here. For example, some energy efficiency projects might be best suited to on-bill financing with a power provider, while others, including renewable energy projects, might be better financed through the California Energy Commission's low interest loan program.

Table 11 summarizes the cumulative impact of project costs, energy cost savings, modified internal rate of return (MIRR), and net present value (NPV[6]) of each of the project groups discussed above. As the following Table 12 reflects, project costs include 5% for project administration and 10% for contingencies.

Table 11: Cumulative Impacts of Implementation Components

Group	Cost	Rebate	Net Cost	Cost Savings	MIRR	NPV	$MTCO_2e$ Saved/yr	% of 2010 Target
G1	$1,256,715	$55,488	$1,201,227	$574,535	50.6%	$12,241,724	1,329	31%
G2	$1,648,041	$129,208	$1,518,833	$671,050	46.7%	$13,002,362	1,603	37%
G3	$5,151,090	$658,780	$4,492,310	$916,946	22.1%	$17,972,540	2,128	49%
G4	$11,951,947	$1,681,151	$10,270,796	$1,187,387	11.8%	$19,908,487	3,069	71%
G5	$14,253,447	$1,681,877	$12,571,570	$1,439,070	10.9%	$20,404,908	4,242	98%
G6	$14,253,447	$1,681,877	$12,571,570	$1,439,070	10.9%	$20,404,908	6,785	157%

Table 12: Investment Cash Flow Assumptions

Energy Cost Escalation	3.0%
Loan Term	15 years
Loan Interest Rate	5.0%
Estimated Cost	$11,951,947
Project Administration	$597,597
Contingencies	$1,195,195
Total Financed Cost	$13,744,739
Rebates	$1,681,151
Savings	$1,187,387

[6] The Net Present Value (NPV) estimates the value of an investment in today's dollars, i.e.: it is the profit made from an investment after the original investment is paid off.

Figure 6 (below) shows the cash flow over time if it is assumed that the City uses a very standard financing strategy to finance all of the projects through Group 4, which will reduce emissions enough to exceed the States 2020 goal and reach 71% of the City's 2010 goal.

Figure 6: Cumulative Discounted Cash Flow

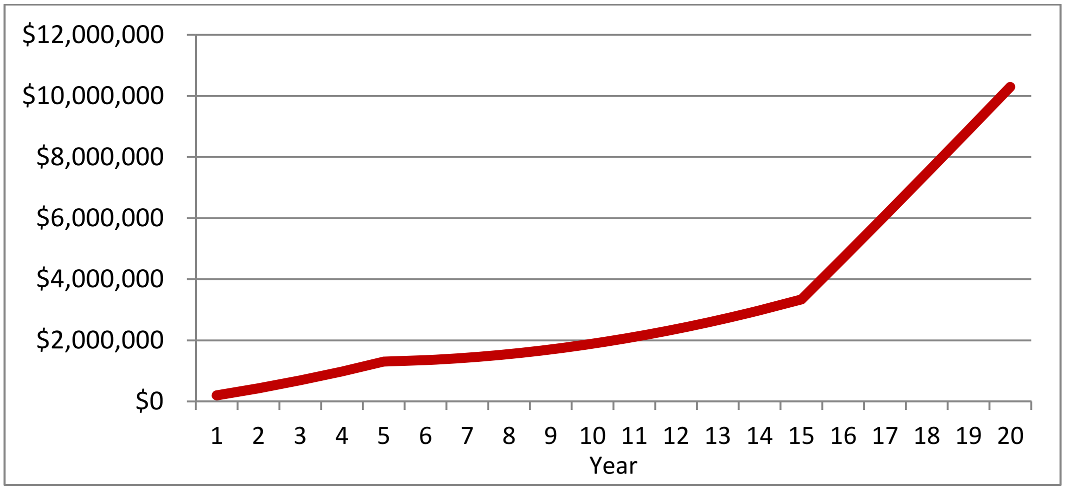


Figure 6 is for demonstration purposes only. This figure shows a positive cash flow because energy cost savings are projected to exceed the cost of the debt service. The actual cash flow to the City will depend on the projects selected by the City and the funding strategies it decides to utilize. It is likely that financing will include a combination of financing methods including power purchase agreements, direct purchase, loans, lease agreements, and on-bill financing. The example is the simplest financing option, but it may not be the most appropriate in all projects. The final financing analysis will likely be more complex.

This sample financial analysis is built on the following assumptions:

- MIRR and NPV calculations ignore potential maintenance and operations costs or savings.
- For MIRR calculation, the finance rate is assumed to be equal to the CEC Loan Finance Rate, and the reinvestment rate is assumed to be equal to the Discount Rate.

The following assumptions in Table 13 were built into the calculations.

Table 13: Calculation Assumptions

Variable	Assumption
Energy escalation rate (avg over xx years)	5.0%
LTP energy escalation rate	3.0%
Discount rate	2.0%
Finance rate – CEC loan – MIRR assumption	3.5%

Appendix 5 – Sensitivity Analysis

The financial return included in the tables throughout this analysis is based on a number of assumptions that are listed in Appendix 4. It is important to note that the results are sensitive to these assumptions, and to the results of the savings models.

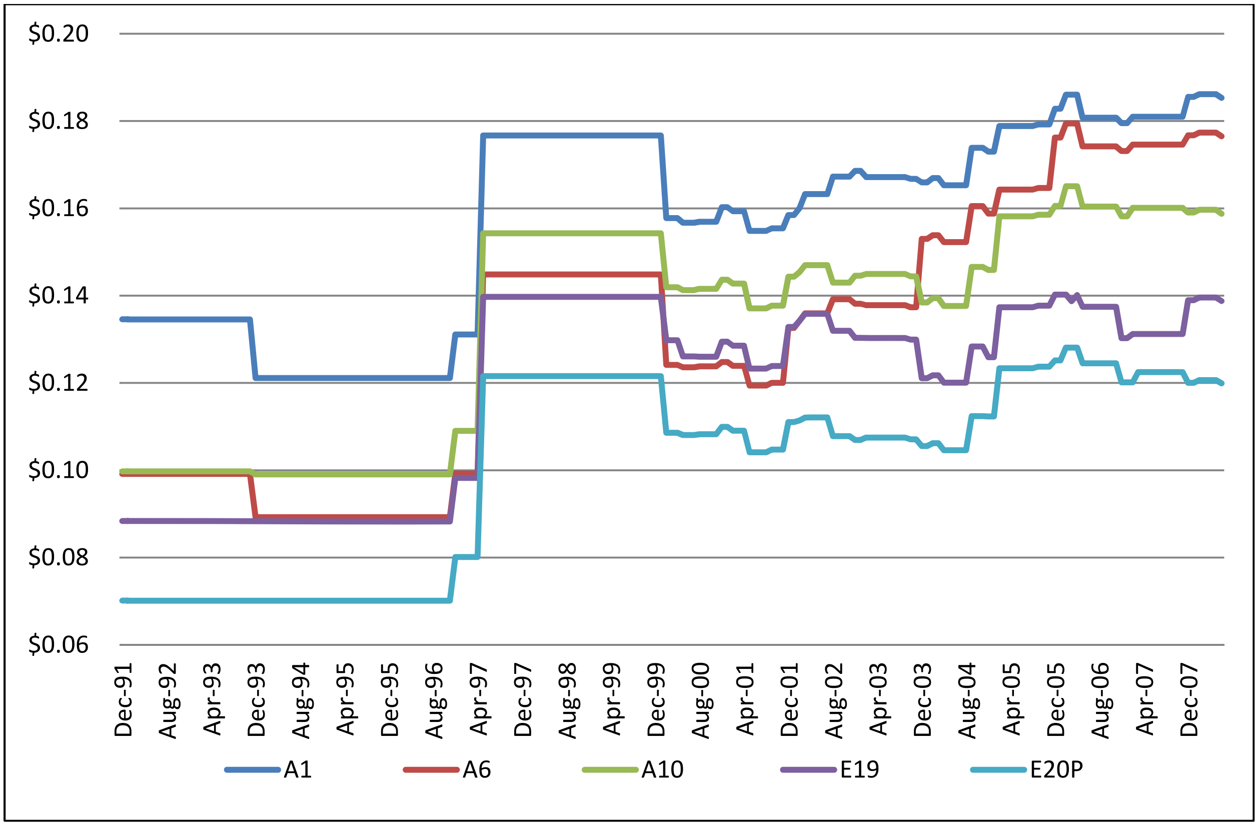
The savings models are reliable and proven to accurately represent the savings that are historically demonstrated in real life projects. However, sometimes savings are less than anticipated for various reasons. One of the most common is with lighting retrofits. Lighting systems often have a fair number of lamps that are burnt out. Completing a retrofit will replace the burnt out lights and actually increase energy use in those light fixtures, resulting in less savings than is anticipated. Other technologies, such as solar energy, typically exceed the performance estimates.

Over the last 10 years PG&E's electric rates have increased by an average of about 6% per year, but much of that was a result of the "energy crisis" in 2000. In the last several years the rates have been more flat. However, a PV project has a long life and energy costs over the next 30 years or so must be considered. There is a looming unknown in the industry related to unrest in the Middle East, possible "peak-oil" issues, and the cost of natural gas which is projected to rise, which make the projection of energy cost increases challenging. Figure 7 shows a graphic representation of changes to PG&E rates over the last 16 years.

PG&E has two types of electric rates: time-of-use (TOU) rates and flat rates. On a flat rate, the cost for each unit of energy, and/or demand (kW) that the facility requires, remains the same regardless of what time of day the energy is used. The only variation in price occurs during seasonal changes, i.e. costs are lower in the winter months as compared to the summer months. Flat rates are best suited for facilities that operate during standard weekday hours. In PG&E's service territory, flat rates include the A1 and A10 rates.

Time-of-use rates charge different amounts based on the time of the day the energy is used, with higher costs being incurred during the peak period of the day when the demand is the highest on the utility's electric system (i.e., noon to 6:00 p.m. summer weekdays). These rates are best suited for facilities that can shift a large portion of their load to the off-peak hours, are already using a lot of energy at night and on weekends, or have a 24-hour operation. TOU rates include the A6, A10SX, E19V, and E20 rates.

Figure 7: PG&E Rate Increases Over Time



There are a number of significant years in Figure 7 above. For example, 1996 is the first year that data is available, 2001 is the year that the electric industry was "deregulated," and 2004 is the year that the "energy crisis" ended. Table 14 (below) summarizes the increase in cost for each of those years as compared to current costs.

Table 14: Annual PG&E Rate Increases

Rate	A1	A6	A10	E19	E20
Since 1996	2.5%	5.2%	3.9%	3.8%	4.7%
Since 2001	3.8%	7.1%	4.1%	3.8%	4.5%
Since 2004	2.2%	5.3%	1.5%	0.9%	1.3%

The Discount Rate is used to calculate the Net Present Value (NPV) of the Project. The NPV is the profit of an investment in today's dollars, after the initial investment has been recouped. The Federal Energy Management Program (FEMP) lists different discount rates, ranging from 0.0% to 2.0% for cost effectiveness analysis, depending on the length of period considered.

Attempting to account for all of the possible scenarios is a time consuming process or requires some specialized software designed for this function. The sensitivity analysis provided here is limited to three basic scenarios: 1) Realistic Outcome, 2) Conservative Outcome, and 3) Very Conservative Outcome. Table 15 shows the assumptions used in each analysis.

Table 15: Assumptions used for Sensitivity Analysis

Component	Realistic Outcome	Conservative Outcome	Very Conservative Outcome
Energy Savings - % of expected	102%	95%	90%
Energy escalation rate	5.0%	3.0%	1.0%
Discount / inflation rate	1.0%	2.0%	3.0%

Based on these assumptions and the sensitivity analysis, Figure 8 (below) shows the cash flow for each of the scenarios above.

Figure 8: Cash Flow Sensitivity

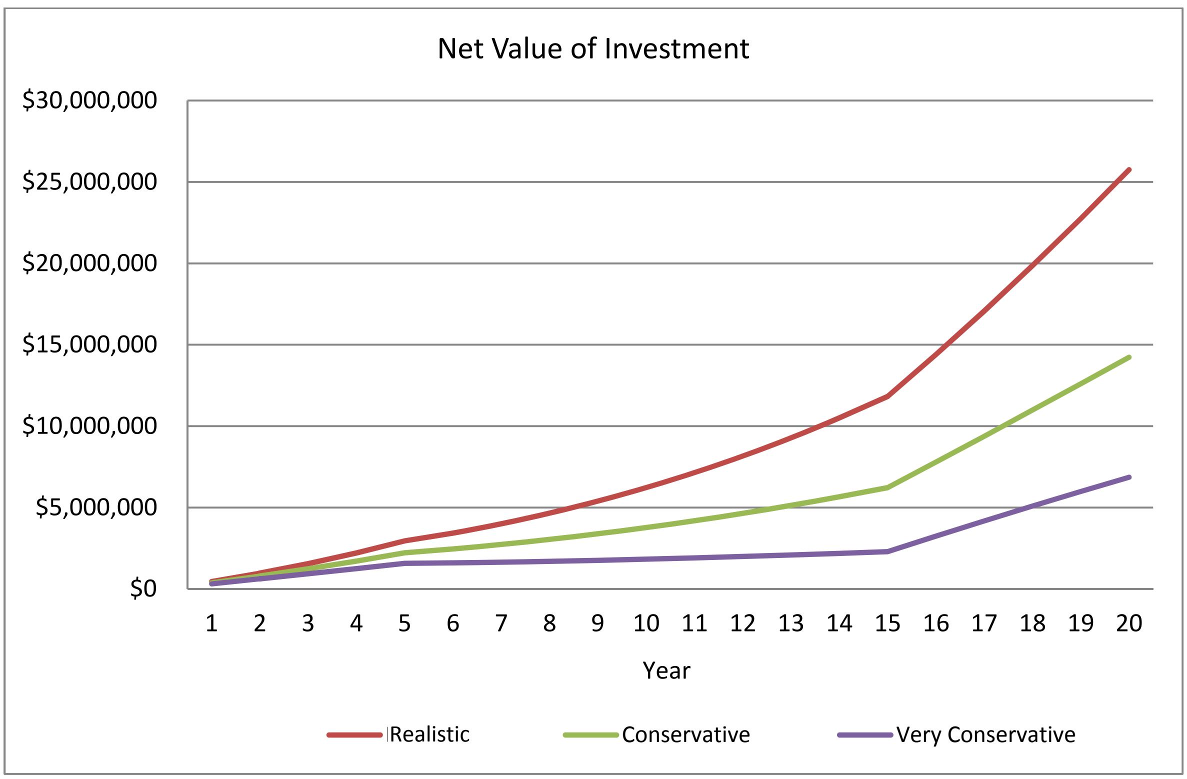


Table 16 (below) shows the actual cash flow for each of the scenarios above.

Table 16: Cash Flow Sensitivity Summary

Year	Realistic Outcome	Conservative Outcome	Very Conservative Outcome
1	$451,101	$379,147	$307,194
2	$968,924	$790,905	$617,735
3	$1,555,618	$1,234,998	$931,268
4	$2,213,417	$1,711,162	$1,247,453
5	$2,944,650	$2,219,140	$1,565,966
6	$3,431,994	$2,454,759	$1,597,764
7	$4,000,923	$2,727,784	$1,639,948
8	$4,654,037	$3,037,862	$1,691,975
9	$5,394,043	$3,384,653	$1,753,323
10	$6,223,764	$3,767,825	$1,823,494
11	$7,146,138	$4,187,057	$1,902,004
12	$8,164,226	$4,642,041	$1,988,393
13	$9,281,216	$5,132,474	$2,082,217
14	$10,500,428	$5,658,068	$2,183,048
15	$11,825,319	$6,218,542	$2,290,476
16	$14,398,375	$7,791,638	$3,242,661
17	$17,073,068	$9,379,520	$4,175,516
18	$19,853,411	$10,982,329	$5,089,434
19	$22,743,578	$12,600,204	$5,984,800
20	$25,747,906	$14,233,287	$6,861,990