CITY OF MOUNTAIN VIEW
RESOLUTION NO.
SERIES 2015

A RESOLUTION APPROVING A MUNICIPAL OPERATIONS CLIMATE ACTION PLAN

WHEREAS, on March 9, 2010, the City Council adopted short- and long-term municipal operations greenhouse gas emission reduction targets; and

WHEREAS, the City Council adopted a 2030 General Plan and associated Greenhouse Gas Reduction Program (GGRP); and

WHEREAS, the GGRP establishes minimum greenhouse gas reduction targets for compliance with the California Environmental Quality Act (CEQA); and these minimum reduction targets are lower than the targets adopted by the City Council in March 2010; and, therefore, the City developed a Municipal Operations Climate Action Plan (MOCAP) in order to meet the targets adopted by the City Council in March 2010 and to establish additional emission reduction targets every five years between 2020 and 2050; and

WHEREAS, on March 31, 2015, the City Council held a duly noticed public hearing to consider a Public Review Draft MOCAP;

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Mountain View that:

1. The proposed plan is in compliance with the provisions of CEQA, because the plan can be seen with certainty to have no significant effect on the environment, and, therefore, is not subject to CEQA (CEQA Guidelines Section 15061.b.3); and

2. The MOCAP, attached hereto as Exhibit A, has been reviewed and approved by the City Council and is hereby adopted.

TIME FOR JUDICIAL REVIEW:

The time within which judicial review of this document must be sought is governed by California Code of Procedure Section 1094.6 as established by Resolution No. 13850 adopted by the City Council on August 9, 1983.

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City of Mountain View

Municipal Operations Climate Action Plan

Final Draft | May 2015

ACKNOWLEDGEMENTS

City of Mountain View

This Municipal Operations Climate Action Plan was developed with assistance from City employees and leadership. The following individuals are specifically acknowledged for their time in the creation of this document.

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Legal Notice

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ACRONYMS

Acronym	Definition
AB	Assembly Bill
ABAU	Adjusted-Business-as-Usual
BAAQMD	Bay Area Air Quality Management District
BAU	Business-as-Usual
C&D	Construction and Demolition
CARB	California Air Resources Board
CCE	Community Choice Energy
CNG	Compressed Natural Gas
CPR	Climate Protection Roadmap
CPUC	California Public Utilities Commission
EPA	Environmental Protection Agency
EV	Electric Vehicle
FEMP	Federal Energy Management Program
GGRP	Greenhouse Gas Reduction Program
GHG	Greenhouse Gas
HPS	High-Pressure Sodium
HVAC	Heating, Ventilating, and Air Conditioning
kW	Kilowatt
kWh	Kilowatt Hours
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
LGOP	Local Government Operations Protocol
MOC	Municipal Operations Center
MOCAP	Municipal Operations Climate Action Plan
MT CO_2e	Metric Tons of Carbon Dioxide Equivalent
MW	Megawatt
MWh	Megawatt Hours
PG&E	Pacific Gas and Electric Company
PPA	Power Purchase Agreement
PV	Photovoltaic
RPS	Renewable Portfolio Standard
VOC	Volatile Organic Compound

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Chapter 1

INTRODUCTION

This chapter is divided into two sections. The first defines the purpose of the City's Municipal Operations Climate Action Plan (MOCAP) and the planning framework used to develop it. More specifically, the first section defines what the MOCAP directs and describes the City's commitment to both climate protection and effective operations and service delivery, as well as how the MOCAP will contribute to the State of California's greenhouse gas (GHG) reduction efforts. The second section of this introductory chapter describes the five-step process used to develop the MOCAP strategies and actions and how the City will ensure effective implementation.

Purpose of Municipal Operations Climate Action Plan

WHAT THE MOCAP DIRECTS

The purpose of the Municipal Operations Climate Action Plan (referred to in this document as "MOCAP") is to define actions that the City can implement to reduce greenhouse gas emissions resulting from municipal operations (e.g., government buildings, facilities, and vehicle fleet). In addition to the emission reduction benefits, implementation of the Plan will lower energy, water, and fuel costs; reduce exposure to future energy cost increases; and improve government service delivery. Developed by City staff over the last two years, the MOCAP identifies priority strategies and actions, performance goals, and departmental responsibility for implementation. The Plan also describes steps for monitoring implementation effectiveness and updating the document's content at regular intervals in the future.

CITY'S COMMITMENT TO CLIMATE PROTECTION

Since 2007, the City of Mountain View has demonstrated a considerable commitment to climate protection. In November 2009, the City Council adopted *voluntary, absolute* community-wide GHG emission reduction targets, and in March 2010 adopted the following *voluntary, absolute* municipal operations GHG emission reduction targets, which are also discussed later in this chapter. (Absolute GHG reduction targets do not consider population or business growth.)

- 15% below 2005 baseline levels by 2010
- 20% below 2005 baseline levels by 2015
- 25% below 2005 baseline levels by 2020
- 80% below 2005 baseline levels by 2050

Since adoption of the targets, the City has initiated numerous policies and programs to reduce emissions from municipal operations. These important past efforts are documented in Appendix B and discussed in Chapter 3 when relevant to a specific MOCAP action.

The City's community-wide emission reduction efforts are reflected in both the adopted Greenhouse Gas Reduction Program (GGRP) and the Climate Protection Roadmap (CPR) project. In 2012, the City adopted the GGRP, which serves to implement the Mountain View General Plan and comply with Bay Area Air Quality Management District (BAAQMD) guidelines that establish a minimum efficiency standard for community-wide greenhouse gas emissions for regulatory compliance. The GGRP defines strategies that improve community-wide greenhouse gas efficiency and provides development streamlining opportunities for future discretionary projects. The CPR will identify additional but "optional" core strategies and policy mechanisms that could be used to reach the City's 2050 community-wide GHG emission reduction target, and will be used by City officials to evaluate and potentially develop long-term community-wide emission reduction initiatives.

STATE POLICY AND REGULATORY CONTEXT

The City's adopted reduction targets are aligned with, and in the near term even surpass, the State of California's greenhouse gas emissions efforts. Assembly Bill 32 (AB 32), the California Global Warming Solutions Act, describes the State's near-term reduction target of achieving 1990 emission levels by 2020. AB 32 resulted in the California Air Resources Board (ARB) adoption of a Climate Change Scoping Plan ("Scoping Plan") in 2008 to define a pathway towards achieving the statewide reduction target. The Scoping Plan outlines the state's plan to achieve emission reductions through a mix of direct regulations; alternative compliance mechanisms; and different types of incentives, voluntary actions, market-based mechanisms, and funding. The Scoping Plan also recommends that local governments reduce municipal operation emissions to a level approximately 15% below 2005 levels by 2020. Executive Order S-3-05, signed by Governor Schwarzenegger and continued by Governor Brown, establishes a long-term target of reducing emissions to 80% below 1990 levels by 2050. Recent guidance from the State Office of Planning and Research recommends that local governments reduce their emissions on a trajectory that would contribute to the State's 2050 target.

To facilitate municipal climate protection efforts, the State prepared the Local Government Operations Protocol (LGOP). The LGOP provides guidance on how to inventory greenhouse gas emissions resulting from government buildings and facilities, government fleet vehicles, wastewater treatment and potable water treatment facilities, landfill facilities, and other operations and services.[1] Local governments are also encouraged to use the LGOP to conduct annual inventories and report their GHG emissions so that achieved reductions can be tracked in a transparent, consistent, and accurate manner. The City's MOCAP was developed in conformance with the guidance provided within the LGOP.

CITY'S COMMITMENT TO EFFECTIVE OPERATIONS AND SERVICE DELIVERY

In addition to its commitment to climate protection, the City is dedicated to providing services, programs, and facilities in a fiscally responsible manner. The City has already made numerous investments that promote efficient resource use, reduce operation and maintenance costs, reduce risks to future cost uncertainty, and strengthen long-term resilience. Examples of past and on-going initiatives include:

- Re-lamping hundreds of indoor and outdoor City-owned lighting fixtures with energy and cost-efficient lighting technologies;
- Installing low-flow plumbing fixtures in City buildings;
- Transitioning to efficient chillers and HVAC units in public buildings;
- Phasing approximately 45 hybrid and fuel-efficient vehicles into the City fleet;

[1] California Environmental Protection Agency, Air Resources Board. *Local Government Operations Protocol for Greenhouse Gas Assessments*. Available: www.arb.ca.gov/cc/protocols/localgov/localgov.htm. Accessed February 27, 2014.

- Using recycled water for Shoreline Park landscape irrigation, including golf course irrigation;
- Operating landfill biogas-to-energy micro-turbines that produce electricity for landfill operations, and selling the excess landfill gas to a local business.
- Adopting a minimum standard of LEED Silver certification for all public new construction and renovation projects over 5,000 square feet.

During the development of the MOCAP, City staff focused on the selection of actions that could both reduce emissions and contribute to effective delivery of municipal operations and services. Implementation of the MOCAP is anticipated to contribute both environmental and fiscal performance benefits.

Climate Action Plan Framework

The MOCAP was developed using a climate action planning framework that includes the following steps:

1. Understand current and future emissions
2. Set emission reduction goals
3. Identify and leverage existing actions
4. Develop future actions
5. Implement plan
6. Monitor and evaluate effectiveness

Understand Current and Future Emissions

Understanding the source and scale of greenhouse gas emissions and the underlying emission generating activities is the foundation for any climate action planning process. The City's 2005 baseline GHG emission inventory, and recently completed 2010 inventory that contains future year emissions projections for 2020, 2035, and 2050, identify the amount of emissions generated by each municipal sector (e.g., Solid Waste, Vehicle Fleet, Facilities) and relevant subsectors. This information, described in detail in Chapter 2, identifies both the challenges and opportunities facing the City and will assist the City Council to select appropriate actions to reduce emissions. It also forms the basis for setting emission reduction targets for future years.

Set Emission Reduction Goals

As described earlier in this chapter, in 2010 the City Council established near- and long-term absolute GHG emission reduction goals for municipal operations. These adopted targets encourage City staff to develop and implement actions that will increase operational efficiencies,

save money, and reduce emissions. The targets are ambitious, yet attainable. The 2010-adopted GHG targets for municipal operations are as follows:[2]

- 15% below 2005 baseline levels by 2010
- 20% below 2005 baseline levels by 2015
- 25% below 2005 baseline levels by 2020
- 80% below 2005 baseline levels by 2050

In approving this MOCAP, the City is adopting additional municipal operations emission reduction targets for every five-year period between 2020 and 2050, as shown below. These interim targets will help keep the City on track to achieve its long-term 2050 target.

- 34% below 2005 baseline levels by 2025
- 44% below 2005 baseline levels by 2030
- 53% below 2005 baseline levels by 2035
- 62% below 2005 baseline levels by 2040
- 71% below 2005 baseline levels by 2045

Achievement of these targets will allow the City to contribute to the previously described State climate protection efforts.

IDENTIFY AND LEVERAGE EXISTING ACTIONS

Greenhouse gas emission mitigation within local governments is most effective when a City can use existing efforts as a foundation on which to build additional future initiatives. During the development the MOCAP, the City identified a wide range of actions that it has already taken to reduce energy and water use, improve vehicle efficiency, and reduce landfill emissions. While the purpose of the MOCAP is to identify and define new actions, the momentum from these existing actions will help produce increased mitigation in the future. Appendix B includes a list of actions implemented by the City between 2005 and 2013, which was compiled during the initial strategy development phase of the project. Discussion of existing efforts is provided within Chapter 3, where relevant to the implementation of a future action.

DEVELOP FUTURE ACTIONS

Future greenhouse gas emission reduction actions need to be feasible, effective, and compatible with other City objectives. To develop the actions contained within the MOCAP, City staff reviewed best practices from other leading jurisdictions and identified strategies that are

[2] Mountain View City Council Proceedings, March 9, 2010. Council Report "Adopt Government Operations Greenhouse Gas Inventory and Emissions Reductions Targets." http://laserfiche.mountainview.gov/Weblink/0/doc/49453/Page1.aspx

compatible with City Council and organizational priorities. Once the preliminary list of strategies was identified, draft actions and implementation steps were developed that could be used to implement these strategies by 2020. Using this list, the City's consultant developed greenhouse gas emission reduction estimates. These estimates were then used to refine the strategies and develop the proposed actions and specific implementation steps contained within Chapter 3.

IMPLEMENT PLAN

The MOCAP directs a wide variety of actions to be implemented. Each action identifies specific implementation steps, responsible parties, a timeline for completion, and recommended performance goals. Some of the actions can be implemented quickly, such as parking lot lighting retrofits, while other actions will require additional research, refinement, development, and coordination in order to achieve the desired outcomes, such as pursuing a Community Choice Energy plan. Chapter 4 provides guidance on how the MOCAP should be implemented.

MONITOR AND EVALUATE EFFECTIVENESS

A key step in climate action planning is to monitor and evaluate the effectiveness of the MOCAP and its actions. Effectiveness can be defined in terms of:

- Overall and sector-level emission reductions as demonstrated by periodic inventories
- Progress toward performance goals defined for each action
- Reduction in City energy, fuel, and related operations and maintenance costs

Chapter 4 concludes by defining a framework and schedule for monitoring and evaluating MOCAP effectiveness and updating the document in the future.

Chapter 2

GREENHOUSE GAS EMISSIONS

Developing a set of strategies and actions that can reduce the City's greenhouse gas emissions requires an understanding of baseline and future emission-generating activities and associated emission factors. Once this information is established, the City can more easily identify areas where it can leverage limited resources to yield the most effective emission reductions and resource efficiency improvements. This chapter provides a summary of the 2005 baseline inventory, the 2010 inventory, and emission forecasts for 2020, 2035, and 2050. Appendix A provides a detailed discussion of methodologies used to develop the inventory.

Greenhouse Gas Inventories

Emission inventories provide a snapshot of the amount and source of greenhouse gas emissions in a given year. The baseline inventory serves as a reference point for reduction targets and informs the strategy and action selection process. Subsequent updated inventories are developed in part to demonstrate progress toward the adopted GHG reduction targets and assess effectiveness of City actions. In 2009, the City prepared a 2005 baseline municipal operations inventory that assessed emissions from City facilities, vehicle fleet, solid waste facilities and generation, and water and wastewater services. In 2012, as part of the Santa Clara County Multiple-Jurisdiction Climate Action Planning process, the City prepared a follow-up 2010 inventory.

The emission inventories were prepared using facility energy consumption data from the Pacific Gas and Electric Company (PG&E) and solid waste and vehicle fleet fuel consumption data from City staff and other relevant agencies. This empirical activity data was converted into greenhouse gas estimates using emission factors provided by PG&E and State and regional agencies.

2005 Baseline Inventory

The baseline inventory identifies that the City's municipal operations generated a total of 15,633 metric tons of carbon dioxide equivalent emissions (MT CO_2e) in 2005. As shown in Table 2.1 and Figure 2.1, emissions from the Solid Waste sector were the largest contributor (64.1%), followed by the Facilities sector (21.6%) and Vehicle Fleet sector (11.0%). Water and Wastewater services are, in comparison, a small contributor, accounting for the remaining 3.3% of the baseline inventory.

The vast majority of the Solid Waste sector emissions were from methane from the closed Shoreline Landfill. Less than 5% of Solid Waste emissions in 2005 were generated by waste produced during municipal operations. The Local Government Operations Protocol, which provides guidance on how to conduct a GHG emission inventory, assigns responsibility for landfill emissions to the jurisdiction that controls the facility. Before it was closed in 1998, the Shoreline Landfill received waste from several communities in the Bay Area. In various years between 1977 and 1997, the City installed a methane capture system (with almost 94% efficiency)[3] that greatly reduces the amount of methane emissions escaping from the landfill. Since the landfill is closed to any new waste, the emissions are anticipated to decrease considerably through 2042 and beyond.

[3] Landfill gas collection efficiency and surface emission figures used for the Shoreline Landfill are based on the *Landfill Surface Emissions Field Monitoring Report* prepared by BAS Consultants in April 2009. The Integrated Surface Methane Concentrations with air dispersion modeling method allowed by ICLEI was used by BAS Consultants in the report to calculate landfill surface emissions. The EPA also requires mandatory annual GHG reporting from various sectors including landfills using the EPA's model. The EPA's theoretical model results are higher than the results reported in BAS 2009 report, which is based on actual landfill surface emissions measurements.

Electricity consumption in City buildings generated approximately 47% of Facility sector emissions, while building natural gas consumption generated approximately 34%. Public lighting generated the remaining 19% of Facility sector emissions.

Approximately 72% of City fleet emissions were generated by gasoline vehicles and equipment. The Police Department, with 98 vehicles/equipment, used the largest amount of gasoline (54%), followed by the Public Works Department (21%) with 172 vehicles/equipment, and the Community Services Department (17%) with 188 vehicles/equipment**.** The Police Department used the most gasoline because it is a 7-day-a-week, 24-hour operation. Vehicles are required to idle for long periods of time to maintain the radio and computer power as well as to be ready to respond to emergency calls. Police cars also frequently experience full-throttle acceleration when responding to calls. Pursuit-rated hybrid or electric vehicles aren't currently available, nor would they be practical for police work. Diesel fuel contributed the remaining 28% of City fleet emissions. Trucks operated by the Public Works Department and the Fire Department generated almost all of these diesel emissions. Public Works vehicles are required to idle for long periods of time at job sites to allow use of their auxiliary systems, such as hydraulic dump beds, back hoes, and bucket loaders.

2010 INVENTORY

The 2010 inventory provides a second point from which to empirically evaluate municipal operations emissions. Between 2005 and 2010, the City's municipal operations emissions decreased to 12,846 MT CO_2e per year, a level 18% below the 2005 baseline level and 3% beyond the City's 15% reduction target for 2010. Emissions were reduced in the Solid Waste, Facilities, and Water and Wastewater sectors. Only the Vehicle Fleet sector emissions grew, but the increase of about 2% was very minor.

- The 2% rise in Fleet emissions was due to a slight increase in diesel usage among light- and heavy-duty vehicles. Also, the City kept vehicles longer (to reduce expenses during the economic downturn that began in 2008). Aging vehicles tend to reduce their fuel efficiency slightly over time. However, the City has purchased 34 alternative fuel vehicles since 2010, which will help reduce Fleet emissions after 2010. All new vehicles purchased are evaluated and equipped with the most fuel-efficient drivetrain while still meeting the operation needs of the vehicle. Vehicles are also downsized whenever possible. In 2015, the City's Parks Division will acquire five electric vehicles, and the Public Works Department will gain two electric cars. All seven vehicles are replacing gasoline-powered models.

- Although the Solid Waste sector overall had more than a 22% reduction in emissions, the Municipal Operations subsector had a 12% increase in emissions due to decreased capture of recyclable materials at the SMaRT Station®. All garbage generated in Mountain View is sorted at the SMaRT Station to remove recyclables prior to being landfilled. In 2010, the Station was ramping up the use of new sorting equipment and

was not operating at full capacity, resulting in a lower capture rate and higher tonnage being sent to landfill as compared to 2005.

Figure 2.1 shows a large reduction in Solid Waste emissions. The reduction is the result of a decreasing amount of organic waste in the closed Shoreline Landfill. Over time, organic components in landfill waste decompose and generate methane emissions, but the rate of decomposition slows down, so that fewer emissions are generated each year.

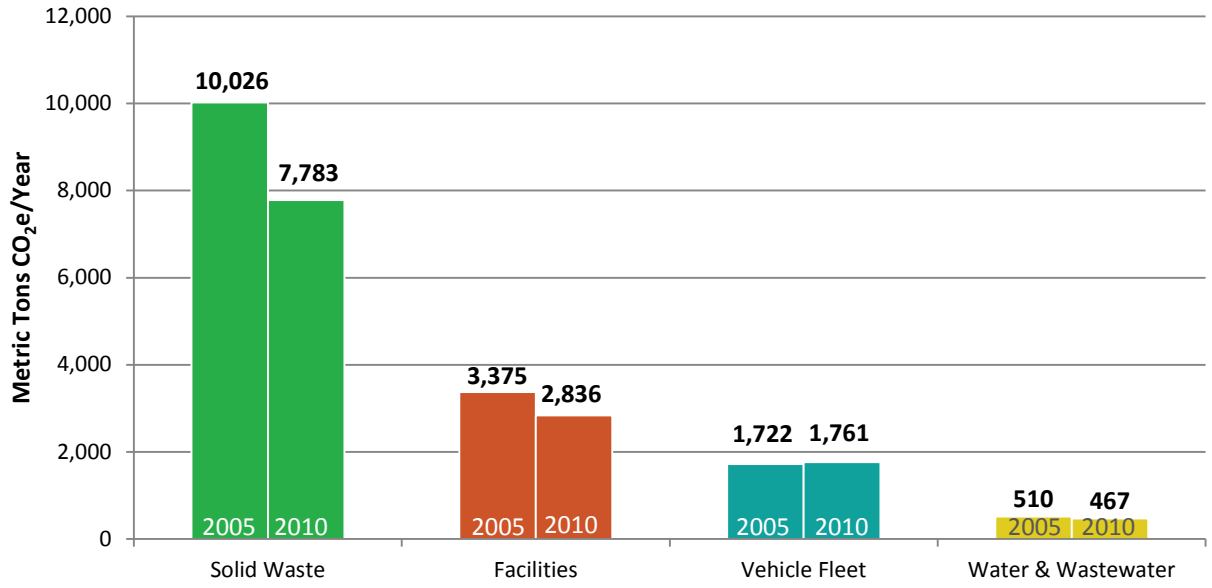
Between 2005 and 2010, natural-gas-related facility emissions decreased by 25%, and electricity-related facility emissions decreased by 17%. Several factors contributed to these reductions in natural gas and electricity emissions. The first factor was a series of City energy efficiency initiatives, such as installing high-efficiency lighting (bi-level LEDs) downtown and in numerous buildings and parking garages, replacing the Civic Center air chiller, and implementing a computer power management system. The second factor contributing to these reductions was the more moderate winter and summer weather in 2010 compared to 2005, resulting in less need for cooling and heating. Additionally, PG&E's 2010 grid electricity was 9% less carbon intensive than in 2005, contributing to Facility sector reductions, as well as reductions in Water and Wastewater service-related emissions.

Table 2.1
2005 Baseline and 2010 Municipal Emissions by Sector

Sector	Subsector	2005 (MT CO_2e/yr)	2005 (%)	2010 (MT CO_2e/yr)	2010 (%)	2005–2010 Change (%)
Solid Waste		**10,026**	**64.1%**	**7,783**	**60.6%**	**-22.4%**
	Municipal Operations	495	3.2%	556	4.3%	12.3%
	Landfill (closed)	9,531	61.0%	7,226	56.2%	-24.2%
Facilities		**3,375**	**21.6%**	**2,836**	**22.1%**	**-15.9%**
	Building Energy	2,735	17.5%	2,246	17.5%	-17.9%
	Public Lighting	640	4.1%	591	4.6%	-7.7%
Vehicle Fleet		**1,722**	**11.0%**	**1,761**	**13.7%**	**2.3%**
Water and Wastewater		**510**	**3.3%**	**467**	**3.6%**	**-8.4%**
	Water and Stormwater Facilities	510	3.3%	371	2.9%	-27.3%
	Wastewater Services	Included in Water above	Included in Water above	96	0.7%	-
Total		**15,633**	**100%**	**12,846**	**100%**	**-17.8%**

Source: AECOM 2013
Note: MT CO_2e = metric tons of carbon dioxide equivalent;
Note: Subtotals of percentages may not equal the sum of their component parts as shown in the table due to rounding

Figure 2.1 – 2005 Baseline and 2010 Municipal Emissions by Sector



Greenhouse Gas Forecasts

Business-as-Usual Emission Forecasts (2020, 2035, 2050)

Business-as-usual (BAU) scenario forecasts are used to estimate the amount of emissions that would occur in future years assuming that current activity intensity factors (i.e., level of activity per sector per capita) and emissions factors (i.e., emissions per unit of activity) are held constant. BAU forecasts provide insight regarding the scale of reductions necessary to achieve an emissions target. Reduction measures are applied to emission forecast levels to determine if the City will achieve its targets.

Forecasts for the City's municipal operation emissions were developed for the years 2020 (aligning with the City's near-term target year), 2035 (aligning with one of the recommended new interim target years), and 2050 (aligning with the City's long-term target year). Forecasts are normally projected forward from the baseline inventory, but due to the availability of the 2010 inventory data, the forecasts in this document are based upon the more recent inventory. These forecasts assume that 2010 activity intensity factors and emissions factors are held constant and that emissions grow in relationship to projected population and employment growth, and the associated need to provide government services. See Appendix A for details on the emission forecast methodology.

Table 2.2 and Figure 2.2 identify projected BAU municipal operations emissions by sector for 2020, 2035, and 2050. Further, Table 2.2 includes the City's emissions reduction targets (including the recommended 2035 target), Baseline emission levels, and the resulting

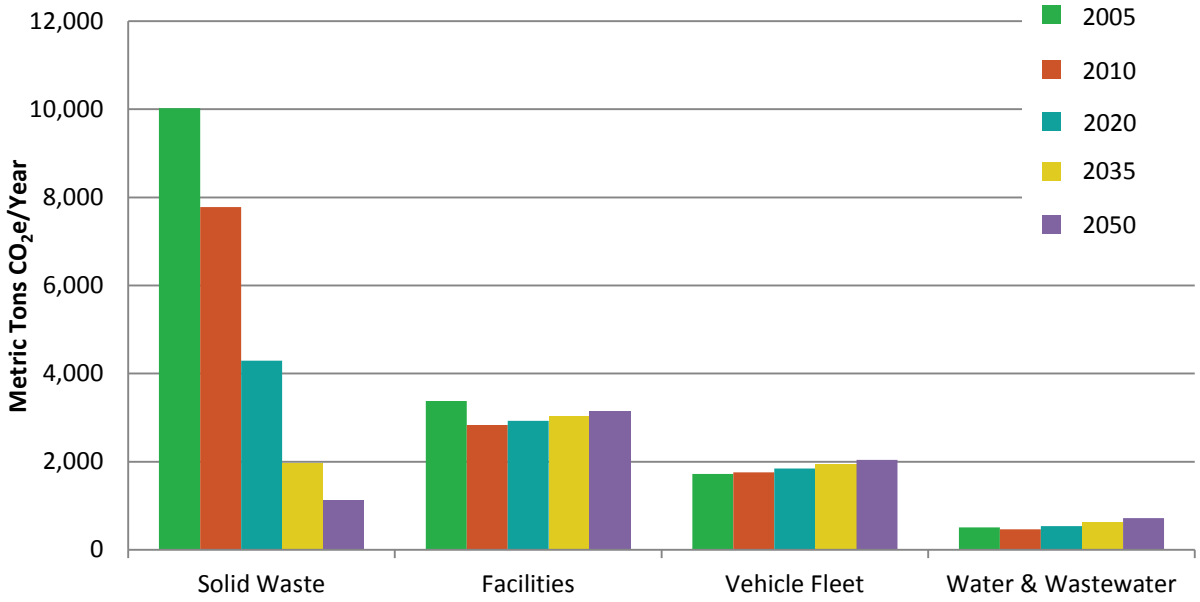
reductions needed to achieve the City's emissions targets. By 2020, municipal operations emissions decrease to approximately 9,600 MT CO_2e per year, a level 39% below the 2005 baseline. By 2035, municipal operations emissions decrease to approximately 7,550 MT CO_2e per year, a level 52% below the 2005 baseline. By 2050, municipal operations emissions decrease to approximately 7,000 MT CO_2e per year, a level 55% below the 2005 baseline.

Table 2.2
Municipal Operations "BAU" Emissions (2005–2050)

Sector	Subsector	2005 (MT CO_2e/yr)	2010 (MT CO_2e/yr)	2020 (MT CO_2e/yr)	2035 (MT CO_2e/yr)	2050 (MT CO_2e/yr)
Solid Waste		**10,026**	**7,783**	**4,293**	**1,967**	**1,122**
	Municipal Operations	495	556	574	594	615
	Landfill (closed)	9,531	7,226	3,719	1,373	507
Facilities		**3,375**	**2,836**	**2,929**	**3,029**	**3,135**
	Building Energy	2,735	2,246	2,319	2,398	2,482
	Public Lighting	640	591	610	631	653
Vehicle Fleet		**1,722**	**1,761**	**1,847**	**1,942**	**2,044**
Water and Wastewater		**510**	**467**	**536**	**618**	**715**
	Water and Stormwater Facilities	510	371	426	492	569
	Wastewater Services	Included in Water above	96	110	126	146
Total		**15,633**	**12,846**	**9,605**	**7,556**	**7,016**
Reduction Target		-	15% below 2005	25% below 2005	53% below 2005	80% below 2005
Target Emissions Level		-	13,288	11,725	7,348	3,127
Reductions Needed to Achieve Target		**-**	**0**	**0**	**208**	**3,889**

Source: AECOM 2013
Note: MT CO_2e = metric tons of carbon dioxide equivalent

Figure 2.2 – Municipal Operations "BAU" Emissions (2005-2050)



In all of the projection years, Facilities, Vehicle Fleet, and Water and Wastewater services sector emissions *increase*, while Solid Waste sector emissions *decrease* considerably, as explained below. These BAU projections are based on estimated population and employment growth within the City, which would lead to increased demand for government services. The projected decrease in Solid Waste emissions is due to declining emissions from the closed Shoreline Landfill.

- Solid Waste: The decomposition of organic waste in the Shoreline Landfill reduces Solid Waste emissions by 45% in 2020, by 75% in 2035, and by 86% in 2050. The scale of the declining landfill emissions negates the slight increase in waste emissions from municipal operations that are projected to occur as a result of increased government services to support population and employment growth projections.

- Facilities: Emissions from the Facilities sector are projected to grow by 3% in 2020, by 7% in 2035, and by 11% in 2050. The slower growth rate for this sector (relative to Water and Wastewater services) is due to efficiencies of scale that can be realized for future service provision in this sector.

- Vehicle Fleet: Emissions from the Vehicle Fleet sector are projected to grow by 5% in 2020, by 10% in 2035, and by 16% in 2050. The slower growth rate for this sector (relative to Water and Wastewater services) is due to efficiencies of scale that can be realized for future service provision in this sector.

- Water and Wastewater: Emissions in this sector grow at a rate closely correlated to population and employment growth; 15% in 2020, 32% in 2035, and 53% in 2050.

See Appendix A for a more detailed description of the emissions forecast methodology.

ADJUSTED BUSINESS-AS-USUAL EMISSION FORECASTS (2020, 2035, AND 2050)

Adjusted-business-as-usual (ABAU) scenario forecasts are used to estimate future local emissions levels, assuming the implementation of key State adopted actions. ABAU forecasts do *not* include any emission-reduction actions taken by the City. The State of California has set forth legislation and regulations aimed at reducing greenhouse gas emissions in a wide range of sectors. Within the ABAU forecasts developed for the MOCAP, it is assumed that emissions within the Facilities and Water and Wastewater services sectors will be reduced through implementation of the State's Renewable Portfolio Standard (RPS) under Senate Bill 1078. The RPS effectively requires electrical utilities to reduce the carbon intensity of their electricity by obtaining 33% of their generation portfolio from renewable sources by 2020.

The above-noted State actions will help reduce municipal operations emissions and contribute toward achievement of the City's emissions targets. The RPS affects sectors in which emissions are generated from electricity consumption. Therefore, the RPS is estimated to reduce emissions related to the Facilities sector through the building energy and public lighting subsectors, pumping equipment in the Waste and Wastewater sector, as well as energy consumption at the City's closed Shoreline Landfill in the Solid Waste sector. The City will monitor the effectiveness of this State action to ensure that the anticipated level of reductions is achieved locally, and to ensure that all applicable statewide reductions are accounted for, should additional actions be developed that would apply to the MOCAP.

Notably the MOCAP does not apply reductions from State actions related to Vehicle Fleet sector emissions, including Assembly Bill 1493 (Pavley I and II), Executive Order S-1-07 (Low Carbon Fuel Standard), and other vehicle efficiency regulations. These actions were excluded to avoid double counting between the State actions and City clean fleet initiatives.

Table 2.3 identifies projected ABAU municipal operation greenhouse gas emissions by sector for 2020, 2035, and 2050, and also includes the City's emission reduction targets (including the recommended 2035 target), baseline emission levels, and the resulting reductions needed to achieve the City's emissions targets. In 2020, municipal operation emissions will be approximately 9,000 MT CO_2e per year, a level 42% below 2005 baseline levels. In 2035, municipal operation emissions will be approximately 6,900 MT CO_2e per year, a level 56% below 2005 baseline levels. By 2050, municipal operation emissions decrease to approximately 6,400 MT CO_2e per year, a level 59% below 2005 baseline levels.

Table 2.3
Municipal Operations "ABAU" Emissions (2005–2050)

Sector	Subsector	2005 (MT CO_2e/yr)	2010 (MT CO_2e/yr)	2020 (MT CO_2e/yr)	2035 (MT CO2e/yr)	2050 (MT CO2e/yr
Solid Waste		**10,026**	**7,783**	**4,278**	**1,952**	**1,107**
	Municipal Operations	495	556	574	594	615
	Landfill (closed)	9,531	7,226	3,704	1,358	492
Facilities		**3,375**	**2,836**	**2,490**	**2,570**	**2,655**
	Building Energy	2,735	2,246	2,015	2,080	2,149
	Public Lighting	640	591	475	490	506
Vehicle Fleet		**1,722**	**1,761**	**1,847**	**1,942**	**2,044**
Water and Wastewater		**510**	**467**	**420**	**480**	**554**
	Water and Stormwater Facilities	510	371	334	382	441
	Wastewater Services	Included in Water above	96	86	98	113
Total		**15,633**	**12,846**	**9,035**	**6,944**	**6,360**
Reduction Target		-	15% below 2005	25% below 2005	53% below 2005	80% below 2005
Target Emissions Level		-	13,288	11,725	7,348	3,127
Reductions Needed to Achieve Target		**-**	**0**	**0**	**0**	**3,233**

Source: AECOM 2013
Note: MT CO_2e = metric tons of carbon dioxide equivalent

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Chapter 3

REDUCTION STRATEGIES

This chapter describes the strategies and actions the City could implement to reduce greenhouse gas emissions to achieve its municipal operations targets. The chapter provides a description of the MOCAP strategy development process, a summary of the emission reductions anticipated from implementation of each proposed strategy, a discussion regarding achievement of the City's 2010, 2015, 2020, and 2035 emission reduction targets, and recommendations for putting the City on a pathway toward reaching its 2050 target. The remainder of the chapter provides descriptions of the individual strategies and implementation actions.

Strategy Development Process

The purpose of the MOCAP strategies is to define future actions and implementation steps the City could take to reduce its municipal operations emissions toward meeting its GHG reduction targets. To develop the strategies and actions contained within the MOCAP, the City conducted the following steps:

1. Reviewed existing City efforts
2. Reviewed best practices and emerging technologies and strategies
3. Selected strategies compatible with City management priorities
4. Developed preliminary actions and implementation steps to carry out strategies
5. Calculated greenhouse gas reduction potential
6. Developed proposed strategies, actions, and implementation steps (with performance goals and departmental responsibility)

During the development of the MOCAP, staff identified a wide range of efforts the City of Mountain View has already implemented to reduce energy and water use, improve vehicle efficiency, and reduce landfill emissions. These existing efforts provide a strong foundation for future actions and allow the MOCAP to focus on additional future actions needed. Table 3.1 lists example existing emission reduction initiatives, while Appendix B provides additional information regarding existing City efforts.

To ensure that the MOCAP contains a full spectrum of emission reduction strategies, staff performed a review of best practices from other leading jurisdictions. From this list, best practices compatible with City Council and organizational priorities were selected to move forward as potential MOCAP strategies. Next, staff reviewed and selected preliminary draft actions and implementation steps that could be used to implement the strategies. Using this list of strategies, actions, and implementation steps, the City greenhouse gas reduction estimates were developed.

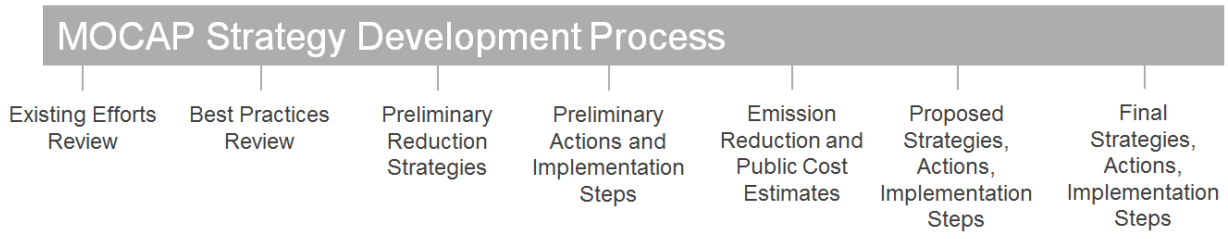


Table 3.1
Example Existing Municipal Emission Reduction Initiatives

FACILITIES	
Renewable or Low-Carbon Energy Generation	
• Solar Photovoltaic Installations on City Property	
Generation Efficiency Improvements	
• Turbine Efficiency Improvements	
Existing Building Energy Retrofit	
• Green Building Standards – LEED Silver • Building Energy Benchmarking • Building Energy Audits • Indoor Building / Parking Garage Lighting Retrofits • Exterior Building Lighting Retrofits	• Advanced Lighting Controls / Monitoring Systems • Building Systems (e.g., HVAC) Retrofits • Cool Roof Retrofits • Low-Flow Fixtures / Low-Flow Toilets at Public Facilities
New Building Energy Performance	
• Green Building Standards – LEED Silver	
Behavior Conservation / Energy Management	
• Energy Efficient Procurement Policy – ENERGY STAR Appliances	• Energy Management Systems – Office Equipment
Public Realm Lighting Efficiency	
• Traffic Signal Retrofits • Street Light Retrofits	• Parking Lot Lighting Retrofits • Park Facility Lighting Retrofits
Water System Energy Efficiency	
• Variable Frequency Drives at Pumping Stations	
Landscape Water Conservation	
• Water Conservation Plan for Public Parks • Climate-Sensitive and Water-Efficient Irrigation Technology	• Advanced Irrigation Training for Parks Staff • Recycled Water Use
VEHICLE FLEET	
Alternative Fuel Vehicles	
• Hybrid and Electric Vehicles	• Electric Vehicle Charging Stations
Behavior / Fuel Optimization	
• Anti-Idling Policy	
SOLID WASTE	
Landscape Waste Diversion	
• On-Site Landscape Waste Reduction Program	• Municipal Landscape Waste Composting Program
Construction and Demolition (C&D) Waste Diversion	
• C&D Waste Diversion Ordinance – 50% Diversion	
Landfill Operations	
• Landfill Biogas Capture and Flare System	• Landfill Biogas-to-Energy Facility

Summary of Proposed Strategies

Table 3.2 summarizes the proposed MOCAP strategies and actions and the associated greenhouse gas emission reductions anticipated from their implementation by the year 2020. It also demonstrates how these estimated reductions for 2020 compare to the total reductions needed to achieve the City's 2050 target, as described in Chapter 2. Strategies are grouped by sector (Facilities, Vehicle Fleet, and Solid Waste); no Water or Wastewater sector-specific strategies are recommended within the MOCAP because of their relatively small emission reduction potential compared to the other sectors. Quantifiable emission reduction estimates are provided for most of the strategies and actions. One strategy and 11 actions are listed as "supporting" because they assist in implementing other strategies and actions, but do not have reductions that are directly attributable to them or their direct reductions cannot be accurately quantified at this time.

Table 3.2 presents these proposed strategies in two scenarios that demonstrate the overlapping impacts of emission-reducing actions. In Scenario 1, the effect of low-carbon electricity accounts for the largest share of emission reduction potential (Strategy F-1). The result of using cleaner electricity in City operations means that other electricity-related strategies, such as lighting efficiency improvements, contribute relatively less to emission reductions because these strategies would result in lower consumption of already low- or zero-emissions electricity.

Scenario 2 shows the reduction potential of the same proposed strategies but without Strategy F-1. This scenario also includes reductions attributed to the State's Renewable Portfolio Standard (RPS), described in Chapter 2, which requires utilities to provide 33% of their electricity portfolio from renewable sources by 2020. Since Strategy F-1 would provide up to 100% renewable electricity for municipal operations, the RPS was not included in Scenario 1 to avoid double counting emission reductions. With Strategy F-1, the city could achieve nearly 67% of the City's 2050 target by the year 2020, compared to about 50% without Strategy F-1.

Table 3.2 also presents estimated costs for implementing the MOCAP actions, which were prepared in order to support the measure selection phase of the MOCAP development process. These costs are "order-of-magnitude," and relate to the 2020 emission reduction estimates. As such, these cost estimates only offer a high-level evaluation of potential implementation costs, and the City may wish to prepare more detailed analysis prior to implementing its selected strategies and actions.

See Appendix C for further details on, and the assumptions behind, these cost estimates.

Table 3.2
Proposed 2020 Municipal Operations Emission Reduction Strategies and Actions

Sector / Strategy / Action	Scenario 1: With Strategy F-1		Scenario 2: Without Strategy F-1		Estimated Cost to Implement (Ann=Annual OT=One-time) [2]
	Emission Reductions in 2020 (MT CO_2e/year)	Contribution to 2050 Target	Emission Reductions in 2020 (MT CO_2e/year)	Contribution to 2050 Target	
FACILITIES SECTOR	**1,886**	**48.5%**	**1,327**	**34.1%**	
F-1 Low-Carbon Grid Electricity	**1,690**	**43.4%**	**0**	**0.0%**	
A. Utility Green Electricity Option	*1,690 (A, B ,or C)*	*43.4%*	*0*	*0.0%*	*$360K (Ann)*
B. Community Choice Energy	*1,690 (A, B, or C)*	*43.4%*	*0*	*0.0%*	*$400K (OT) then Annual Savings*
C. Large-Scale Renewable Energy Generation	*1,130 (A, B, or C)*	*29.0%*	*0*	*0.0%*	*$15M (OT)*
F-2 Renewable / Low-Carbon Electricity Generation	**6**	**0.2%**	**236**	**6.1%**	
A. Solar PV Installations on City Buildings, Parking Lots, Land	*0*	*0.0%*	*230*	*5.9%*	*$5.3M (OT)*
B. Solar Hot Water Installations in City Facilities	*6*	*0.2%*	*6*	*0.2%*	*$525K (OT)*
F-3 Existing Building Energy Retrofit and Management	**190**	**4.9%**	**380**	**9.7%**	
A. Energy Efficiency Fund	*Supporting*	-	*Supporting*	-	*$100K (Ann)*
B. Energy Efficiency Procurement Policy	*0*	0.0%	*40*	*1.0%*	*$15K (OT)*
C. Consumption Data Collected per Facility	*190 (C, D, and E combined)*	*4.9%*	*340 (C, D, and E combined)*	*8.7%*	*$15K (OT)*
D. Retro-Commissioning Program					*$30K (Ann)*
E. Employee Information / Education					*$20K (OT)*
F-4 New Building Energy Performance	**Supporting**	**-**	**Supporting**	**-**	
A. Enhanced Green Building Standard	*Supporting*	-	*Supporting*	-	*$15K (OT)*
F-5 Public Realm Lighting Efficiency	**0**	**0.0%**	**140**	**3.6%**	
A. Parking Lot Lighting Retrofits	*0*	*0.0%*	*120*	*3.1%*	*$1.2M (OT)*
B. Park Facility Lighting Retrofits	*0*	*0.0%*	*20*	*0.5%*	*$125K (OT)*
C. Parking Garage Lighting Retrofits	*Supporting*	-	*Supporting*	-	*Varies by Scale*
F-6 Landscape Water Conservation	**0**	**0.0%**	**1**	**0.0%**	
A. Green Grounds Policy	*0*	*0.0%*	*1*	*0.0%*	*$15K (OT)*
Statewide Actions	**0**	**0.0%**	**570**	**14.7%**	
Renewable Portfolio Standard[1]	*0*	*0.0%*	*570*	*14.7%*	*N/A*
VEHICLE FLEET SECTOR	**350**	**9.0%**	**260**	**6.7%**	
VF-1 Efficient Vehicles	**30**	**0.8%**	**30**	**0.8%**	
A. Fuel-Efficient Vehicle Procurement Policy	*30*	*0.8%*	*30*	*0.8%*	*$15K (OT)*
B. Fuel-Efficient Operational and Maintenance Policies	*Supporting*	-	*Supporting*	-	*$15K (OT)*

Table 3.2
Proposed 2020 Municipal Operations Emission Reduction Strategies and Actions

Sector / Strategy / Action	Scenario 1: With Strategy F-1		Scenario 2: Without Strategy F-1		Estimated Cost to Implement (Ann=Annual OT=One-time) [2]
	Emission Reductions in 2020 (MT CO_2e/year)	Contribution to 2050 Target	Emission Reductions in 2020 (MT CO_2e/year)	Contribution to 2050 Target	
VF-2 Alternative Fuel Vehicles	**240**	**6.2%**	**150**	**3.9%**	
A. Municipal Fleet Emissions Target	*Supporting*	-	*Supporting*	-	*$15K (OT)*
B. Vehicle Fleet Plan	*240*	*6.2%*	*150*	*3.9%*	*$30K (OT)*
C. CNG Fueling Stations	*Supporting*	-	*Supporting*	-	*$1M (OT)*
D. Electric Vehicle Charging Stations	*Supporting*	-	*Supporting*	-	*$175K (OT)*
VF-3 Behavior / Fuel Optimization	**80**	**2.1%**	**80**	**2.1%**	
A. Telematics	*80*	*2.1%*	*80*	*2.1%*	*$45K (OT) then Annual Savings*
B. Fuel Saving Recognition Program for Employees / Departments	*Supporting*	-	*Supporting*	-	*$10K (Ann)*
SOLID WASTE SECTOR	**360**	**9.3%**	**360**	**9.3%**	
SW-1 Waste Reduction	**90**	**2.3%**	**90**	**2.3%**	
A. Green Procurement Specifications	*Supporting*	-	*Supporting*	-	*$15K (OT)*
B. Waste Reduction and Diversion Goals	*90*	*2.3%*	*90*	*2.3%*	*$35K (OT)*
C. Waste Audits / Surveys and Diversion Rate Tracking at Municipal Facilities	*Supporting*	-	*Supporting*	-	*$15K (OT)*
SW-2 Recyclable Paper Reduction	**70**	**1.8%**	**70**	**1.8%**	
A. Paperless Office Policy / Program	*70*	*1.8%*	*70*	*1.8%*	*$15K (Ann)*
SW-3 Landscape Waste Diversion	**80**	**2.1%**	**80**	**2.1%**	
A. Municipal Landscape Waste Composting Program	*80*	*2.1%*	*80*	*2.1%*	*$20K (OT)*
SW-4 Construction and Demolition Waste Diversion	**120**	**3.1%**	**120**	**3.1%**	
A. Municipal Construction and Demolition Standards	*120*	*3.1%*	*120*	*3.1%*	*$15K (OT)*
TOTAL 2020 MOCAP REDUCTIONS	**2,596**	**66.7%**	**1,947**	**50.1%**	

Notes: Columns may not total to values shown due to rounding

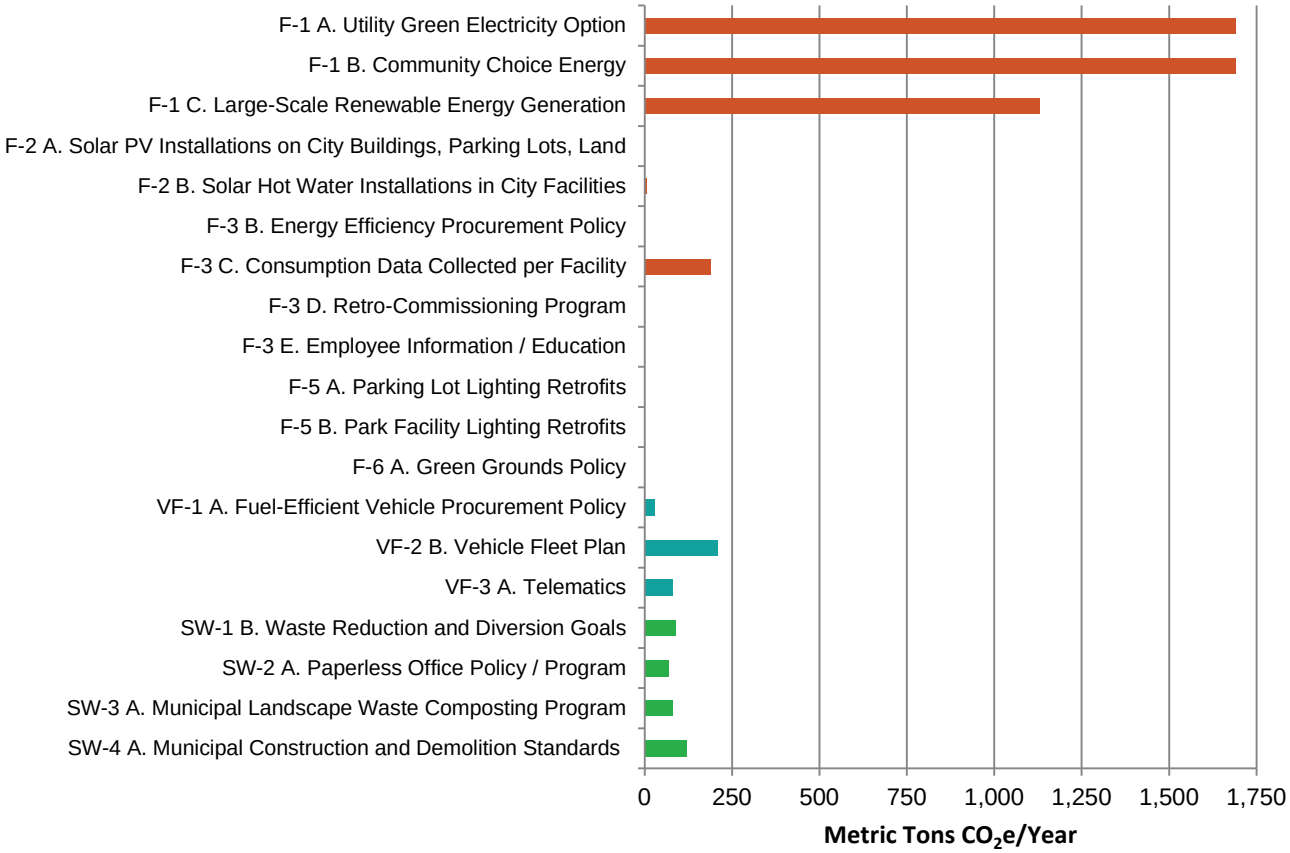
[1] The Renewable Portfolio Standard requires California's utilities to provide 33% of their electricity from renewable sources by 2020. Strategy F-1 considers actions that would result in up to 100% of the City's electricity being generated from renewable sources. To avoid double counting the effects of the Renewable Portfolio Standard, this table presents two scenarios to demonstrate the differences between sourcing 100% clean electricity (Scenario 1) versus relying on this statewide action to clean 33% of the electricity grid (Scenario 2).

[2] The "Estimated Cost to Implement" numbers were prepared to support the measure selection phase of the MOCAP development process, and represent an "order-of-magnitude" cost related to the 2020 emission reduction estimates. See Appendix C for additional information about these cost estimates.

GREENHOUSE GAS EMISSION REDUCTIONS EFFECTIVENESS

As shown in Table 3.2 and Figure 3.1, the Facilities sector strategies have the largest emission reduction potential for 2020. Facilities strategies are anticipated to reduce emissions by nearly 1,900 MT CO_2e per year under Scenario 1. This represents approximately 50% of reductions needed to achieve the City's 2050 target. The Vehicle Fleet sector strategies are anticipated to reduce emissions by approximately 350 MT CO_2e per year, or nearly 10% of total reductions needed by 2050. The Solid Waste sector strategies, which focus on the diversion of municipally generated waste, not on the Shoreline Landfill emissions, are also estimated to reduce emissions by approximately 350 MT CO_2e per year, or 10% of total reductions needed by 2050.

Figure 3.1 – Comparative Emission Reduction Potential of MOCAP Actions (2020)



Reduction Target Achievement

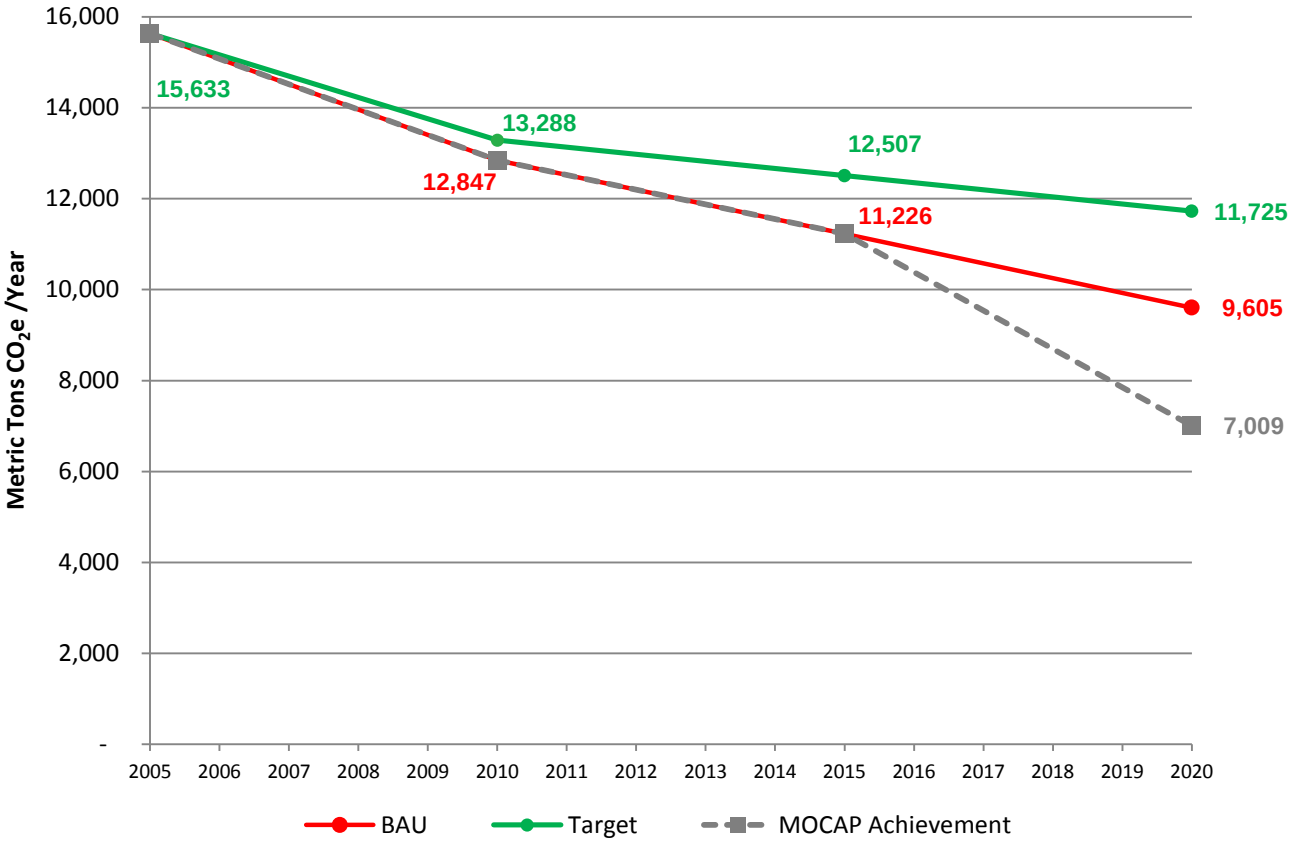
The purpose of the MOCAP is to identify strategies and actions that the City could take to reduce municipal operations greenhouse gas emissions. This section demonstrates how the City has achieved its 2010 target and is on track to achieve its 2015, 2020, and 2035 reduction

targets through reductions in Shoreline Landfill emissions and implementation of the proposed MOCAP strategies. The section concludes with a discussion of the steps that should be taken to put the City on a path towards achievement of the long-term 2050 reduction target.

2010 Target Achievement

Figure 3.2 reveals that the City has successfully achieved its 2010 target of reducing municipal operations greenhouse gas emissions to a level 15% below the 2005 baseline. The green line represents the City's emission reduction targets as described in Chapter 2. The red line represents the City's business-as-usual emissions, also described in Chapter 2. As shown, the emissions line in 2010 is lower than the City's target by nearly 450 MT CO_2e per year, demonstrating a nearly 18% reduction from 2005 baseline levels. This exceeds the City's 2010 target of 15% below 2005 levels. The primary driver of this achievement is a reduction in Shoreline Landfill methane emissions, supplemented by additional reductions in building energy, public lighting, and water/wastewater operation-related emissions.

Figure 3.2 – Emission Reduction Potential of MOCAP (2005-2020)



2015 AND 2020 TARGET ACHIEVEMENT

Figure 3.2 also demonstrates that the City will surpass both its 2015 and 2020 targets due to ongoing emission reductions attributed to closing the Shoreline Landfill. No new waste is accepted into the landfill, and the methane emissions coming from the existing waste will continue to decline over time as organic landfill waste decomposes. It is estimated that BAU emissions in 2015 will be approximately 28% lower than 2005 levels, which exceeds the City's 2015 target of 20% below 2005 levels. It should be noted that the 2015 BAU emission forecasts in Figure 3.2 were interpolated between 2010 inventory values and the 2020 forecast values.

Similarly, as a result of the reductions in Shoreline Landfill methane emissions and implementation of past energy, water, and wastewater energy efficiency actions, the City is on track to achieve BAU emissions of approximately 9,600 MT CO_2e per year in 2020. This represents an emission level that is approximately 39% below the 2005 baseline, exceeding the City's 2020 target of 25% below 2005 levels. Implementation of MOCAP strategies and actions shown in Table 3.2 (Scenario 1) could contribute additional reductions, achieving an emission level of approximately 7,000 MT CO_2e per year or 55% below baseline. For illustrative purposes, the gray dashed line in Figure 3.2 indicates a linear emission reduction trajectory for these MOCAP strategies and actions between 2015 and 2020. The actual curve of this line will depend upon the City's implementation schedule for the strategies and actions. The implementation performance assumptions for these 2020 strategies and actions are presented in Appendix C.

TRAJECTORY TOWARD 2035 AND 2050 TARGETS

This MOCAP was developed to identify strategies to help the City achieve its long-term 2050 reduction target. The strategies and reduction estimates presented in this chapter are based on reasonable estimates for what is possible to occur between MOCAP adoption and 2020. However, the accuracy of emission projections and reduction estimates becomes less certain the farther into the future they are projected. The 2050 reduction estimates are based on the same 2020 MOCAP strategies described in this chapter, with increased implementation performance assumptions occurring between 2020 and 2050. Reduction estimates for the year 2035 were interpolated between the 2020 and 2050 calculated emission reduction values.

These 2050 reduction estimates are provided for demonstrative purposes only. As described in Chapter 4, the City will need to regularly assess the effectiveness of MOCAP strategies to ensure that future emission levels are on track to achieve the 2050 target. Implementation assumptions underlying the 2035 and 2050 reduction estimates are presented in Appendix C along with the 2020 assumptions. Table 3.3 shows the estimated 2050 reductions for the proposed strategies and actions, and indicates their contributions to the 2050 target. This table, like Table 3.2, is organized into two scenarios to show the importance of Strategy F-1 for long-term target achievement. Based on the implementation assumptions described in Appendix C, the City would not achieve its 2050 target without implementation of Strategy F-1.

Reducing Natural Gas Usage

As shown in Table 3.3, the MOCAP's long-term emission reduction strategy focuses heavily on transitioning municipal electricity use to low- or zero-emission electricity (i.e., 50% of the 2050 GHG reduction target can be achieved by implementing Strategy F-1). In the 2005 baseline year, almost 60% of Building Energy emissions were a result of electricity consumption. As described in Strategy F-1, those emissions could be entirely eliminated by developing a local Community Choice Energy program or by purchasing additional renewable energy through PG&E' s Green Option program, which is expected to launch in late 2015.

While almost 60% of 2005 Building Energy emissions came from electricity consumption, 36% came from the combustion of natural gas, primarily for building heating. A municipal shift toward clean electricity would address the largest source of Building Energy emissions, however it would not impact the City's natural gas-based GHG emissions. Since the City is committed to identifying all feasible and financially viable emission reduction opportunities, the City could begin considering options to reduce natural gas used for building heating as an additional long-term strategy.

There are several options that may be viable to further reduce building emissions. In general, these include (1) improving operating efficiencies of existing heating equipment (e.g. through implementing Strategy F-3: Existing Building Energy Retrofit and Management), (2) increasing the thermal performance of municipal buildings (e.g. through window retrofits or additional insulation), and (3) converting natural gas-based heating systems to electric, ground source heat pumps, or other lower-emissions fuel sources. Each option will have different implementation and operational costs, and financing strategies, which the City will need to consider on a case-by-case basis as it further explores their application to specific municipal facilities. These options are considered long-term strategies that can contribute to achievement of the 2050 GHG reduction target, particularly if electricity-based heating systems are found to be viable and the City purchases all municipal electricity from emission-free sources. Fleet and Facilities and Sustainability staff can work together to evaluate the long-term operational savings that could occur as a result of switching from natural gas heating to ground-source heat pump or electric heating options. Payback periods for ground-source heat pumps are typically shorter in regions that have a greater difference in average summer and winter temperatures, as opposed to the Bay Area's moderate climate. However, several large-scale systems have been installed in the Bay Area in recent years because such systems can have longer operating lives than traditional heating systems (which helps to make their longer payback periods financially viable), and because of their associated environmental benefits (e.g., emission reductions and water conservation potential).

As the City considers its existing building systems in the context of retrofit opportunities and alternative heating systems, it can develop a framework to guide decision-making and investments toward long-term natural gas reductions. With a strategic framework in place, these investments can be phased in gradually through the City's capital improvement process. Future MOCAP updates should incorporate these preferred strategies and estimate their specific

emission reduction potential within the overall GHG target achievement analysis. Based on the emission inventories and forecasts described in Chapter 2, a full transition to electricity-based heating systems (powered by emissions-free electricity) could produce reductions of approximately 860 MT CO2e per year in 2035 and nearly 890 MT CO2e per year in 2050.

Table 3.3
Proposed 2050 Municipal Operations Emission Reduction Strategies and Actions

Sector / Strategy / Action	Scenario 1: With Strategy F-1		Scenario 2: Without Strategy F-1	
	Emission Reductions in 2050 (MT CO_2e/year)	Contribution to 2050 Target	Emission Reductions in 2050 (MT CO_2e/year)	Contribution to 2050 Target
FACILITIES SECTOR	**2,440**	**62.7%**	**2,123**	**54.6%**
F-1 Low-Carbon Grid Electricity	**1,960**	**50.4%**	**0**	**0.0%**
A. Utility Green Electricity Option	*1,960 (A,B,or C)*	*50.4%*	*0*	*0.0%*
B. Community Choice Energy	*1,960 (A,B,or C)*	*50.4%*	*0*	*0.0%*
C. Utility-Scale Renewable Energy Generation	*1,130 (A,B,or C)*	*29.0%*	*0*	*0.0%*
F-2 Renewable / Low-Carbon Electricity Generation	**70**	**1.8%**	**520**	**13.4%**
A. Solar PV Installations on City Buildings, Parking Lots, Land	*0*	*0.0%*	*450*	*11.6%*
B. Solar Hot Water Installations in City Facilities	*70*	*1.8%*	*70*	*1.8%*
F-3 Existing Building Energy Retrofit and Management	**410**	**10.5%**	**790**	**20.3%**
A. Energy Efficiency Fund	*Supporting*	-	*Supporting*	-
B. Energy Efficiency Procurement Policy	*0*	0.0%	*90*	*2.3%*
C. Consumption Data Collected per Facility	*410 (C, D, and E combined)*	*10.5%*	*700 (C, D, and E combined)*	*18.0%*
D. Retro-Commissioning Program				
E. Employee Information / Education				
F-4 New Building Energy Performance	**Supporting**	**-**	**Supporting**	**-**
A. Enhanced Green Building Standard	*Supporting*	-	*Supporting*	-
F-5 Public Realm Lighting Efficiency	**0**	**0.0%**	**150**	**3.9%**
A. Parking Lot Lighting Retrofits	*0*	*0.0%*	*130*	*3.3%*
B. Park Facility Lighting Retrofits	*0*	*0.0%*	*20*	*0.6%*
C. Parking Garage Lighting Retrofits	*Supporting*	-	*Supporting*	-
F-6 Landscape Water Conservation	**0**	**0.0%**	**3**	**0.1%**
A. Green Grounds Policy	*0*	*0.0%*	*3*	*0.1%*
Statewide Actions	**0**	**0.0%**	**660**	**17.0%**
Renewable Portfolio Standard[1]	*0*	*0.0%*	*660*	*17.0%*
VEHICLE FLEET SECTOR	**1,220**	**31.4%**	**750**	**19.3%**
VF-1 Efficient Vehicles	**50**	**1.3%**	**50**	**1.3%**
A. Fuel-Efficient Vehicle Procurement Policy	*50*	*1.3%*	*50*	*1.3%*
B. Fuel-Efficient Operational and Maintenance Policies	*Supporting*	-	*Supporting*	-
VF-2 Alternative Fuel Vehicles	**1,080**	**27.8%**	**650**	**16.7%**
A. Municipal Fleet Emissions Target	*Supporting*	-	*Supporting*	-
B. Vehicle Fleet Plan	*1,080*	*27.8%*	*650*	*16.7%*
C. CNG Fueling Stations	*Supporting*	-	*Supporting*	-
D. Electric Vehicle Charging Stations	*Supporting*	-	*Supporting*	-

Table 3.3
Proposed 2050 Municipal Operations Emission Reduction Strategies and Actions

Sector / Strategy / Action	Scenario 1: With Strategy F-1		Scenario 2: Without Strategy F-1	
	Emission Reductions in 2050 (MT CO_2e/year)	Contribution to 2050 Target	Emission Reductions in 2050 (MT CO_2e/year)	Contribution to 2050 Target
VF-3 Behavior / Fuel Optimization	**90**	**2.3%**	**50**	**1.3%**
A. Telematics	*90*	*2.3%*	*50*	*1.3%*
B. Fuel Saving Recognition Program for Employees / Departments	*Supporting*	-	*Supporting*	-
SOLID WASTE SECTOR	**530**	**13.6%**	**530**	**13.6%**
SW-1 Waste Reduction	**100**	**2.6%**	**100**	**2.6%**
A. Green Procurement Specifications	*Supporting*	-	*Supporting*	-
B. Waste Reduction and Diversion Goals	*100*	*2.6%*	*100*	*2.6%*
C. Waste Audits / Surveys and Diversion Rate Tracking at Municipal Facilities	*Supporting*	-	*Supporting*	-
SW-2 Recyclable Paper Reduction	**170**	**4.4%**	**170**	**4.4%**
A. Paperless Office Policy / Program	*170*	*4.4%*	*170*	*4.4%*
SW-3 Landscape Waste Diversion	**90**	**2.3%**	**90**	**2.3%**
A. Municipal Landscape Waste Composting Program	*90*	*2.3%*	*90*	*2.3%*
SW-4 Construction and Demolition Waste Diversion	**170**	**4.4%**	**170**	**4.4%**
A. Municipal Construction and Demolition Standards	*170*	*4.4%*	*170*	*4.4%*
TOTAL 2020 MOCAP REDUCTIONS	**4,190**	**107.7%**	**3,403**	**87.5%**

Notes: Columns may not total to values shown due to rounding

[1] The Renewable Portfolio Standard (RPS) requires California's utilities to provide 33% of their electricity from renewable sources by 2020. While it is possible additional State legislation will increase the RPS requirements, these potential future levels are not known at this point. Therefore, this calculation assumes an RPS level of 33% in 2050. Strategy F-1 considers actions that would result in up to 100% of the City's electricity being generated from renewable sources. To avoid double counting the effects of the RPS, this table presents two scenarios to demonstrate the difference between sourcing 100% clean electricity (Scenario 1) versus relying on the RPS to source 33% clean electricity (Scenario 2).

Trajectory toward 2035 Target

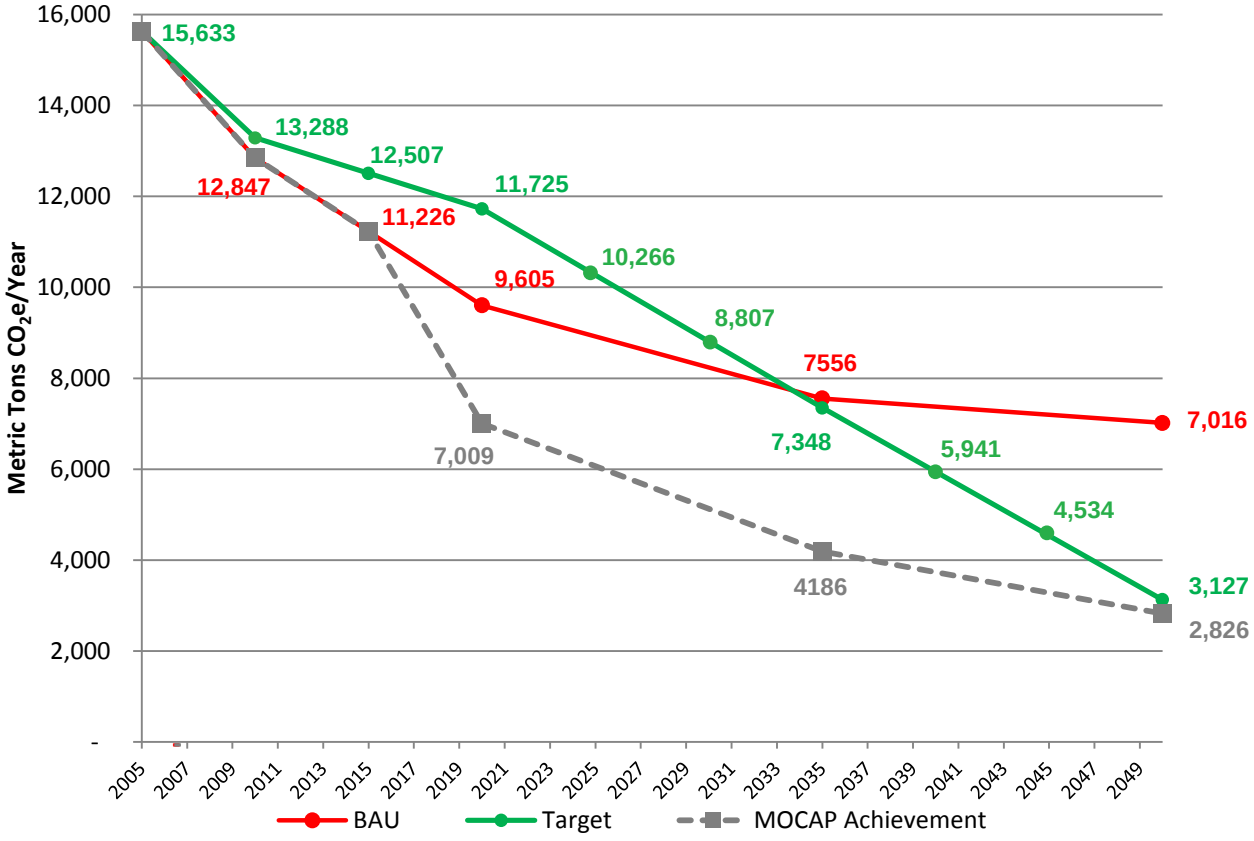
Figure 3.3 shows that the City will need to implement additional local actions to achieve its interim 2035 target of reducing municipal operations emissions to a level 53% below the 2005 baseline. While the reduction in Shoreline Landfill methane emissions is estimated to reduce BAU emissions to approximately 7,500 MT CO_2e per year (i.e., 52% below the 2005 baseline), additional efforts will be needed to achieve the 2035 target level of approximately 7,350 MT CO_2e per year. Implementation of MOCAP strategies and actions could contribute additional reductions totaling 3,370 MT CO_2e per year, or 73% below 2005 levels.

Trajectory toward 2050 Target

It is difficult to establish performance assumptions for horizon years far in the future given unknown budgetary conditions, emergence of new and evolving technologies, and potential State and Federal actions. For this reason the MOCAP does not attempt to define specific implementation actions for 2050. However, this section does discuss the role the proposed MOCAP strategies could play in facilitating the achievement of the City's long-term reduction target (i.e., 80% below 2005 baseline by 2050).

To achieve the 2050 emission reduction target, the City will need to implement additional, aggressive increases in facility energy efficiency and renewable energy generation, and a continued shift towards low-carbon fleet vehicles. MOCAP strategies and actions would serve as a foundation for City action in these areas, but would have to be enhanced past the assumptions contained in the 2020 and 2035 performance metrics. Figure 3.3 illustrates a scenario in which enhanced implementation of MOCAP measures could achieve the 2050 target (per Scenario 1 shown in Table 3.3). The performance assumptions for 2050 strategy implementation are contained in Appendix C.

Figure 3.3 – Emission Reduction Potential of MOCAP (2005-2050)



FACILITIES SECTOR STRATEGIES

Facility sector emissions represented approximately 22% of total municipal emissions in 2010. However, the sector's proportional share of total emissions is forecast to account for 40% of total municipal emissions in 2035, as emissions from the City's closed Shoreline Landfill continue to decrease over time. Energy emissions come from the electricity and natural gas used to power the City's building and facilities. Electricity from the public utility grid is generated from a variety of sources, including natural gas and coal power plants, hydroelectric generators, wind farms, and large-scale solar facilities. The mix of energy sources used to supply the grid is one factor used to calculate the City's energy-related emissions. Electricity powers the City's building and facility lighting, air conditioning, computers, and other office equipment that support daily operations. Electricity is also used to power City-owned water and wastewater pumps and public lighting, including streetlights, traffic lights, municipal parking lot lights, and park and recreational lighting. Energy-related emissions also include natural gas used for indoor space heating and hot water use, heating public pool water, and other operations.

The City has already taken a number of steps to reduce energy emissions through energy efficiency improvements and renewable energy installations. Existing buildings and facilities have been made more energy efficient with indoor lighting retrofits, lighting occupancy sensors, office equipment energy management systems, and exterior lighting and traffic signal retrofits. Building energy improvements have also included the installation of a high-efficiency chiller at the Civic Center and cool roof retrofits at the Municipal Operations Center to reduce summer air conditioning loads. Current plans for new boilers at City Hall and improved HVAC controls at the Library will bring additional energy savings. The City has also reduced indoor water use with the installation of low-flow plumbing fixtures, which reduces energy use from the City's water and

wastewater pumping infrastructure. In addition to efficiency improvements, the City has installed a solar photovoltaic (PV) energy system on the downtown 850 California Street parking garage, as well as solar-powered water pumps at the Shoreline Sailing Lake. These systems help to offset emissions that would otherwise be associated with using traditional grid electricity.

The City has also demonstrated a leadership role through policy and operational guidance, including adoption of a green building policy in 2009 that requires new construction and significant retrofits of City facilities to meet Leadership in Energy and Environmental Design (LEED) Silver standards. A municipal purchasing policy directs use of ENERGY STAR-rated appliances and equipment to increase operational efficiency. Landscape water conservation practices on City property are also contributing to energy and water conservation through use of water budgets, recycled water for irrigation, and through training park staff in water conservation best management practices. The City should consider using an Energy Management System (EMS) to be able to monitor its building energy use more easily and to identify and correct operational issues more quickly.

This sector includes six new strategies that expand upon the City's previous successes in energy efficiency and renewable energy development to help the City achieve its 2020 and 2035 targets, and establish a framework for achieving its 2050 target. The following strategies will provide emission reductions through cleaner grid electricity; expanded renewable energy development; additional existing building retrofits; enhanced standards for new building energy performance; operational improvements; lighting retrofits; and enhanced landscape irrigation.

As described above, the actions described in Strategy F-1 would result in lower emissions from all municipal electricity use. Therefore, Strategy F-1 directly affects the other electricity-reducing strategies and will impact their emission reductions *potential*. Implementing Strategy F-1 will lower the emission reduction potential of the other electricity-related strategies because the City's energy supply will be much less carbon-intensive, resulting in less carbon savings per kilowatt-hour of electricity saved. If all Facility sector strategies are implemented by the year 2020, their total reduction potential would be approximately 1,900 MT CO_2e per year. If only strategies F-2 through F-6 are implemented by 2020, total reduction potential would be approximately 1,300 MT CO_2e per year (including reductions associated with the State's Renewable Portfolio Standard).

STRATEGY F-1 LOW-CARBON GRID ELECTRICITY

Procure Low-Carbon Grid Electricity through Utility Programs or Large-Scale Renewable Energy Development.

The greenhouse gas emissions attributed to electricity use are a direct result of the energy-generating sources contained within the electricity grid's portfolio. Shifting the grid's portfolio to cleaner energy sources (e.g., wind, solar, geothermal) will reduce emissions related to building energy use, such as lighting, mechanical systems, and office equipment. PG&E currently provides electricity and natural gas to all City buildings and facilities, and is responsible for determining the grid's energy portfolio. Strategy F-1 presents the City's opportunities to either influence the portfolio mix of energy provided to the City or develop utility-scale renewable energy systems to meet municipal energy demands.

There are several options to implement this strategy, described as Actions A–C below, including purchasing cleaner electricity directly from PG&E through its Green Option Program; partnering with other area jurisdictions to develop a Community Choice Energy (CCE) district that can independently buy cleaner electricity; or developing a large-scale renewable energy system to meet some of the City's electricity demand. These actions are not necessarily mutually exclusive, though it is assumed in the MOCAP that the City would not opt to pursue all of them.

This strategy is supported by other MOCAP strategies and existing City actions that reduce electricity demand, either through energy efficiency improvements or educational programs that promote energy conservation, and should be pursued in tandem. Implementation of this strategy could reduce emissions by as much as 1,690 MT CO_2e per year in 2020, depending on which strategy the City selects. It should also be noted that Community Choice Energy has the potential to provide significant energy-sector reductions at the community-wide level as well, which could help the City achieve its long-term community-wide emission reduction goals.

Action A: Utility Green Electricity Option

PG&E is in the process of finalizing its proposed Green Option Program, which would allow customers to voluntarily purchase up to 100% renewable electricity. If approved by the California Public Utilities Commission (CPUC), PG&E expects the program to be available for subscription by mid-late 2015. The program is currently expected to be capped at 272 MW of demand during a five-year pilot program. It is currently unknown how participation will be granted, should the program become fully subscribed. Timely assessment of PG&E's program, including cost implications and variables, is recommended in order to best position the City for participation in the utility's program. This type of action was previously recommended by the City's 2008 community Environmental Sustainability Task Force.

Action B: Community Choice Energy

Assembly Bill 117, which was signed into law in 2002, enables California cities and counties to either individually or collectively supply electricity to customers within their borders through the establishment of a Community Choice Energy district. Unlike a municipal utility, a CCE district does not own nor maintain the transmission and distribution infrastructure, nor handle the billing nor customer service (the responsibilities for which stay with PG&E). Instead, the CCE is responsible for providing electricity to its residents and businesses via the existing "grid." The CCE may develop and own electricity generating facilities, thereby stimulating the local economy, but more often it purchases power from private electricity generators.

A key benefit of a CCE is that the participating jurisdictions can determine the amount of renewable energy contained within the generation portfolio, allowing a CCE to exceed current State requirements directing California's utilities to provide 33% of their electricity from renewable sources by 2020. The program would be most effective if the City partnered with other local government agencies to jointly pursue a regional CCE program. Another benefit, as shown in Figure 3.1, is that CCE is tied with Action F-1 A as the most effective measure, by far, the City can take to significantly reduce its emissions in the short- and long-term. Since CCE start-up expenses would ultimately be refunded to the City, this action has the potential to both reduce emissions and generate cost savings through reduced energy expenses.

CCE programs have historically been challenged by local investor owned utilities (IOUs) and other stakeholders. One recent challenge was AB 2145 (Bradford), which gained early momentum in the 2014 legislative cycle. AB 2145 generated significant and widespread statewide opposition from public agencies and environmental organizations, and ultimately did not reach the Governor's desk. This result preserves the City's flexibility and choice in determining how and to what extent it may scale its energy portfolio toward increasingly renewable sources.

Action C: Large-Scale Renewable Energy Generation

Instead of purchasing renewable electricity from PG&E or through development of a CCE, the City could also develop its own large-scale renewable energy projects, such as a solar farm. The City could finance, own, and maintain its own project to increase local government use of renewable energy. The Local Government Renewable Energy Self-Generation Bill Credit Transfer Program (authorized and required by AB 2466) allows local governments to develop renewable generating facilities of up to 5 MW each. The facilities would be interconnected to the utility grid, and the City would receive utility bill credit for *only* the "generation" component of the energy generated at the facilities. A somewhat similar program, Aggregated Net Energy Metering (NEMA), would allow renewable systems of up to 1 MW to be built and interconnected at one facility and offset electrical usage at other meters on the same or contiguous land parcels. With NEMA, though, the City would receive *full* utility bill credit for the energy generated at the facility. Alternatively, the City could sign a Power Purchase Agreement (PPA) with a solar service provider, representing a commitment to purchase a set amount of electricity from a renewable generating facility. With a PPA, a solar service provider pays up-front installation

costs, and owns and maintains the generating facility, while the City pays the service provider for the electricity generated. A PPA also provides a guaranteed, escalating price of electricity for the life of the contract, which traditionally spans twenty years.

	Strategy and Actions	Emission Reductions in 2020 with Strategy F-1 (MT CO_2e/year)	Emission Reductions in 2020 without Strategy F-1 (MT CO_2e/year)	Contribution to 2050 Target[1] in 2020	Contribution to 2050 Target[2] in 2050
F-1	**Low-Carbon Grid Electricity**	**1,690**	**0**	**43.4%**	**50.4%**
A.	Utility Green Electricity Option	1,690	0	43.4%	50.4%
B.	Community Choice Energy	1,690	0	43.4%	50.4%
C.	Large-Scale Renewable Energy Generation	1,130	0	29.0%	29.0%

[1] Based on Scenario 1 in Table 3.2, which assumes Strategy F-1 is implemented.
[2] Based on Scenario 1 in Table 3.3, which assumes Strategy F-1 is implemented.

STRATEGY F-2 RENEWABLE / LOW-CARBON ELECTRICITY GENERATION

Develop Additional Renewable Energy Facilities.

The City has installed a solar PV system at the downtown 850 California Street parking garage, as well as solar-powered pumps at the Shoreline Sailing Lake. Additional installations would help to offset building or facility-specific energy loads (as opposed to Strategy F-1, which explores supplying renewable energy to the utility grid). Combined with energy efficiency improvements, PV installations could offset the entire electricity demand of certain buildings or facilities. The City has already explored the feasibility of adding solar PV to several other buildings. This analysis builds off of a recommendation in the City's 2012 Greenhouse Gas Reduction Plan (GGRP), which directed the City to conduct feasibility analyses for additional solar PV installations. The City can also look for opportunities to install solar hot water systems on City facilities with high hot water usage, including public swimming pools. Implementation of this strategy could reduce emissions by up to 240 MT CO2e per year (if Strategy F-1 is not implemented). The following two actions provide a pathway toward increased use of building-scale renewable energy systems.

Action A: Solar PV Installations on City Buildings, Parking Lots, Land

As noted in the introduction to Strategy F-2, the City has explored the feasibility of installing solar PV on several municipal buildings or facilities. Depending on which projects are deemed viable and worth pursuing, the City will need to determine the best funding mechanism to

pursue those projects, such as through partnership with solar service providers or direct City ownership. Future additional installation sites should also be identified and analyzed, including several municipally owned downtown surface parking lots and City park parking lots.

Action B: Solar Hot Water Installations in City Facilities

Solar hot water systems use the heating potential of solar energy to offset the more conventional use of natural gas or electric heaters. Solar hot water systems tend to be most cost-effective for large hot water consumers (e.g., shower facilities, public swimming pools, laundry facilities). The City has preliminarily analyzed various sites using a high-level study, which identified a few potentially viable sites. More detailed analysis of these buildings should be performed to identify the most cost-effective opportunities.

Strategy and Actions		Emission Reductions in 2020 with Strategy F-1 (MT CO_2e/year)	Emission Reductions in 2020 without Strategy F-1 (MT CO_2e/year)	Contribution to 2050 Target[1] in 2020	Contribution to 2050 Target[2] in 2050
F-2	**Renewable / Low-Carbon Electricity Generation**	**6**	**236**	**0.2%**	**1.8%**
A.	Solar PV Installations on City Buildings, Parking Lots, Land	0	230	0.0%	0.0%
B.	Solar Hot Water Installations in City Facilities	6	6	0.2%	1.8%

[1] Based on Scenario 1 in Table 3.2, which assumes Strategy F-1 is implemented.
[2] Based on Scenario 1 in Table 3.3, which assumes Strategy F-1 is implemented.

STRATEGY F-3 EXISTING BUILDING ENERGY RETROFIT AND MANAGEMENT

Reduce Energy Consumption in Existing Municipal Buildings through Energy Efficiency Improvements, Interactive Management Systems, Employee Education, and Building Operation and Maintenance Policies.

Improving energy efficiency and management in existing buildings can provide the immediate benefits of reduced emissions and operational savings through utility cost savings, and potentially provide longer-term maintenance cost savings. Additionally, advanced analytic energy management systems have increasingly become more sophisticated and offer another tool to achieve significant, cost-effective energy savings. Building efficiency and conservation improvements also support the City's plans for additional renewable energy generation. Energy efficiency has been identified by the State as the first enabling strategy in the "loading order" of

energy improvement approaches, first adopted by California's energy agencies in the 2003 Energy Action Plan and reaffirmed by the energy sector provisions of CARB's AB 32 Scoping Plan. The order allows for accuracy and optimal effectiveness in energy use and the right-sizing of solar PV systems to offset remaining electricity use.

The City already uses building energy benchmarking and energy audits to track and compare energy use and identify operational or mechanical problems and opportunities for system improvements. The City has also replaced or plans to replace several conventional roofs with cool roofs, which help reduce air conditioning demands. Extensive indoor lighting and lighting control system retrofits have been installed at various buildings and facilities, including:

- City Hall
- Center for Performing Arts
- Library
- Community Center
- Police/Fire Administration Building
- Fleet Services Building
- Mountain View Sports Pavilion and Whisman Sports Center
- Parking Garages (Civic Center, Library, 135 Bryant Street)

The actions included within this strategy are intended to reinforce the City's previous energy efficiency activities; identify the next candidates for retrofit programs; enhance the City's existing energy efficiency procurement policy; facilitate collection of energy use data at a building or facility level; provide policy guidance for regular building system commissioning; and elevate energy conservation awareness across all levels of City employees. As with the previous strategies, project financing is a primary consideration. Implementation of this strategy could reduce emissions by up to 380 MT CO_2e per year (if Strategy F-1 is not implemented).

Action A: Energy Efficiency Fund

The establishment of a municipal energy efficiency revolving loan fund (RLF) could provide a self-sustaining source of money to support future building efficiency retrofits. Initial funding for the RLF could come from rebate or matching money from the utility or from City funds, such as the City's existing annual energy efficiency capital improvement project (CIP). With an RLF, money from the fund is "loaned" to pay for municipal energy efficiency projects, and the financial savings from those projects are directed back into the RLF (for an agreed-upon period of time) to fund additional municipal efficiency projects, which then generate more savings. To ensure the fund's longevity, loan repayment parameters should be established that capture efficiency project utility cost savings for a set number of years, after which additional cost savings accrue to the project's managing department. The County of Alameda, the City of El Cerrito, and the Southern California Regional Energy Network maintain comparable programs that could be used as models to establish a similar program in Mountain View.

Action B: Energy Efficiency Procurement Policy

The City Council approved an Environmentally Preferable Purchasing Policy in 2008, which includes requirements for ENERGY STAR-rated appliance purchases when such models exist. This policy could be revised to include opportunities for plug-load energy savings through application of advanced power strips in office environments or other locations with high-concentrations of office equipment or small appliances. The City should further support implementation of this policy through development of a Green Procurement Specifications handbook, which would help department managers and staff to select environmentally preferred options when purchasing appliances, office furniture, paint and carpet, vehicles and equipment, and various other items. The US EPA's web-based buying guides for government procurement provide a reference for creation of a Mountain View-specific handbook.

Action C: Consumption Data Collected per Facility

The ability to monitor and analyze energy use in City buildings and facilities is largely a function of the number and location of utility meters. For example, without dedicated meters, electricity used for a park's lights is not measureable if the park lights are on the same meter as an adjacent City building. Cross-metering is common, and makes it difficult to isolate opportunities for improvement or monitor the results of any installed retrofit programs. The City should partner with PG&E to install additional utility meters at City buildings and facilities to the extent that Facilities staff would be able to effectively monitor and analyze energy-use trends at the building- or facility-level. The City should consider using an Energy Management System (EMS) to be able to monitor its building energy use more easily, identify and correct operational issues more quickly, and to track and quantify post-installation, measure-specific impacts. This ability to disaggregate utility consumption at a finer grain of detail would support the City's existing benchmarking program and help to remotely identify efficiency improvement opportunities, without the need to physically audit each individual building.

Action D: Retro-Commissioning Program

Commissioning, and retro-commissioning, is the process of verifying that building systems are operating at optimal efficiency. The State's building code already requires commissioning in new construction and major renovations. Development of a City policy that requires all major building systems (e.g., mechanical, electrical, ventilation) to be retro-commissioned at five-year intervals will help ensure optimal facility operations. This policy could also help extend the life of existing systems, defer expensive upgrades, and ensure timely identification of energy efficiency opportunities. This policy should be developed in a way to provide efficiencies and/or cost savings associated with the City's existing service agreements for regular maintenance of various City buildings.

Action E: Employee Information / Education

Providing employees with information about energy-efficient policies and practices, as well as energy use within their buildings, can promote a culture of conservation within various departments. The City could install energy use dashboards in public areas of the City's primary

buildings (e.g., City Hall, the Center for Performing Arts, the Library, and the Municipal Operations Center or MOC) and connect the dashboards to its website for more visible tracking of energy use in specific buildings. Different City departments or buildings (depending on the distribution of utility meters) could also set energy-use reduction targets and encourage staff to help achieve them. This could include training on day-to-day energy conservation practices and use of existing equipment energy-saving settings. Additionally Facilities staff will receive training on how to optimize building energy components through use of the City's building management system.

	Strategy and Actions	Emission Reductions in 2020 with Strategy F-1 (MT CO_2e/year)	Emission Reductions in 2020 without Strategy F-1 (MT CO_2e/year)	Contribution to 2050 Target[1] in 2020	Contribution to 2050 Target[2] in 2050
F-3	**Existing Building Energy Retrofit and Management**	**190**	**380**	**4.9%**	**10.5%**
A.	Energy Efficiency Fund	Supporting Action – provides funding to Actions B–E			
B.	Energy Efficiency Procurement Policy	0	40	0.0%	0.0%
C.	Consumption Data Collected per Facility	190 (C, D, and E combined)	340 (C, D, and E combined)	4.9%	10.5%
D.	Retro-commissioning Program				
E.	Employee Information / Education				

[1] Based on Scenario 1 in Table 3.2, which assumes Strategy F-1 is implemented.
[2] Based on Scenario 1 in Table 3.3, which assumes Strategy F-1 is implemented.

STRATEGY F-4 NEW BUILDING ENERGY PERFORMANCE

Establish Energy Efficiency Targets for New Municipal Buildings.

The City already adopted a green building standard in 2009 that requires all new municipal buildings to achieve LEED Silver certification. However, there are multiple pathways to achieve this certification, some of which emphasize indoor air quality, construction material reuse, energy and water conservation, or a blend of strategies. The City could modify its green building standards to include minimum energy performance goals in addition to LEED Silver certification. While implementation of this strategy supports the City's long-term emission reduction goals by ensuring new construction is highly efficient, the exact emission reduction potential is currently unknown.

Action A: Enhanced Green Building Standard

Enhance the existing municipal green building requirements to define minimum energy efficiency levels that require new construction to reach beyond LEED Silver's basic energy modeling requirements. Any additional standards should be developed to allow flexibility in compliance, rather than prescribing certain technologies. This will allow application of the most cost-effective design strategies.

Strategy and Actions	Emission Reductions in 2020 with Strategy F-1 (MT CO_2e/year)	Emission Reductions in 2020 without Strategy F-1 (MT CO_2e/year)	Contribution to 2050 Target in 2020	Contribution to 2050 Target in 2050
F-4 New Building Energy Performance	**Supporting Strategy**			
A. Enhanced Green Building Standard	Supporting action – emission reductions are possible, and would be reflected in future emission inventory updates			

STRATEGY F-5 PUBLIC REALM LIGHTING EFFICIENCY

Upgrade Public Realm Lighting to More Efficient Technology.

Lighting efficiency upgrades typically represent one of the most cost-effective solutions for energy conservation, providing lower utility costs and, often, lower maintenance costs as well due to less frequent bulb replacements. Public realm lighting in Mountain View includes traffic lights, street lights, municipally owned parking lot lights, and public park lights. The City has already upgraded its traffic signal lights from incandescent bulbs to LEDs, and has begun converting its post-top high-pressure sodium (HPS) streetlights to induction lighting. More than 600 streets lights in various parks and in downtown Mountain View have already been converted, with plans to convert the remaining streetlights in two phases over the next decade. The City has converted all downtown City parking lots to induction lighting. Additionally, lights at Eagle, Pioneer, and Rengstorff Parks (except tennis court lights at Rengstorff Park) have been converted to induction lighting, as well as those at Centennial Plaza. To support future energy conservation in public lighting, the City is in the process of updating its Standard Provisions for new public lighting to specify that new lights should be LED, induction, or an equivalent technology. The actions implementing this strategy build from these successes in lighting upgrades, and address the few remaining opportunities in City-owned parking lots and public parks. Implementation of this strategy could reduce emissions by up to 140 MT CO_2e per year (if Strategy F-1 is not implemented).

Action A: Parking Lot Lighting Retrofits

The City should develop a lighting retrofit schedule that includes conversion of all City-owned parking lot lights that still use HPS bulbs. Recent parking lot conversions used induction lighting and are estimated to last 15–20 years. However, the City should continue to monitor advancements in lighting technology, such as LEDs, and select the best available option at the time of retrofit with considerations for application need, cost, and available rebate or financing options.

Action B: Park Facility Lighting Retrofits

The remaining opportunities for park facility lighting primarily involve recreational lighting. The Graham Reservoir and Sports Complex and Whisman Sports Center have not yet undergone lighting upgrades. Each facility is co-owned by the City and the Mountain View-Whisman School District, so the two entities will need to collaborate on the development of a lighting upgrade program. The tennis courts in Rengstorff Park and Cuesta Park are also candidates for future retrofits. Though the City has explored various lighting options, a viable alternative has not yet been identified to provide the quality of lighting required for play at a tennis court. Additionally, other public lighting throughout Cuesta Park remains an opportunity area for retrofits.

Action C: Parking Garage Lighting Retrofits

The City has already retrofitted three of its four parking garages with LED bi-level lighting systems. The 850 California Street garage may also be a good candidate for lighting retrofits. Utility cost savings at this garage would be low since the structure has a roof-mounted solar PV system. However, this action is in line with the City's goal to reduce long-term maintenance costs associated with lighting fixtures. As lighting technology continues to advance, the City should continue to stay informed of new opportunities for even deeper energy savings.

Strategy and Actions	Emission Reductions in 2020 with Strategy F-1 (MT CO_2e/year)	Emission Reductions in 2020 without Strategy F-1 (MT CO_2e/year)	Contribution to 2050 Target[1] in 2020	Contribution to 2050 Target[2] in 2050
F-5 Public Realm Lighting Efficiency	**0**	**140**	**0.0%**	**0.0%**
A. Parking Lot Lighting Retrofits	0	120	0.0%	0.0%
B. Park Facility Lighting Retrofits	0	20	0.0%	0.0%
C. Parking Garage Lighting Retrofits	Supporting action – emission reductions will occur, but quantity currently unknown			

[1] Based on Scenario 1 in Table 3.2, which assumes Strategy F-1 is implemented.

[2] Based on Scenario 1 in Table 3.3, which assumes Strategy F-1 is implemented.

STRATEGY F-6 LANDSCAPE WATER CONSERVATION

Formalize Existing Landscape Conservation Practices Into a Green Grounds Policy.

Treating, pumping, and distributing water throughout cities is often an energy intensive activity. However, the majority of Mountain View's water comes from the gravity-fed Hetch Hetchy Reservoir system, and therefore, has lower embodied energy related to its transport than other water sources. Regardless of the energy savings related to water conservation, the City believes that water, as a limited natural resource, should be conserved, especially in light of recent drought conditions statewide. The City already employs a water conservation plan for its public parks that saves an estimated 4.25 million gallons of water per year. More than half of those savings come from the use of landscape water budgets in nineteen public parks. The City plans to extend its water budget program to additional parks in the future. The City also uses climate-sensitive and water-efficient irrigation technology to continually adjust landscape watering schedules and amounts based on data collected from local weather stations. In support of this technology, Parks Division staff is trained to adjust irrigation according to weather conditions. They are trained, as well, in other landscape water conservation best management practices. The City uses recycled water irrigation in the Shoreline Park and Golf Course area to offset potable water use, and the North Bayshore area is plumbed for recycled water use at City-owned buildings and facilities. In 2014 the City completed a study to evaluate the feasibility of expanding the recycled water system to areas east of Stevens Creek and south of Highway 101. The study identified an expansion of the system to the Bayview development / NASA properties as the most cost-effective alternative. The City will monitor development activity and funding opportunities and develop a system expansion strategy as appropriate.

The following action describes a framework to support the City's water conservation practices and to help identify additional opportunities. Implementation of this strategy could reduce emissions by up to 1 MT CO_2e per year (if Strategy F-1 is not implemented), though as previously stated, the real benefit is in conserving a limited resource.

Action A: Green Grounds Policy

As described above, the City currently employs a number of water-conserving strategies. The City could support and enhance its conservation of potable water through formal adoption of these strategies. Development of a Green Grounds Policy that contains all of the strategies in one place could help to ensure their consistent and correct application. The policy should also specify the landscape water budgets, which could require occasional policy updates as the recycled water system is further implemented. The Green Grounds Policy could also include the City's existing strategies related to green waste collection in parks, medians, and other City-owned property, as described in the Solid Waste Sector Strategy area of this document.

Strategy and Actions	Emission Reductions in 2020 with Strategy F-1 (MT CO_2e/year)	Emission Reductions in 2020 without Strategy F-1 (MT CO_2e/year)	Contribution to 2050 Target[1] in 2020	Contribution to 2050 Target[2] in 2050
F-6 Landscape Water Conservation	**0**	**1**	**0.0%**	**0.0%**
A. Green Grounds Policy	0	1	0.0%	0.0%

[1] Based on Scenario 1 in Table 3.2, which assumes Strategy F-1 is implemented.

[2] Based on Scenario 1 in Table 3.3, which assumes Strategy F-1 is implemented.

VEHICLE FLEET SECTOR STRATEGIES

The City Vehicle Fleet sector is responsible for approximately 11% of the City's greenhouse gas emissions. Similar to the Facilities sector emissions, the proportional share of Vehicle Fleet emissions is expected to rise over time as Solid Waste emissions from the Shoreline Landfill decrease. Emissions from this sector are generated through the combustion of diesel and gasoline used to fuel the City's vehicle fleet. The fleet is used to perform a wide range of City services, such as police patrols and police and fire department emergency responses; maintenance at water and wastewater facilities; Public Works project inspections; and community building inspections and code enforcement.

The City has already converted a portion of its fleet to more efficient, lower emission, alternative fuel vehicles. As of March 2015, almost 16% of the fleet was hybrid or all-electric models. The City has also begun installing alternative fuel infrastructure, including four electric vehicle charging stations, with five more dual-port stations planned for installation. During the procurement process, the City also looks for the most fuel-efficient vehicle available for a specific task, and downsizes vehicles when feasible. The City's procurement policy allows flexibility in vehicle purchase options, and the City anticipates replacing older vehicles with both hybrid electric and all-electric models (as appropriate). An anti-idling policy also prohibits non-emergency vehicles from idling for more than 5 minutes, unless idling is needed for the vehicle to perform its designed function or to defrost the windows for safety reasons.

This sector includes three strategies that build upon the City's previous successes in assembling a more efficient, cleaner vehicle fleet. Strategies address vehicle fleet efficiency, fuel types and refueling infrastructure, and fleet operational behavior. As with the Facilities

sector strategies, implementation of Strategy F-1 will influence the reduction potential of Vehicle Fleet sector strategies that include shifting portions of the municipal fleet towards electric vehicle models. Providing cleaner electricity as a fuel source for electric vehicles improves the emission reduction potential of Vehicle Fleet sector strategies. Strategies in this sector have the ability to reduce greenhouse gas emissions by approximately 350 MT CO_2e per year (if Strategy F-1 is implemented).

STRATEGY VF-1 EFFICIENT VEHICLES

Transition City Fleet to More Efficient Vehicles and Provide Operational Improvement Guidance.

This strategy aims to reduce vehicle fleet fuel consumption through replacement of older, less-efficient models and implementation of fuel-efficient operations and maintenance practices. The City already informally considers fuel efficiency during vehicle replacement. Development of a fleet efficiency target would help to formalize this consideration and accelerate transition towards a highly efficient fleet. Similarly, while the City performs regular maintenance on all vehicles, it may want to consider adopting more formal practices. According to the Federal Energy Management Program (FEMP), a regularly maintained fleet can save 12–18% in long-term maintenance costs compared to reactive maintenance programs.[4] Operational and maintenance behaviors, such as proper tire pressure inflation, regular vehicle inspections, timely repairs, and fuel-efficient driving techniques can extend the operating life of fleet vehicles and improve fuel efficiency by approximately 19% (FEMP 2012). Implementation of this strategy could reduce emissions by approximately 30 MT CO_2e per year.

Action A: Fuel-Efficient Vehicle Procurement Policy

Approximately 50% of the City's light passenger vehicles are already fuel-efficient models, with hybrids representing 50% of these. A broader shift to fuel-efficient vehicles is partially dependent upon the vehicle market and the types of vehicles being offered. For example, some efficient models that the City purchased in the past are no longer available and models that are available may be unsuitable for their requisite tasks. Recognizing that a full fleet transition to efficient vehicles is dependent on vehicles available in the market, the City can still establish a fleet efficiency target to guide future vehicle procurement decisions. The target could be developed to specify a desired proportion of zero- or low-emissions vehicles in the fleet, or more broadly as a fleet carbon reduction target that could be achieved through efficiency improvements and further integration of alternative fuel vehicles. Santa Clara County adopted a

[4] Federal Energy Management Program. 2012 (download May 2012 http://www1.eere.energy.gov/femp/program/om_preventive.html)

similar policy (Santa Clara County Policy 352) that requires preference be given to the lowest emission vehicles available. The City could also discuss aggregated vehicle procurement opportunities with agencies in neighboring jurisdictions to negotiate lower per-unit prices with vehicle vendors.

Action B: Fuel-Efficient Operational and Maintenance Policies

The City currently adheres to an informal set of fuel-efficient driving and maintenance practices, including an anti-idling policy and regularly scheduled preventative maintenance. Formalizing these practices through development of a Fuel-Efficient Operational and Maintenance policy could help prioritize these actions for the City's maintenance staff and vehicle operators. The policy could be developed to document existing maintenance activities and tune-up schedules, require fuel-efficient driving training, and raise awareness among all City employees about fuel-saving priorities. Training sessions should engage fleet staff, maintenance shop managers and staff, and City vehicle operators and drivers.

	Strategy and Actions	Emission Reductions in 2020 with Strategy F-1 (MT CO_2e/year)	Emission Reductions in 2020 without Strategy F-1 (MT CO_2e/year)	Contribution to 2050 Target[1] in 2020	Contribution to 2050 Target[2] in 2050
VF-1	**Efficient Vehicles**	**30**	**30**	**0.8%**	**1.3%**
A.	Fuel-Efficient Vehicle Procurement Policy	30	30	0.8%	1.3%
B.	Fuel-Efficient Operational and Maintenance Policies	Supporting action – supports Action A to encourage fuel-efficient driving, but is not individually quantifiable			

[1] Based on Scenario 1 in Table 3.2, which assumes Strategy F-1 is implemented.
[2] Based on Scenario 1 in Table 3.3, which assumes Strategy F-1 is implemented.

STRATEGY VF-2 ALTERNATIVE FUEL VEHICLES

Increase Use of Alternative Fueled Vehicles and Refueling Infrastructure.

This strategy aims to reduce emissions from the City's fleet by transitioning vehicles from gasoline and diesel towards alternative fuels that are less carbon intensive, such as electric vehicles (EV), hybrid fuel models (e.g., gasoline-electric), and/or compressed natural gas (CNG). To support the incorporation of alternative fuel vehicles in its fleet, the City will need to further develop charging and alternative refueling infrastructure, including electric vehicle charging stations and possibly a CNG refueling station for heavier-duty vehicles. CNG vehicles

can often perform the same tasks as diesel vehicles, while generating lower tailpipe emissions due to the lower carbon intensity of natural gas compared to diesel fuel (i.e., natural gas contains less carbon than any other fossil fuel). CNG is still a carbon-based fossil fuel, and it could be used as a bridge technology to help cities transition from gasoline and diesel to alternative fuels, but the City should carefully weigh the benefits of CNG against the environmental degradation associated with extracting, transporting, and using natural gas (e.g. methane leakage, water pollution from fracking, etc.). Low domestic CNG prices present an opportunity to reduce operating costs and fleet emissions simultaneously, provided access to a refueling station is available. To further enhance the emission-reducing potential of electric and hybrid electric vehicle purchases, the City should implement Strategy F-1 (described above) to provide cleaner electricity through its EV charging stations. Implementation of this strategy could reduce emissions by up to 240 MT CO_2e per year (with implementation of Strategy F-1).

Action A: Municipal Fleet Emission Target

The City should establish a long-term target for the municipal fleet that promotes an overall reduction in petroleum fuel consumption. Fuel-based reduction goals can be achieved with investments in alternative fuel vehicles and refueling technology, depending upon technological advancements and City budget considerations. The target will focus future fleet procurement objectives and guide long-term public infrastructure investments. Like other strategies in this MOCAP, this strategy can also be used to support a broad based, community-wide market shift that supports the City's long-range community emission reduction targets. The City of San Jose has a similar fleet target, which promotes a shift to a public fleet with 100% alternative fuel vehicles by 2022.

Action B: Vehicle Fleet Plan

Following establishment of a fuel reduction target, the City should create a plan to achieve the target through replacement of non-emergency passenger vehicles and light-duty trucks with alternative fuel vehicles, assuming they meet the operational needs of the organization. Success in implementing a vehicle fleet plan will depend on the City's ability to implement other actions described in this strategy. Assuming that refueling infrastructure can be installed, the City should develop specific vehicle fleet targets for various types of alternative fuel vehicles. For example, the City could establish a long-term target to replace all diesel vehicles with CNG models at time of replacement. The City could also establish targets to transition passenger vehicles and light-duty trucks from gasoline to hybrid, electric, and/or CNG models, gradually increasing targets as achievements are made. Further, the City could transition medium- and heavy-duty vehicles to biofuel, and investigate the feasibility of using biogas in various vehicles. The implementation plan should be reviewed and revised annually to account for progress made, operating budgets, and emerging and evolving technologies.

Action C: CNG Fueling Station

The City is analyzing opportunities to convert some diesel vehicles to CNG models. While there are currently five CNG refueling stations in the County (three in San José, one in Cupertino, and

one in Santa Clara), and a sixth in the planning phase (in San José), the City could consider developing its own station for convenient, local access. A publicly accessible CNG station could also help support a community-wide shift toward CNG vehicles. Opportunities may exist for funding partnerships with other local governments, regional agencies, or local businesses that operate their own vehicle fleets.

Action D: Electric Vehicle Charging Stations

As previously noted, the City has four electric vehicle charging stations, with five more dual-port stations planned for installation. While the City anticipates incorporating primarily hybrid electric vehicles, certain City functions may allow for the purchase of 100% electric models, such as are being used by the Parks Division. Properly functioning recharging infrastructure will be required to support use of these vehicles. As with a CNG fueling station, publicly accessible electric vehicle charging stations can support the City's longer-term, community-wide emission reduction goals.

Strategy and Actions		Emission Reductions in 2020 with Strategy F-1 (MT CO_2e/year)	Emission Reductions in 2020 without Strategy F-1 (MT CO_2e/year)	Contribution to 2050 Target[1] in 2020	Contribution to 2050 Target[2] in 2050
VF-2	**Alternative Fuel Vehicles**	**240**	**150**	**6.2%**	**27.8%**
A.	Municipal Fleet Emission Target	Supporting action – supports Action B to establish framework for transitioning fleet to alternative fuel vehicles			
B.	Vehicle Fleet Plan	240	150	6.2%	27.8%
C.	CNG Fueling Station	Supporting action – supports City's ability to transition part of fleet to CNG vehicles; quantifications shown in Action B			
D.	Electric Vehicle Charging Stations	Supporting action – supports City's ability to transition part of fleet to electric vehicles; quantifications shown in Action B			

[1] Based on Scenario 1 in Table 3.2, which assumes Strategy F-1 is implemented.
[2] Based on Scenario 1 in Table 3.3, which assumes Strategy F-1 is implemented.

STRATEGY VF-3 BEHAVIOR / FUEL OPTIMIZATION

Encourage and Promote Fuel-Efficient Driving.

Reducing vehicle fleet fuel use translates directly into emission reductions. To accurately strategize and implement policies for promoting fleet efficiency, it is important to have accurate data about the fuel efficiency of vehicles and driver behaviors. Telematics systems installed on fleet vehicles can help optimize routes, enable managers to accurately track and monitor fuel

efficiency, and positively influence driver behavior. Honoring department managers and operators who model fuel-efficient practices can raise awareness of positive behaviors and encourage more widespread fuel savings. Implementation of this strategy could reduce emissions by up to 80 MT CO_2e per year (with implementation of Strategy F-1).

Action A: Telematics

Telematics systems can empower fleet managers and operators to quickly identify fuel consumption-related maintenance issues and inefficient driving patterns. Accurate telematics data provide documentation that enables confident decision-making when identifying potential vehicles for replacement and when transitioning to more fuel-efficient and alternative fuel vehicles. The system also enables staff to dispatch help more promptly to stranded vehicles.

Use of a telematics system can result in fuel savings and reduced engine wear by enabling staff to track idle times and send friendly reminders to drivers to shut off vehicles if idling longer than 5 minutes. In addition, since the system can also monitor speed, location, acceleration, and hard braking, drivers naturally tend to drive more slowly and safely when they know that the system can monitor these elements.

The City of Cupertino is a local example, based on its use of telematics for Building Department inspections. Mountain View is encouraged to consider a telematics system, as real-world examples have shown to produce fuel savings of 10–20% per year.

Action B: Fuel Saving Recognition Program for Employees / Departments

Establishing a program for recognizing employees and departments for reducing fuel usage and/or reducing vehicle miles travelled can raise awareness of exemplary behavior throughout departments. Identification of key performance indicators such as annual fuel use reduction compared to a historical baseline, or a per-employee efficiency average, can promote engagement from all departments (Typically, emergency services are excluded from these types of programs). Cupertino currently operates a rewards program that is linked to information generated by its fleet telematics program.

	Strategy and Actions	Emission Reductions in 2020 with Strategy F-1 (MT CO_2e/year)	Emission Reductions in 2020 without Strategy F-1 (MT CO_2e/year)	Contribution to 2050 Target[1] in 2020	Contribution to 2050 Target[2] in 2050
VF-3	**Behavior / Fuel Optimization**	**80**	**80**	**2.1%**	**2.3%**
A.	Telematics	80	80	2.1%	2.3%
B.	Fuel Saving Recognition Program for Employees / Departments	Supporting action – supports Action A to encourage fuel-efficient driving behavior			

[1] Based on Scenario 1 in Table 3.2, which assumes Strategy F-1 is implemented.

[2] Based on Scenario 1 in Table 3.3, which assumes Strategy F-1 is implemented.

SOLID WASTE SECTOR STRATEGIES

The Solid Waste sector is currently the largest contributor of greenhouse gas emissions in the inventory (61% in 2010), though this proportion will decrease considerably over time as methane generation within the closed Shoreline Landfill continues to decrease. Methane also has a high global warming potential; it is approximately 25 times more potent than carbon dioxide at trapping greenhouse gases in the atmosphere. Although nearly 94% of the landfill-generated methane is captured for beneficial reuse or destruction through flaring, the remaining 6% is considered fugitive methane, and is the primary contributor to the City's Solid Waste emissions at this time. Once the Shoreline Landfill ceases methane production, the City's Solid Waste emissions will be based solely on the disposal of waste generated from municipal activities, such as facility operations, park landscaping and maintenance, and other City activities. Although the majority of landfill emissions will cease around 2027, landfill gas will continue to be generated at lower levels through 2042 and beyond.

Numerous actions have already been taken to reduce City-generated waste. Paper and container recycling programs have been in place at all City facilities for a number of years. A recent operations and waste audit at the library resulted in the addition of hardback book and electronic media recycling programs, which resulted in landfilled tons being reduced by almost 50%, from 42 to 22 tons annually.

The City has been using mulching lawnmowers for the past 30 years to return grass clipping to the turf. This practice reduces maintenance costs and fertilizer needs. Similarly, the City chips all tree trimming material, and applies the mulch to bare landscape areas. All other green waste collected by the Parks Division is placed in designated bins for delivery to the SMaRT Station and subsequent composting at Z-Best.

For planned future actions, the City is developing a zero-waste strategy that will include diversion goals and descriptions of diversion programs. Currently, the City diverts 75% of its waste from landfills. The zero-waste strategy may include more aggressive targets, such as 90% diversion by 2025. Organic waste will be collected through the City's commercial/industrial composting program, which will allow collection of food scraps and compostable paper from City operations.

The City will continue its efforts to reduce the amount of waste generated from municipal operations, while diverting waste from landfills through composting, recycling, and reuse. Expanding upon existing efforts, this sector includes four strategies, including: establishing policies, goals, and audits to reduce waste; developing paperless office practices; expanding composting activities; and increasing construction and demolition diversion requirements. These strategies do not result in reductions of municipal electricity use, so the implementation of Strategy F-1 has no influence within this strategy sector. When implemented, the Solid Waste sector strategies have the ability to reduce emissions by approximately 360 MT CO_2e per year.

STRATEGY SW-1 WASTE REDUCTION

Reduce Municipal Waste through Procurement Policies, Waste Diversion Goals, and Waste Stream Monitoring and Analysis.

Cities can reduce their contribution of solid waste sent to landfills through careful consideration at the procurement phase of a product's recyclability, reuse opportunities, useful life expectancy, and comparable substitutes. Green procurement specifications can be enforced through incorporation of City-wide or departmental diversion goals that elevate these considerations during decisions-making processes. Similarly, monitoring the implementation of these policies and goals is necessary to evaluate the success of a waste reduction program. This strategy includes the development of procurement guidance documents, departmental waste diversion goals, and waste monitoring and tracking mechanisms. Implementation of this strategy could reduce emissions by 90 MT CO_2e per year.

Action A: Green Procurement Specifications

Green procurement specifications can be developed to prioritize City purchases that generate lower waste across a product's lifecycle, allow local recycling or composting, incorporate recycled or reused content, and support healthy working environments (e.g., low volatile organic compound (VOC) paints and carpets). The City should develop a user-friendly handbook that staff can use when making procurement decisions. The handbook would incorporate previous research efforts on preferred products for use in daily operations or at City-sponsored events, with an emphasis on preference for recycled/recyclable products, compostable products,

minimal packaging, and other low-waste options. The handbook should also incorporate or reference the City's existing Energy Efficient Procurement Policy to serve as a clearinghouse document on all City procurement policies related to resource conservation.

Action B: Waste Reduction and Diversion Goals

Adopting waste reduction and diversion goals would help support implementation of the City's future zero-waste strategy. The City could develop overarching goals at the City operation level (e.g., divert 90% of waste generated from City operations), as well as building- or department-specific goals that would allow each department to determine the most efficient strategies for goal achievement.

Action C: Waste Audits / Surveys and Diversion Rate Tracking at Municipal Facilities

Analysis of municipal waste volume and composition can provide important data about diversion target feasibility and waste reduction opportunities. Waste audits and surveys at municipal facilities also provide opportunities to engage department managers and employees regarding recycling and diversion efforts, potentially leading to higher participation rates and development of new strategies. The City has already received green business certification for City Hall, the Center for Performing Arts, the Library, the Senior Center, and the MOC, and certification of Fire Station #5 is underway. The City should continue this process until all municipal facilities have been certified, and partner with its franchise waste hauler to perform waste audits and develop a tracking/reporting mechanism to measure diversion target achievements.

	Strategy and Actions	Emission Reductions in 2020 with Strategy F-1 (MT CO_2e/year)	Emission Reductions in 2020 without Strategy F-1 (MT CO_2e/year)	Contribution to 2050 Target[1] in 2020	Contribution to 2050 Target[2] in 2050
SW-1	**Waste Reduction**	**90**	**90**	**2.3%**	**2.6%**
A.	Green Procurement Specifications	Supporting action – supports organic waste reduction that will lead to emission reductions, but is not individually quantifiable			
B.	Waste Reduction and Diversion Goals	90	90	2.3%	2.6%
C.	Waste Audits / Surveys and Diversion Rate Tracking at Municipal Facilities	Supporting action – supports implementation of Action B, but is not individually quantifiable			

[1] Based on Scenario 1 in Table 3.2, which assumes Strategy F-1 is implemented.
[2] Based on Scenario 1 in Table 3.3, which assumes Strategy F-1 is implemented.

STRATEGY SW-2 RECYCLABLE PAPER REDUCTION

Reduce Paper Use in Municipal Operations.

Office environments typically generate substantial waste from white paper, mixed office paper, newspaper, and corrugated cardboard. Approximately 90% of all office waste is paper. Enhanced office paper recycling can help reduce emissions associated with organic landfill waste, and help to conserve raw materials. In addition to fully implemented recycling programs, "paperless office" policies can further reduce office waste and lower operating costs by reducing unnecessary printing, minimizing space needed for paper file storage, and improving file management efficiency. This strategy incorporates technology and file management practices to enhance City waste reduction efforts. Implementation of this strategy could reduce emissions by 70 MT CO_2e per year.

Action A: Paperless Office Policy / Program

As a City in the heart of Silicon Valley, Mountain View should maximize its application of computer technology and digital systems in areas where it can lead to operational cost savings and resource efficiency. One opportunity is through development and implementation of paperless office practices. The City should transition to an electronic file-management system that reduces (or eliminates) paper waste. Implementing this action will require Environmental Sustainability and Information Technology (IT) staff to: investigate print-tracking software compliance problems, establish paper-use reduction goals, and develop employee education programs about file management processes and paper-use tracking. Paper reduction goals can be tracked through reduced procurement costs for paper, ink, and other printer-related costs.

Strategy and Actions	Emission Reductions in 2020 with Strategy F-1 (MT CO_2e/year)	Emission Reductions in 2020 without Strategy F-1 (MT CO_2e/year)	Contribution to 2050 Target[1] in 2020	Contribution to 2050 Target[2] in 2050
SW-2 Recyclable Paper Reduction	**70**	**70**	**1.8%**	**4.4%**
A. Paperless Office Policy / Program	70	70	1.8%	4.4%

[1] Based on Scenario 1 in Table 3.2, which assumes Strategy F-1 is implemented.
[2] Based on Scenario 1 in Table 3.3, which assumes Strategy F-1 is implemented.

STRATEGY SW-3 LANDSCAPE WASTE DIVERSION

Expand City Efforts in Landscape Waste Composting.

Organic materials such as grass clippings, leaves, branches, stumps, and other landscape waste products can be composted or mulched for beneficial reuse and diversion from landfills, where they would otherwise decompose to release methane gas. As previously described, the City already has an effective green waste collection system through its Parks Division. This strategy presents one opportunity for expansion of this program. Implementation of this strategy could reduce emissions by 80 MT CO_2e per year.

Action A: Municipal Landscape Waste Composting Program

While the landscape crews move most of the green material generated through maintenance activities to the green waste box located at the Municipal Operations Center, for efficiency purposes, some trimmings are placed in trash bins at the parks. The new commercial organics collection program provides an opportunity to place green waste bins at parks that generate enough trimmings, thereby increasing source-separated diversion of these materials.

Strategy and Actions	Emission Reductions in 2020 with Strategy F-1 (MT CO_2e/year)	Emission Reductions in 2020 without Strategy F-1 (MT CO_2e/year)	Contribution to 2050 Target[1] in 2020	Contribution to 2050 Target[2] in 2050
SW-3 Landscape Waste Diversion	**80**	**80**	**2.1%**	**2.3%**
A. Municipal Landscape Waste Composting Program	80	80	2.1%	2.3%

[1] Based on Scenario 1 in Table 3.2, which assumes Strategy F-1 is implemented.
[2] Based on Scenario 1 in Table 3.3, which assumes Strategy F-1 is implemented.

STRATEGY SW-4 CONSTRUCTION AND DEMOLITION WASTE DIVERSION

Increase Construction and Demolition Waste Diversion Rates for Municipal Projects.

According to the City's 2010 Waste Characterization Study, construction and demolition (C&D) materials account for approximately 10% of the waste stream in Mountain View. Many

construction materials can be diverted from the waste stream for reuse or recycling, including scrap lumber, concrete and asphalt, bricks, scrap metal, and drywall.

The California Green Building Code currently requires 50% diversion of C&D materials for all new projects, with few exceptions. The City formalized this requirement through adoption of a C&D ordinance. As green building practices become more common in the region, waste haulers and contractors will improve their abilities to divert higher percentages of C&D waste in support of project documentation requirements for various green building certification programs (e.g., LEED, Green Point Rated). This strategy expands the City's commitment to C&D waste diversion efforts. Implementation of this strategy could reduce emissions by 120 MT CO_2e per year.

Action A: Municipal Construction and Demolition Standards

The City could increase its C&D diversion requirements for municipal projects (e.g., 75%). The City has already adopted green building standards that require achievement of LEED Silver certification in new municipal construction projects. Similar to Strategy F-4, which suggests specific energy efficiency targets be established for new construction or substantial retrofits, this action could be implemented as part of the green building standards as well. Both strategies expand upon existing City actions with a focus on emission reduction opportunities in construction projects. Prior to revising the City's existing 50% C&D diversion requirement, City staff should research opportunities and constraints associated with implementing more stringent requirements, such as the ability of local waste haulers and area landfills to achieve higher diversion rates. The City of San Francisco has required 65% diversion from C&D projects since 2006, indicating feasibility in the Bay Area to exceed current statewide requirements.

	Strategy and Actions	Emission Reductions in 2020 with Strategy F-1 (MT CO_2e/year)	Emission Reductions in 2020 without Strategy F-1 (MT CO_2e/year)	Contribution to 2050 Target[1] in 2020	Contribution to 2050 Target[2] in 2050
SW-4	**Construction and Demolition Waste Diversion**	**120**	**120**	**3.1%**	**4.4%**
A.	Municipal Construction and Demolition Standards	120	120	3.1%	4.4%

[1] Based on Scenario 1 in Table 3.2, which assumes Strategy F-1 is implemented.

[2] Based on Scenario 1 in Table 3.3, which assumes Strategy F-1 is implemented.

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Chapter 4

PLAN IMPLEMENTATION

This chapter describes how the City will implement the MOCAP emission reduction strategies and actions. The chapter covers the following topics:

- Implementation and Monitoring: This section describes how City staff will implement the MOCAP strategies and related actions, and track progress against the goals identified for each strategy within Chapter 3.
- MOCAP Evaluation and Evolution: This section discusses a process for evaluating, updating, and amending the MOCAP over time, so it remains effective and current.

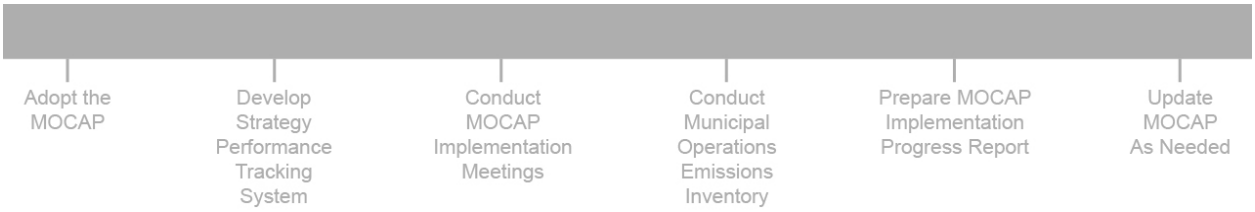
Implementation and Monitoring

Ensuring that the MOCAP strategies translate from this document into on-the-ground results is critical to the success of the MOCAP and the City reaching its 2035 and 2050 emission reduction targets. To facilitate this, each strategy described in Chapter 3 contains an associated table that identifies the strategy's greenhouse gas (GHG) reduction amount in 2020 and its contribution toward meeting the City's 2050 reduction targets.

To help City staff implement the MOCAP strategies, Appendix C provides the specific actions the City can take for each strategy and the City department responsible for those actions. Appendix C also provides performance goals for 2020, 2035, and 2050 to enable City staff, the City Council, and the public to track strategy implementation and monitor overall MOCAP implementation progress. The 2020 and 2035 performance goals are especially important, as they provide a checkpoint to evaluate if a strategy is on target to achieving its anticipated long-term emission reductions. The 2050 performance goals are only provided for demonstrative purposes, due to the inherent uncertainties associated with emission reductions over the next thirty-five years. These performance goals indicate what level of performance would be required to achieve the City's 2050 target. The ability for the City to actually achieve the estimated 2050 performance goals should be reviewed and revised as that future target year approaches.

Each strategy's estimated GHG emission reductions are based on that strategy's quantified performance goals, which will help City staff track progress toward the GHG reduction targets. For example, Strategy F-2 (shown in Table 4.1) focuses on the installation of renewable energy systems. The strategy's estimated GHG emission reductions are based on various assumptions, including the generation capacity of additional solar photovoltaic and solar hot water systems installed on City buildings, parking lots, and other facilities between 2010 and the 2020 target year. For 2020, the performance goals are based on installation of an additional 1 MW (approximately 70,000 square feet) of photovoltaic systems on City buildings, parking lots, and other facilities, and installation of solar hot water systems at the Eagle and Rengstorff swimming pool facilities (which will displace 50% of hot water related natural gas demand at each site). If the City is able to install more renewable energy capacity than estimated in this strategy, additional emission reductions will occur. Likewise, if the amount of renewable energy installed is less than the amount indicated in the performance goals, then this strategy will achieve less than its stated GHG reductions.

Upon adoption of the MOCAP, the City departments identified in Appendix C will have responsibility for investigating or implementing their assigned actions. Environmental Sustainability staff will work with key staff in each department to facilitate the strategies and actions. To assess the status of City efforts, MOCAP implementation meetings should take place on a regular basis. Some actions will require interdepartmental cooperation, and appropriate partnerships will need to be established.



MOCAP Evaluation and Evolution

The MOCAP represents the City's first plan to reduce municipal operations GHG emissions in alignment with its adopted short- and long-term absolute reduction targets. Staff will need to evaluate the MOCAP's performance over time and be ready to alter the plan if it is not achieving its reduction targets.

MOCAP Evaluation

Two types of performance evaluation are important: (a) evaluation of the City's overall ability to reduce GHG emissions, and (b) evaluation of the performance of individual MOCAP strategies. Municipal operations emission inventories will provide the best indication of MOCAP effectiveness. Conducting these inventories periodically will enable direct comparison to the 2005 baseline inventory and measurement of progress toward meeting the City's adopted, absolute GHG reduction targets.

GHG inventories provide information about overall emission reductions, but it will also be important to understand the effectiveness of each strategy. Evaluation of the emission reduction progress of individual strategies will improve staff and decision makers' ability to manage and implement the MOCAP. The City can reinforce successful strategies and reevaluate or replace underperforming ones. Evaluating strategy performance will require implementation-level data.

To track strategy performance, City staff will need to collect key pieces of data. While much of the data is already available in existing reports or processes, some improvements in data collection will be needed. It is therefore important that Environmental Sustainability staff and key staff from relevant departments establish methods of collecting data in a consistent and, ideally, centralized way. Once the data is collected, City staff will be able to track strategy implementation effectiveness.

Table 4.1 provides an example of a tracking template that could be used to monitor the effectiveness of each MOCAP strategy. The table is similar to those included in Appendix C, but has been expanded to include Phasing and Tracking Mechanisms. The Phasing column allows each responsible department to identify internal timelines for implementing specific action steps. These could be expressed as specific target years or more generally as short-, medium-, and long-term actions. The Tracking Mechanisms specify how implementation of the Goals will be monitored. The Goals should be evaluated regularly to ensure each strategy is on track to achieve its stated emission reductions. If during the implementation review process a strategy is

found to be falling short of its performance goals, then additional attention can be given to modifying the implementation actions. If implementation review indicates that a strategy will be unable to achieve its stated reduction level, then new MOCAP strategies would need to be developed to make up the difference, or other existing strategies could be enhanced to increase their emission reduction potential. MOCAP implementation should be an iterative process to reflect future changes in technology, available budget, and staff resources. City staff will use the Strategy Implementation Tracking Template and develop a performance tracking system that covers each MOCAP strategy and action.

Environmental Sustainability staff will collaborate with staff from responsible departments to evaluate strategy performance on a regular, defined basis. Environmental Sustainability staff will prepare a periodic summary report that outlines progress toward MOCAP strategies and actions. (The report could cover areas such as estimated GHG emission reductions to date, progress toward the next reduction target, progress toward implementation of the actions, achievement of strategy performance goals, implementation challenges, and recommended next steps.) Staff may want to deliver this report in conjunction with the State-required annual report to the City Council regarding implementation of the City's General Plan.

MOCAP EVOLUTION

For it to remain relevant, the MOCAP should be adapted over time. In the future, new GHG reduction technologies and strategies will be developed, new financing mechanisms will be available, and State and Federal legislation will change. It is also possible that future GHG emission inventories will indicate that the City is not on track toward achieving its adopted GHG reduction targets. If this is the case, the City can assess the implications of new scientific findings, explore new emission reduction technologies, respond to changes in State and Federal climate change policy, and modify the MOCAP accordingly to help the City get back on track toward meeting its GHG reduction targets.

Table 4.1
Example Strategy Implementation Tracking Template

STRATEGY F-2 Renewable or Low-Carbon Electricity Generation

Develop Additional Renewable Energy Facilities.

Actions and Implementation Steps	Department Responsible	Phasing
A. Solar PV Installations on City Buildings, Parking Lots, Land ▪ Based on results of City's current feasibility study for solar PV sites, determine the most cost-effective financing mechanism to install PV systems at the 135 Bryant St. Parking Garage, the MOC, Fire Station #5, the Shoreline Maintenance Facility, the Shoreline Golf Pro Shop, and/or other City facilities. ▪ Pending installation of previous five PV sites, examine future potential for additional PV installations on City-owned parking lots.	Public Works	Establish a target date or timeframe for implementing each action, (e.g., September 2015, Fall 2015, or FY 2015–16.)
B. Solar Hot Water Installations in City Facilities ▪ Conduct feasibility analysis for solar hot water systems at City pools (i.e., Eagle and Rengstorff). ▪ Based on results of study, implement cost-effective solar hot water options. ▪ Review hot water usage at existing City buildings to identify additional cost-effective solar hot water installations.	Public Works	
Goals	**Year**	**Tracking Mechanisms**
▪ Installation of 1 MW (approximately 70,000 square feet) of distributed PV systems on City buildings, parking lots, and land ▪ Installation of solar hot water (SHW) systems on City buildings replaces 12% of 2010 baseline natural gas consumption; installed SHW systems achieve 50% solar fraction (i.e., solar energy replaces 50% of natural gas demand).	2020	Collect installation data from renewable energy project contracts (or meters) and analyze data to gauge progress toward goals: Examples: What was the total installed generation capacity (in MW) for the additional photovoltaic systems? How many therms of natural gas will be reduced by the solar hot water systems?

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Appendix A

GHG Inventory Methodology

2005 and 2010 Baseline Emission Inventories Assumptions and Methods

EMISSIONS QUANTIFICATION METHODOLOGY

The California Air Resources Board, ICLEI – Local Governments for Sustainability (ICLEI), and the Climate Registry (TCR) have co-developed standardized methods for quantifying and reporting GHG emissions from local government sources. These methods are contained within the Local Government Operations Protocol (LGOP).

The Mountain View municipal operations 2010 inventory was developed by the City of Mountain View in cooperation with Joint Venture: Silicon Valley. The 2005 inventory was developed by ICLEI and uses the same methodologies used within the 2010 inventory.

Emissions Inventory Boundaries

Establishing the boundaries of an emissions analysis is an important first step in the greenhouse gas (GHG) inventory process. A city exerts varying levels of control or influence over the activities occurring within its borders. A municipal GHG inventory should be defined broadly enough to include all emissions sources that fall within the local government's direct and indirect control. In general, the inventory should encompass sources that are within the purview of the City's discretionary actions and regulatory authority, including sources of indirect emissions that can be influenced by City policies or programs, such as waste reduction.

Mountain View's Organizational Boundary

Setting an organizational boundary for a GHG inventory involves identifying the facilities and operations that are to be included. National and international GHG accounting standards define the organizational boundary as the boundary that determines the operations owned or controlled by the reporting entity. The City of Mountain View's municipal operations inventory encompasses the GHG emissions resulting from actions governed directly by the local government, such as municipal buildings, fleet, and streetlights. It should be noted that emissions from City employee commute trips were excluded from the inventories due to the lack of ownership of or control over the employee vehicles and employees commuting choices. This exclusion is compatible with the guidance provided within the LGOP.

Scope of Emissions Sources in Mountain View

The GHG Protocol defines the operational boundary as the sum of all sources of direct and indirect emissions that are included in the inventory. The GHG Protocol divides the operational boundary into three different Scopes, defined as follows:

- **Scope 1** emissions are those that come from sources that are owned or controlled by the reporting entity, in this case, the City of Mountain View. From the municipal perspective, Scope 1 emissions are direct GHG emissions from sources owned or controlled by the City within Mountain View's boundaries. Such sources

include stationary emitters like furnaces and boilers, and mobile emitters like vehicles and construction equipment.

- **Scope 2** emissions are indirect GHG emissions related to the consumption of purchased energy (i.e., electricity) that is produced by third-party entities, such as power utilities. From the municipal perspective, the emissions associated with all power purchased by the City are considered Scope 2.
- **Scope 3** emissions are other indirect GHG emissions not covered by Scope 2 that are associated with municipal activities. In a municipal inventory this generally includes emissions occurring upstream or downstream of a municipal activity, such as the methane emissions resulting from degradation of the City's solid waste deposited at a landfill outside of city limits, or the electricity used to pump water to the City from upstream reservoirs. Quantification and reporting of Scope 3 emissions is generally considered optional, but including them in a municipal inventory is appropriate where there is local control over an activity that has an indirect emissions reduction impact, such as diverting waste from landfills.

The 2010 municipal operations inventory includes emissions from the following sectors:

- **Solid Waste:** This sector comprises the total solid waste sent to or contained within government-operated landfills (Scope 3), and solid waste sent to a landfill that is generated by government-owned and/or operated facilities (Scope 3);
- **Facilities:** This sector comprises direct stationary emissions from natural gas combustion (Scope 1) and indirect emissions from purchased electricity for City buildings and facilities, and City streetlights and traffic signals (Scope 2);
- **Vehicle Fleet:** This sector includes direct emissions from fuel combustion in fleet vehicles (Scope 1); and
- **Water and Wastewater**: This sector comprises indirect emissions from electricity used to convey water and wastewater within the City (Scope 2).

MUNICIPAL OPERATIONS INVENTORY METHODS BY SECTOR

Solid Waste

The Solid Waste sector comprises the Municipal Operations and Landfill subsectors. The Municipal Operations subsector includes landfill methane emissions produced by solid waste generated by City government facilities. Municipal solid waste and recycling volume data was provided for each city facility. In accordance with the LGOP, a first order decay method was used to estimate the amount of fugitive methane emissions generated from the waste sent to landfills. The Landfill subsector includes landfill methane emissions generated by solid waste contained within the City of Mountain View's closed Shoreline Landfill facility. Data for the volume of methane generated and the amount combusted at flare stations and micro-turbines were provided by facility staff.

Facilities

The Facilities sector comprises the Building Energy and Public Lighting subsectors. Building Energy emissions were calculated using metered electricity and natural gas activity data from the buildings and facilities operated by the City of Mountain View and 2005 and 2010 emission factors. The activity data and emission factors were provided by PG&E. The Public Lighting subsector includes electricity consumption from City-operated streetlights, traffic lights, and other outdoor lighting operated by the City. Emissions were calculated using activity data from the streetlight, traffic light, and other outdoor lighting meters and 2005 and 2010 emission factors. The activity data and emission factors were provided by PG&E.

Vehicle Fleet

This sector includes emissions from on-road and off-road fuel consumption from vehicles operated by the City of Mountain View, including the City vehicle fleet. Fleet data and fuel usage data was provided by the City. Relevant emission factors were applied to both gasoline and diesel fuel quantities to obtain emissions estimates.

Water and Wastewater

This sector comprises electricity consumed by the City's water delivery and stormwater subsector and wastewater subsector (collection, transmission, and handling equipment). The activity data were provided by each City facility. Emission factors were provided by PG&E.

2005 AND 2010 MUNICIPAL OPERATIONS INVENTORY RESULTS

The results from the 2005 and 2010 emission inventories are included in Table A-1.

It should be noted that both the 2005 and 2010 municipal inventories were prepared separately from the remainder of the MOCAP (i.e., emissions forecasts, MOCAP document, supporting appendices), and were not prepared by the MOCAP project team. Per the Santa Clara County regional CAP project scope under which the MOCAP was prepared, the 2010 municipal inventory was used as the baseline from which the 2020, 2035, and 2050 emissions forecasts were calculated. The 2010 municipal inventory totals were provided in metric tons of carbon dioxide equivalent (MT CO_2e). However, the supporting activity data and emissions factors used to prepare the 2010 inventory analysis were not provided to the MOCAP project team in a standardized format, and therefore are not represented in Table A-1.

Table A-1
Municipal Operations Emissions for 2005 and 2010

Sector	Subsector	Emissions (MT CO_2e/yr)			
		2005	% of total	2010	% of total
Solid Waste		**10,026**	**64.1%**	**7,783**	**60.6%**
	Municipal Operations	*495*	*3.2%*	*556*	*4.3%*
	Landfill (closed)	*9,531*	*61.0%*	*7,226*	*56.3%*
Facilities		**3,375**	**21.6%**	**2,836**	**22.1%**
	Building Energy	*2,735*	*17.5%*	*2,246*	*17.5%*
	Public Lighting	*640*	*4.1%*	*591*	*4.6%*
Vehicle Fleet		**1,722**	**11.0%**	**1,761**	**13.7%**
Water and Wastewater		**510**	**3.3%**	**467**	**3.6%**
	Water and Stormwater Facilities	*510*	*3.3%*	*371*	*2.9%*
	Wastewater Services	*Included in Water*	*NA*	*96*	*0.7%*
Total		**15,633**		**12,846**	

Note: MT CO_2e = metric tons of carbon dioxide equivalent; column sums may not match total shown due to rounding

Emission Forecasts Assumptions and Methods

Forecast Methodology

While standardized methods for quantifying *baseline* local government operations emissions are provided within the LGOP, the LGOP does not provide guidance on developing *future-year* emissions forecasts. For this reason AECOM utilized a growth estimation methodology based on methods used frequently within city fiscal impact analyses. Rather than assuming that each emissions sector will increase at a one-to-one ratio with new population and employment growth, the analysis assumes that a portion of each sector's activity is independent and not influenced by growth. To reflect this assumption, the analysis estimates the degree of independence or dependence (expressed as a variable percentage) for each sector. The higher the percentage the more closely correlated the growth in emissions is to the growth in population and employment (referred to as service population). The factors used within the MOCAP are presented below in Table A-2.

Table A-2
Sector Activity Growth Variable Factors

Sector / Subsector	Variable Factor
Solid Waste	
Municipal Operations	20%
Landfill (closed)	-6%
Facilities	
Building Energy	20%
Public Lighting	20%
Vehicle Fleet	30%
Water and Wastewater	
Water and Stormwater Facilities	90%
Wastewater Services	90%

Municipally-generated waste, building energy, and public lighting factors are 20% based on the understanding that future city growth will not create much additional need for city administrative operations, and since the growth is of an infill nature it is unlikely that public lighting needs will greatly increase. The vehicle fleet factor is 30% based on the reality that the infill growth will generate only a small increase in the need for City vehicle use (e.g., police and code enforcement). The water and wastewater sector used a 90% factor based on the assumption that treating and pumping demand will likely grow in close parallel to service population growth, but some efficiencies of scale would exist. It should be noted that the negative variable factor for the landfill subsector (-6%) was developed to reflect the closed status of the Shoreline Landfill and the declining amount of waste-in-place; over time the organic component of waste-in-place decomposes and produces fewer and fewer methane emissions. AECOM estimated the annual rate of emissions reduction based on the City's fugitive methane data from 2005 and 2010. It is acknowledged that this is a rough approximation of the actual rate of emissions decline; a detailed analysis was out of the scope of this project.

Additionally, the analysis utilized service population factors to identify the amount of emissions likely generated by an additional resident and employee. A residential factor of 100% and an employment factor of 50% were utilized. The lower employment factor serves to reduce the overall service population growth factor, and reflects the reality that the average resident demands considerably more services than the average non-resident employee. Table A-3 demonstrates how these factors dampen the service population growth rate.

The application of the sector variable factors and the residential and employment factors allow a more appropriate method for estimating municipal operations growth. Using this method, emissions forecasts were developed for 2020, 2035, and 2050.

Table A-3
Residential and Employment Factors Influence on Service Population Growth Rates

	2010		2020		2035		2050	
	Value	Service Factor	Value	Service Factor	Value	Service Factor	Value	Service Factor
Population	72,100	1.0	79,670	1.0	89,868	1.0	101,370	1.0
Employment	51,990	0.5	68,816	0.5	87,583	0.5	111,467	0.5
Raw Service Population	124,090		148,486		177,451		212,837	
Raw Service Population Annual Growth Rate	-	-	2010-2020	1.97%	2020-2035	1.30%	2035-2050	1.33%
Weighted Service Population	98,095		114,078		133,660		157,104	
Weighted Service Population Annual Growth Rate	-	-	2010-2020	1.63%	2020-2035	1.14%	2035-2050	1.17%

BUSINESS-AS-USUAL AND ADJUSTED BUSINESS-AS-USUAL FORECASTS

It is standard practice to prepare both Business-as-Usual (BAU) and Adjusted Business-as-Usual (ABAU) emissions forecasts. BAU forecasts assume that no action, local or otherwise, is taken to reduce emissions in the future. Emission factors are held constant and activity levels increase only in relationship to the natural growth or decline of the sector. ABAU forecasts account for anticipated emission reductions from implementation of State, federal, or other agency actions. In California, ABAU forecasts often include: (1) anticipated emission reductions from improved electricity emission factors related to the mandated Renewable Portfolio Standard (RPS), (2) improvements in new building energy efficiency related to the State energy code, (3) reductions in the carbon content of vehicle fuels from the Low Carbon Fuel Standard (LCFS), and (4) various other improvements in vehicle efficiency from State and federal requirements.

In the City's ABAU forecast, only the effects of the RPS are included. This is due to the fact that some of the City's proposed MOCAP strategies, if implemented, would overlap and potentially surpass these State and federal actions. For example if the City chooses to switch a high portion of its vehicle fleet from gasoline vehicles to electric or compressed natural gas vehicles, then taking credit for the LCFS would be inappropriate, as it would double count emissions reductions between the local and State actions.

FORECAST RESULTS

The results from the 2020, 2035, and 2050 BAU emission forecasts are included in Table A-4, while ABAU forecasts are shown in Table A-5.

Table A-4
Municipal Operations "BAU" Emissions (2005-2050)

Sector	Subsector	Emissions (MT CO_2e/year)				
		2005	2010	2020	2035	2050
Solid Waste		**10,026**	**7,783**	**4,294**	**1,967**	**1,222**
	Municipal Operations	*495*	*556*	*574*	*594*	*615*
	Landfill (closed)	*9,531*	*7,226*	*3,719*	*1,373*	*507*
Facilities		**3,375**	**2,836**	**2,929**	**3,029**	**3,135**
	Building Energy	*2,735*	*2,246*	*2,319*	*2,398*	*2,482*
	Public Lighting	*640*	*591*	*610*	*631*	*653*
Vehicle Fleet		**1,722**	**1,761**	**1,847**	**1,942**	**2,044**
Water and Wastewater		**510**	**467**	**436**	**618**	**715**
	Water and Stormwater Facilities	*510*	*371*	*426*	*492*	*569*
	Wastewater Services	*Included in Water*	*96*	*110*	*126*	*146*
Total		**15,633**	**12,846**	**9,604**	**7,556**	**7,017**

Note: MT CO_2e = metric tons of carbon dioxide equivalent; column sums may not match total shown due to rounding

Table A-5
Municipal Operations "ABAU" Emissions (2005-2050)

Sector	Subsector	2005 Emissions (MT CO_2e/yr)	2010 Emissions (MT CO_2e/yr)	2020 Emissions (MT CO_2e/yr)	2035 Emissions (MT CO2e/yr)	2050 Emissions (MT CO2e/yr
Solid Waste		**10,026**	**7,783**	**4,278**	**1,952**	**1,107**
	Municipal Operations	495	556	574	594	615
	Landfill (closed)	9,531	7,226	3,704	1,358	492
Facilities		**3,375**	**2,836**	**2,490**	**2,569**	**2,655**
	Building Energy	2,735	2,246	2,015	2,080	2,149
	Public Lighting	640	591	475	490	506
Vehicle Fleet		**1,722**	**1,761**	**1,847**	**1,942**	**2,044**
Water and Wastewater		**510**	**467**	**420**	**480**	**554**
	Water and Stormwater Facilities	510	371	334	382	441
	Wastewater Services	Included in Water above	96	86	98	113
Total		**15,633**	**12,846**	**9,035**	**6,943**	**6,360**

Source: AECOM 2013
Note: MT CO_2e = metric tons of carbon dioxide equivalent; column sums may not match total shown due to rounding

Appendix B

Past City Actions

As described in Chapter 3, reduction strategies were developed as part of a regional effort among other Santa Clara County participating jurisdictions. The strategy development process began with a review of best management practices (BMP) in emissions reductions from other jurisdictions within California and around the world. These BMPs were then compared against existing or planned City actions, policies, and programs to identify opportunities for expansion of existing City actions as well as opportunities for new action.

Table B-1 shows the BMP list used to initiate the strategy development process. The table is organized topically by strategy areas (e.g. Facilities, Vehicle Fleet), then by sub-strategies (e.g. Low-Carbon Grid Electricity, Existing Building Energy Retrofits). The BMPs are presented in the left hand column as "Measures". The next four columns indicate if a particular BMP is "Existing" within the City, "Planned" for future implementation, or an opportunity to "Expand" existing City actions or develop "New" actions. The right hand column then presents notes describing the City's existing and planned BMPs, as well as the MOCAP project team's rationale for initially considering expanded or new opportunities. BMPs in which none of the four columns are marked indicate strategies that have not yet been implemented within the City and were not considered priority opportunities at this time.

Some of the BMP strategies or sub-strategies do not apply to the Mountain View context (e.g. Airport Energy Efficiency Retrofits), but are included in the table because this work was prepared through the previously-mentioned regional framework.

Note: Table B-1 provides a snapshot of the initial strategy development process, and represents the first filter of potential opportunities for the City's MOCAP. Additional meetings with City staff resulted in the refined list of final opportunities presented in Chapter 3.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		EXISTING	PLANNED	EXPAND	NEW	NOTES / RATIONALE
FACILITIES						
F-1	**Low-Carbon Grid Electricity**					
A	Utility-Enhanced Clean Generation Portfolio				X	**New:** Environmental Sustainability Task Force (ESTF) report recommends city enroll in PG&E's ClimateSmart program to offset all GHG emissions resulting from city's energy use.
B	Community Choice Energy					
C	Utility-Scale Renewable or Low-Carbon Electricity Generation				X	**New:** The City is waiting to see if SB 43 (Community Solar) passes, which would provide another avenue for contemplating a large solar installation. Utility scale generation can be a cost effective way to reduce emissions and reduce long-term energy costs.
F-2	**Site-Scale Renewable or Low-Carbon Electricity Generation**					
A	Energy Bonds (CREBS and QECBS)					
B	Solar PV Installations on City / County Buildings, Parking Lots, Land	X	X	X		**Existing:** California Street parking structure has 90 kW PV system; City uses 2 Solar Bee pumps in the Shoreline Sailing Lake and 2 solar pumps at the Municipal Operations Center (MOC) Whisman Reservoir to circulate water. **Planned:** City is evaluating the feasibility of installing solar PV at 5 facilities: 135 Bryant St. Parking Garage, MOC, Fire Station #5, Shoreline Maintenance Facility, and Shoreline Golf Pro Shop. **Expand:** Greenhouse Gas Reduction Plan (GGRP) action item to conduct feasibility analysis for solar PV installations on other city facilities.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		**EXISTING**	**PLANNED**	**EXPAND**	**NEW**	**NOTES / RATIONALE**
C	Solar Thermal Installations on City / County Facilities	X	X		X	**Existing:** City prepared high-level analysis of potential solar thermal sites with NREL. **Planned:** City plans to investigate installation of solar hot water systems on its facilities in FY 2014-2015. **New:** ESTF report recommends city install Solar Hot Water (SHW) on all City buildings where net present value (NPV) of project is positive. SHW systems are most cost effective for large hot water consumers, such as swimming pool heating systems.
D	Ground Source Heat Pump					
E	Fuel-Cell Installations					
F	Biogas Capture / Combustion	X				**Existing:** Landfill gas captured from city's landfill at Shoreline Regional Park provides power for 1 local business and city facilities. A private company purchases enough gas to produce 1 MW of electricity; the landfill gas also powers two microturbines that provide 130 kW of electricity to the city-owned Flare Station and Irrigation and Sewage Pump Stations.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		EXISTING	PLANNED	EXPAND	NEW	NOTES / RATIONALE
F-3	**Existing Building Energy Retrofit**					
A	Energy Efficiency Fund				X	**New:** Energy efficiency fund creates self-renewing source of funds for energy efficiency investment. San Jose's program has been successful and could be replicated in Mountain View.
B	Building Retrofit Standard (e.g., LEED Silver)	X				**Existing:** City Council adopted policy in March 2009 requiring all new public construction and renovation projects over 5,000 square feet to be designed to LEED Silver standards.
C	Building Energy Benchmarking	X	X			**Existing:** The City is tracking building energy usage through the Energy Star Portfolio Manager. **Planned:** In FY 2014-15, staff will investigate the feasibility of using a more sophisticated Energy Management System (EMS).
D	Municipal Building Energy Retrofit Targets / Policy (e.g., Reduce Energy Use by XX%)		X			**Planned:** GGRP measure to reduce municipal building energy use by 121 MWh/yr by 2020 and another 121 MWh/yr by 2030.
E	Building Energy Audits	X	X			**Existing:** City performs ongoing energy audits of municipal buildings. **Planned:** City planning to audit highest energy-using buildings in 2014-15, and perform upgrades over the next several years as time and budget allows.
F	Building Energy Audit Targets / Policy (e.g., # of Audits/yr, Audits Required Every 5 yrs.)		X			**Planned:** GGRP action item to develop schedule for municipal building energy audits such that buildings are audited every 10 years.
G	Energy Service Companies (ESCO)				X	**New:** Reduces potential first cost barriers by utilizing private sector to finance and implement energy efficiency investments.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		**EXISTING**	**PLANNED**	**EXPAND**	**NEW**	**NOTES / RATIONALE**
H	Indoor Lighting Retrofits (e.g., Ballast Lighting, Exit Signs)	X	X			**Existing:** City installed efficient lighting, lighting occupancy sensors, and energy-efficient office equipment in several buildings; replaced 162 metal halide fixtures at Mountain View Sports Pavilion and Whisman Sports Center with fluorescent T-5 lamps; retrofitted approximately 1,700 T-12 fluorescent bulbs with T-8 fluorescent tubes and ballasts at Police/Fire Administration Building; replaced 250-watt metal halide fixtures with high-bay T-5 fluorescent fixtures at Fleet Services Building; replaced T-8 lighting fixtures in Civic Center stairwells with energy-saving bi-level fixtures with motion sensors; replaced antiquated lighting control system for City Hall, Center for Performing Arts (CPA), and Library; retrofitted interior lighting at Community Center; and retrofitted CPA balcony with LEDs. **Planned:** Will retrofit canned, tube, and rope lighting in Library, City Hall and CPA with LEDs.
I	Exterior Building Lighting Retrofits (e.g., Security Lighting)	X	X			**Existing:** Retrofitted high pressure sodium (HPS) lamps in Pioneer Park, Centennial Plaza, and Eagle Park with induction lights. Retrofitted exterior and parking lot lighting at Community Center. In process of retrofitting exterior lights at MOC with LEDs. **Planned:** Retrofitting lights in Charleston Park with induction fixtures.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		EXISTING	PLANNED	EXPAND	NEW	NOTES / RATIONALE
J	Parking Garage Lighting Retrofits	X	X	X		**Existing:** Replaced 46 metal halide fixtures with LED bi-level fixtures in library parking garage, and 150 HPS lights in Bryant Street Parking Structure; replaced fixtures in City Hall and CPA garages with LED bi-level lighting. **Planned:** Retrofitting fixtures at 850 California Street garage with LEDs.
K	Advanced Lighting Controls / Monitoring Systems (e.g., Automatic Dimmers)	X	X			**Existing:** Completed Master Lighting Control project, enabling remote access scheduling and shut-down capabilities in City Hall, CPA, and Library. **Planned:** Lighting control project at MOC.
L	Building Envelope Retrofits					
M	Building Systems Retrofits (e.g., HVAC, MEP)	X	X			**Existing:** High-efficiency chiller installed at Civic Center; installed 4-5 new HVAC units at Community Center. **Planned:** New boilers at City Hall and CPA, and improved HVAC controls at Library. Will evaluate condition of HVAC at MOC and Fire Station #1.
N	Cool Roof Retrofits	X	X			**Existing:** Cool roofs on MOC Buildings A, B, C, Fleet, and Warehouse. **Planned:** Install cool roof on MOC and Police / Fire Administration Building in FY 2016-17.
O	Green Roofs					City has identified a green roof on a new downtown commercial property that will serve as a case study pilot to educate others about what's involved. No City green roofs planned.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		**EXISTING**	**PLANNED**	**EXPAND**	**NEW**	**NOTES / RATIONALE**
P	Low-Flow Fixtures at Public Facilities (e.g., Pool Showers)	X				**Existing:** City installed low-flow showerheads and upgraded pool showerheads; also installed low-flow and automatic faucets in public buildings (e.g., City Hall, Police locker rooms); installed 145 high-efficiency showerheads and faucet aerators in public buildings. The new models use 2.0 and 1.5 gallons per minute, respectively.
Q	Low-Flow Toilets	X				**Existing:** Retrofitted 80 toilets with green dual-flush handles; installed / retrofitted 175 high-efficiency toilets and urinals in public buildings. The new models / retrofits use 1.28 and 0.125 gallons per flush, respectively.
F-4	**New Building Energy Performance**					
A	Green Building Standard (with Specific Energy Performance Requirement)	X		X		**Existing:** City Council adopted policy in March 2009, requiring all new public construction and renovation projects over 5,000 square feet to be designed to LEED Silver standards. Fire Station #5 achieved LEED Gold certification. **Expand:** City could consider defining desired outcome from LEED certification to help guide building design projects (e.g., focus on energy conservation or water conservation credits).
B	Passive Energy Design (e.g., Solar Orientation)				X	**New:** Provides direction to incorporate passive solar design in new municipal buildings (where appropriate). Long-term operation cost reductions.
C	Solar-Ready Construction				X	**New:** Reduces installation barriers to future solar PV systems.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		**EXISTING**	**PLANNED**	**EXPAND**	**NEW**	**NOTES / RATIONALE**
F-5	**Behavior / Conservation / Energy Management**					
A	Energy Efficient Procurement Policy (e.g., Requires Energy Star Appliances)	X		X		**Existing:** City Council approved an Environmentally Preferable Purchasing Policy (EP3) in 2008 that explicitly states ENERGY STAR purchases. **Expand**: City could develop a handbook for city employee use to help guide compliance with EP3.
B	Energy Management Systems - Office Equipment (e.g., Monitors, Printers)	X				**Existing:** Installed power management software on city's computer network; power management software for lighting controls in City Hall, CPA, and Library; HVAC system with controls in same three buildings plus Community Center, Senior Center, and Fire Station #5.
C	Consumption Data Collected per Facility (e.g., per park unit, not per meter in each park)				X	**New:** Allows more detailed analysis of energy use to develop efficiency programs.
D	Commissioning and Retro Commissioning Program				X	**New:** High payback intervention that ensures building systems are functioning at optimal efficiency.
E	Interdepartmental Conservation Competitions					
F	Employee Information / Education					City's former Green Team focused on identifying green policies and practices relevant to city facilities / operations and educating employees on ways to change their behavior accordingly; Green Team developed list of 130 actions to reduce resource consumption; Green Team is no longer active. Staff from Community Development and Public Works departments were trained in green building practices in Oct. 2011.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		**EXISTING**	**PLANNED**	**EXPAND**	**NEW**	**NOTES / RATIONALE**
F-6	**Public Realm Lighting Efficiency**					
A	Traffic Signal Efficiency Retrofits	X				**Existing:** City replaced incandescent traffic signals with LED signals.
B	Street Light Efficiency Retrofits	X	X			**Existing:** Phasing in conversion of all high-pressure sodium (HPS) streetlights, beginning with conversion of 177 streetlights on California Street, El Monte Street and Rengstorff Street in North Bayshore Area; and retrofitting 460 post top HPS lights in downtown. **Planned:** Phase I (conversion of 1,600 to 1,800 street lights in North Bayshore area and on major arterials throughout town), and Phase II (remaining 1,600-1,800 street lights in residential areas will be converted over the next 2-10 years).
C	Solar Street Light Retrofits					
D	Parking Lot Lighting Retrofits	X		X		**Existing:** Some surface parking lots and all downtown parking lot lights have been converted. **Expand:** Convert all municipal parking lot lights to higher efficiency technology, particularly park parking lots.
E	Park Facility Lighting Retrofits	X		X		**Existing:** Eagle, Pioneer, Rengstorff parks and Centennial Plaza lighting upgraded with induction lighting technology. Attempted to retrofit tennis court lights at Rengstorff and Cuesta parks, but a viable replacement light could not be found. **Expand:** Cuesta Park only park unit where lighting upgrades have not been done yet; possible opportunity to upgrade tennis / handball court lights if effective alternative can be found.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		**EXISTING**	**PLANNED**	**EXPAND**	**NEW**	**NOTES / RATIONALE**
F	Public Realm Lighting Efficiency Standards		X			**Planned:** City standard for new public lighting (Standard Provisions) says new light should be induction or equivalent; currently with Engineering Dept. for approval; lowering lighting levels further is not an option.
F-7	**District Heating**					
A	District Energy System				X	**New:** GGRP action item to work with landfill gas end users to develop combined heat and power system. Gilroy has small district energy system, and completed feasibility study for new systems. San Jose has example at airport Terminal B.
B	District Energy Feasibility Study Program					
C	District Energy Infrastructure Development Program					
F-8	**Water System Energy Efficiency**					
A	Variable Frequency Drives at Pumping Stations	X				**Existing:** Small number of city-owned wells (2-3% of annual supply); pump stations are relatively new, so limited opportunity for efficiency upgrades; possible routine upgrades in next decade would bring additional efficiency. Variable frequency drives installed at some wastewater pumping stations, but as part of a larger planning effort, a cursory review to evaluate abandonment potential of pumping systems for gravity-fed system in future; Pumps 20 and 21 recently replaced, should result in substantial savings.
B	Water Treatment Plant Process Energy Optimization					Treated water is imported from SFPUC and SCVWD. The sanitary sewer collection system is discharged and treated at the Palo Alto Regional Water Quality Plant.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		**EXISTING**	**PLANNED**	**EXPAND**	**NEW**	**NOTES / RATIONALE**
F-9	**Landscape Water Conservation**					
A	Water Conservation Plan for Public Parks	X	X			**Existing:** City's Water Conservation Plan for City Properties will save an estimated 4.25 million gallons of water per year; 2.5 million gallons will come from Landscape Water Budget project that assigned water budgets to Sylvan, Pioneer, Cuesta, and Magnolia Parks in 2010. **Planned:** Will add an additional 10 parks to the landscape water budget program.
B	Climate Sensitive and Water Efficient Irrigation Technology	X				**Existing:** Parks Division adjusts landscape watering on weekly basis using rainfall and ET data collected at local weather stations; City routinely tests irrigation systems for efficiency and replaces broken or inefficient systems with more efficient equipment; completed water audits for 4 park irrigation systems; 85-95% of controllers linked to Rain Master iCentral system.
C	Advanced Irrigation Training for Parks Staff	X				**Existing:** All Parks Department staff are trained to adjust irrigation according to weather conditions, and are trained on other landscape water conservation BMP's.
D	Recycled Water Use	X		X		**Existing:** Recycled water irrigation in Shoreline Park and Golf Course area; North Bayshore area plumbed for recycled water use with 13 connections for city-owned buildings / facilities. **Expand:** Feasibility analysis for recycled water use expansion south across 101 Highway; study to be completed in 2013.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		EXISTING	PLANNED	EXPAND	NEW	NOTES / RATIONALE
E	Green Grounds Policy (e.g., Watering Schedules, Plant Selection)				X	**New:** Long-term water conservation plans might include removing turf from medians, plant material selection, retrofitting older systems, new park / median design with lower water use in mind.
F-10	**Airport Energy Efficiency Retrofits**					
A	Green Building Construction / Retrofit Standard					
B	Lighting Fixture Retrofit					
VEHICLE FLEET						
V-1	**Efficient Vehicles**					
A	Vehicle Fleet Plan (e.g., Transition to Fuel Efficient Vehicles)	X				**Existing:** No official policy standard for vehicle procurement, but Fleet Services Section has successfully converted large number of vehicles to more efficient, lower emission models. As of August 2013, 45 of 310 total fleet vehicles were hybrid.
B	Fuel-Efficient Vehicle Procurement Policy				X	**New:** Establish fuel-efficiency as primary consideration in the purchase of new fleet vehicles (in cases where appropriate models exist to perform required tasks). Santa Clara County has example policy in place.
C	Fuel-Efficient Operational and Maintenance Policies				X	**New:** Defines maintenance actions and schedules to minimize fuel use. Operational policies could include fuel use monitoring software / hardware and more formal training opportunities; the City is looking to replace its Hansen system.
D	Anti-Idling Policy	X				**Existing:** City has anti-idling policy that prevents non-emergency vehicles from idling for more than 5 minutes, unless idling is needed for the vehicle to perform its designed function or to defrost the windows for safety reasons.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		**EXISTING**	**PLANNED**	**EXPAND**	**NEW**	**NOTES / RATIONALE**
V-2	**Alternative Fuel Vehicles**					
A	Zero Emissions Municipal Fleet Target					
B	Vehicle Fleet Plan (e.g., Transition to Alternative Fuel Vehicles)					
C	Alternative Fuel Vehicle Procurement Policy					
D	Bio-Fuel Production					
E	CNG Fueling Stations				X	**New:** City could consider CNG fuel options for medium- to heavy-duty vehicles; City will possibly look at this in the future for street-sweepers, etc. San Jose has installed CNG infrastructure for vehicle fleet use.
F	Electric Vehicle Charging Stations	X	X			**Existing:** There are 4 charging stations at City Hall (1 is an older model) and 3 older models at the MOC. City is looking to replace older charging stations. City will likely replace older vehicles with hybrid options, rather than fully electric models due to price constraints. **Planned:** Five charging stations planned for installation.
G	Fuel Cell Fueling Stations					

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		EXISTING	PLANNED	EXPAND	NEW	NOTES / RATIONALE
V-3	**Behavior / Fuel Conservation**					
A	Fuel-Efficient Driver Training					
B	Route Optimization		X			**Planned:** "New" city policy stating vehicles can only be driven home within 30 mile radius.
C	Telematics				X	**New:** Allows analysis of fleet drivers' driving behavior and route selection.
D	Municipal Bike Fleet					
E	Car Share Program					
F	Fuel Saving Recognition Program for Employees / Departments				X	**New:** Recognition program for drivers or departments that are able to achieve certain fuel savings targets.
G	Fleet Reduction Program (e.g., Vehicle Sharing, Bicycle Police Patrols)		X			**Planned:** City will investigate feasibility of vehicle-sharing among certain departments.
V-4	**Airport Ground Operations**					
A	Airport Ground Operations Vehicle Fuel Conversion					
V-5	**Airplane Taxi Efficiency Improvements**					
A	Surface Airplane Congestion Reduction Program					
B	Assisted Airplane Towing					
C	Equipment Fuel Conversion					
POWER GENERATION FACILITIES						
P-1	**Generation Efficiency Improvements**					
A	Turbine Efficiency Improvements	X				**Existing:** City operates two 65 kW microturbines in Shoreline Park that generate energy to power the flare station and irrigation and sewage pumps. The microturbines were replaced in 2012.
P-2	**Combined Heat & Power**					
A	Co-Generation System					
P-3	**Alternative Fuels**					
A	Biomass					

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		**EXISTING**	**PLANNED**	**EXPAND**	**NEW**	**NOTES / RATIONALE**
SOLID WASTE FACILITIES						
S-1	**Waste Reduction**					
A	Green Procurement Specifications				X	**New:** Helps city to avoid excess materials (e.g., packaging) at time of purchase and prioritize products with recycled content.
B	Zero-Waste Strategy		X			**Planned:** City is developing communitywide Zero-Waste strategy; City has draft vision to recover all materials (reach zero waste) by 2025; currently diverting 75% of waste.
C	Waste Reduction and Diversion Goals (e.g., All City Operations or per Department)				X	**New:** City could add recommendation to Zero Waste Plan for City facility waste diversion / reduction goals.
D	Diversion Rate Tracking at Municipal Facilities	X		X		**Existing:** City has data on number / location of waste containers, but not actively tracking waste generation. **Expand:** Could actively track waste generation per facility to identify trends, and compare against waste reduction goals.
E	Hand-Sorted Waste Containers					
F	Waste Audits and Surveys				X	**New:** Provides waste generation data for City operations, allowing better management and strategy development.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		EXISTING	PLANNED	EXPAND	NEW	NOTES / RATIONALE
S-2	**Food Scrap and Compostable Paper Diversion**					
A	Municipal Collection and Composting Program		X			**Planned:** Commercial / Industrial composting program will be available to City facilities; would allow collection of food scraps and compostable paper.
B	Composting at Airport Terminals					
S-3	**Recyclable Paper Diversion**					
A	Paperless Office Policy / Program				X	**New:** City could consider a paperless office policy. Reduces unnecessary paper printing and documents; can also save money and simplify / improve file management processes.
S-4	**Landscape Waste Diversion**					
A	On-Site Landscape Waste Reduction Program	X				**Existing:** City has used mulching mowers for over 30 years. All grass clippings are returned to turf, which helps to reduce cost and other inputs (e.g., fertilizer).
B	Municipal Landscape Waste Composting Program	X				**Existing:** City uses its tree trimmings for mulching purposes; all green waste is placed in special bin and composted at SMaRT Station.
C	Waste Management Training for Park Department Staff / Groundskeepers	X				**Existing:** City provides training and operational support to landscape staff to divert organic materials from waste stream. Green waste is placed in separate bin and composted at SMaRT Station.
S-5	**Construction and Demolition Waste Diversion**					
A	C+D Diversion Policy for Municipal Projects (e.g., 75% Lumber Diversion)	X		X		**Existing:** The City's Construction and Demolition ordinance requires 50% diversion, but has no diversion percentage requirements for specific materials. **Expand:** City can be local leader in construction and demolition diversion by voluntarily diverting 75% or more of waste lumber from landfills during municipal construction projects.

TABLE B-1 - CITY OF MOUNTAIN VIEW PAST ACTIONS						
MEASURE		EXISTING	PLANNED	EXPAND	NEW	NOTES / RATIONALE
S-6	**Methane Capture and Combustion**					
A	Landfill Biogas Capture and Flare System	X	X			**Existing:** Shoreline landfill has high-efficiency gas collection and destruction system; 93.7% methane capture rate, 99.96% efficient flare destruction. **Planned:** City plans to replace the flare station.
S-7	**Waste-To-Energy**					
A	Landfill Biogas-to-Energy Facility	X				**Existing:** Shoreline landfill facility produces 900 scfm of biogas; private company has ownership rights for all of it (minus city's microturbine use at 70 scfm); private company currently uses 365 scfm, remainder is flared; private company has 3 microturbines, but usually only runs 1; private company contract expires in 2021 with 2 possible 5-year extensions; at end of all possible private company contracts, landfill biogas production will nearly be expired.
B	Food Waste-Bio digester Energy Facility					
C	Waste-to-Energy Gasification Facility					
D	Anaerobic Digestion at Wastewater Treatment Plant					
WASTEWATER TREATMENT FACILITIES (NON ENERGY-RELATED EMISSIONS)						
W-1	**Methane Capture and Combustion**					
A	Methane Capture and Generation System					
W-2	**Nitrous Oxide Emission Reduction**					
A	Improved Plant Design					
B	Improved Operations					

Appendix C

Performance Metric and Cost Assumptions

2020, 2035, and 2050 Performance Metric Assumptions

The reduction estimates shown in Chapter 3 are based on the implementation assumptions in the tables in this appendix. These tables cover each of the reduction strategies and actions from Chapter 3, and include descriptive implementation steps that the City could follow. The tables also provide relevant “Goals” for the 2020, 2035, and 2050 horizon years. These goals describe the changes in municipal operations required to achieve the emissions reduction estimates. The goals for 2020 were developed with input from various City departments, to ensure they were as realistic as possible. The goals for 2050 were developed to demonstrate one possible pathway for achieving the City’s 2050 reduction target. In most cases, the 2050 goals represent an increased level of participation or deeper implementation of the various strategies. The 2050 goals correlate with the 2050 emissions reduction estimates included in Chapter 3. The 2035 goals approximate a linear trajectory between the 2020 and 2050 goals. The tables also indicate the department responsible for each action and implementation step.

2020 Cost Estimate Assumptions

The tables include high-level cost estimates for implementation of the various actions. A cost ranking (e.g. High, Medium, Low) and an associated dollar cost is provided for each action. The ranges for the cost ranking are:

- Very Low: <$10,000
- Low: $10,001-20,000
- Medium: $20,001-100,000
- High: $100,001–500,000
- Very High: >$500,000

These cost estimates were prepared to support the measure selection phase of the MOCAP development process, to provide an “order-of-magnitude” estimation associated with the 2020 emission reduction calculations. As such, these estimates only offer an approximate evaluation of potential implementation costs. Some cost estimates are more precise than others when their assumption parameters could be more clearly defined (e.g., the cost to install a 5MW solar photovoltaic system is based on current per-MW installation costs in California). The City may wish to prepare a more detailed cost estimate prior to implementing a given strategy or action. The “Cost” column of the tables provides either annual or one-time costs, depending on the specific actions described. Cost estimate assumptions are also provided, with links to specific data sources or case studies in some instances. Actions related to policy or program development, as opposed to equipment purchases or infrastructure development, are based on a calculation of the effort needed from a full-time equivalent (FTE) employee.

Table C-1
Strategy F-1 Low Carbon Grid Electricity

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
A. Utility Green Electricity Option ▪ Conduct feasibility study of PG&E Green Option financial costs (per kWh costs have not been finalized yet as part of program development) ▪ Develop resolution to opt into PG&E Green Option program for municipal electricity purchases (Note: program is currently capped at 125 MW and 5 year pilot program; it is currently unknown how enrollment decisions will be made should program become fully subscribed)	100% of electricity comes from renewable (or zero carbon) sources via CCA or PG&E Green Option	100% of electricity comes from renewable (or zero carbon) sources via CCA or PG&E Green Option	100% of electricity comes from renewable (or zero carbon) sources via CCA or PG&E Green Option	Community Development (Environmental Sustainability)	High	$359,000 (annual cost to participate in PG&E Green Option)	Based on comparison of PG&E base rate versus PGE Green option rate for commercial; Green Option program has not yet been approved by CPUC, and participation costs (i.e., $/kWh) are not yet finalized. Cost estimates are based on currently available information from PG&E Green Option website: http://www.pge.com/myhome/environment/pge/greenoption/faq/ PG&E base rate = $0.228/kWh Estimated PG&E Green Option 100% rate = $0.257 Estimated City electricity demand in 2020 = 12,708 MW
B. Community Choice Energy ▪ Identify potential jurisdictional partners for development of CCE ▪ Conduct feasibility study to assess viability of CCE program in Mountain View ▪ Based on results of feasibility study, pursue development of CCE per state requirements ▪ Adopt resolution for city to participate in CCE	100% of electricity comes from renewable (or zero carbon) sources via CCE *or* PG&E Green Option	100% of electricity comes from renewable (or zero carbon) sources via CCE *or* PG&E Green Option	100% of electricity comes from renewable (or zero carbon) sources via CCE *or* PG&E Green Option	Community Development (Environmental Sustainability)	Cost Neutral or cost savings	$400,000 (one-time to establish program) $22,900 (annual savings from participation in CCE; excludes CCE start-up costs)	$400,000 to establish program with other cities/agencies; money would be returned to City through program revenue. Based on comparison of PG&E base rate versus Marin CCE 100% clean option rate for commercial. Assumes 100% of total city electricity consumption at $0.227/kWh, which is current rate of Marin Clean Energy's Deep Green (100% clean electricity) option: https://mcecleanenergy.com/rates-com PG&E base rate = $0.228/kWh Marin Clean Energy's Deep Green Option rate = $0.227 Est. City electricity demand in 2020 = 12,708 MW
C. Large-Scale Renewable Energy Generation ▪ Perform cost-benefit analysis comparing options of: (a) City-owned development of renewable energy facilities, (b) purchase of electricity from off-site generators (pending state enabling legislation), (c) direct purchase of clean energy from PG&E, or (d) development of and participation in CCE ▪ If development of municipally-owned renewable facilities is found to be preferred option (and legislative barriers are removed), study further development of previously-identified 5 MW solar farm site ▪ Identify opportunities for additional municipally-owned renewable generation facilities (as State legislative changes allow)	OPTIONAL: 1,130 MT CO_2e/year in additional reductions if city also installs a 5MW solar farm in 2020 and maintains system through 2050 (assumes no system expansion)			Community Development (Environmental Sustainability)	Very High	$15,000,000 (one-time installation cost, excludes on-going maintenance and utility or other rebates)	Assumes 5 MW system installed 5MW = 5,000,000 watts $3.00 avg. cost/watt installed for large-scale systems, per consultation with Optony on 3/23/15. $15,000,000 total cost

Table C-2
Strategy F-2 Renewable for Low-Carbon Electricity Sources

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
A. Solar PV Installations on City Buildings, Parking Lots, Land ▪ Based on results of city's current feasibility study for solar PV sites, determine the most cost effective financing mechanism to install PV systems at the 135 Bryant St. Parking Garage, the MOC, Fire Station #5, the Shoreline Maintenance Facility, the Shoreline Golf Pro Shop, and/or other city facilities ▪ Pending installation of previous five PV sites, examine future potential for additional PV installations on city-owned parking lots	Installation of 1MW (approximately 70,000 square feet) of distributed PV systems on city buildings, parking lots, land)	Installation of 1.5 MW (approximately 102,000 square feet) of distributed PV systems on city buildings, parking lots, land)	Installation of 2MW (approximately 133,000 square feet) of distributed PV systems on city buildings, parking lots, land)	Public Works (Fleet and Facilities) Community Development (Environmental Sustainability)	Very High	$5,250,000 (one-time installation cost, excludes on-going maintenance and utility or other rebates)	Assumes 1 MW system installed 1,000,000 watts = 1MW $5.25 avg. cost/watt installed for systems >10kW http://www.californiasolarstatistics.ca.gov/ $5,250,000 total cost
B. Solar Hot Water Installations in City Facilities ▪ Conduct feasibility analysis for solar hot water systems at city pools (i.e., Eagle and Rengstorff) ▪ Based on results of study, implement cost-effective solar hot water options ▪ Review hot water usage at existing city buildings to identify additional cost-effective solar hot water installations	Installation of solar hot water (SHW) systems on city buildings replaces 12% of 2010 baseline natural gas consumption; installed SHW systems achieve 50% solar fraction (i.e., solar energy replaces 50% of natural gas demand)	Installation of solar hot water (SHW) systems on city buildings replaces 13% of 2010 baseline natural gas consumption; installed SHW systems achieve 50% solar fraction (i.e., solar energy replaces 50% of natural gas demand)	Installation of solar hot water (SHW) systems on city buildings replaces 14% of 2010 baseline natural gas consumption; installed SHW systems achieve 50% solar fraction (i.e., solar energy replaces 50% of natural gas demand)	Public Works (Fleet and Facilities)	Very High	$523,650 (one-time installation cost, excludes on-going maintenance and utility or other rebates)	195,989 baseline therms 12% of baseline therms replaced 23,519 therms replaced $22.27 avg. cost/therm saved http://www.pge.com/includes/docs/pdfs/shared/solar/solareducation/solar_water_heating_basics_march_2010.pdf $523,650 total cost

Table C-3
Strategy F-3 Existing Building Energy Retrofit and Management

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
A. Energy Efficiency Fund ▪ Evaluate the potential for and requirements (e.g., size, terms, etc.) of a self-sustaining city energy efficiency loan fund ▪ Develop fund parameters that support continual replenishment of funding pool (e.g., 80% of cost savings resulting from project implementation are returned to fund for 5 years) ▪ Allocate funding for long-term energy efficiency fund (from EECBG program, municipal bond, etc.) ▪ Assign manager to support and coordinate fund and its projects	Supporting Action – No goal provided			Public Works (Fleet and Facilities) Community Development (Environmental Sustainability)	Medium	$100,000 (annual cost until total fund value is achieved)	$100,000 per year based on case study from Ann Arbor, MI http://www.c40.org/case_studies/an-energy-efficiency-fund-costing-500000-over-five-years-that-is-reducing-co2-emissions-by-980-tonnes-annually
B. Energy Efficiency Procurement Policy ▪ Create Green Procurement Specifications handbook with guidance for city staff to help implement ENERGY STAR appliance purchasing requirements ▪ Evaluate potential for additional energy management devices or technologies to address plug load energy use from ancillary office equipment (e.g., computer speakers, monitors, printers/scanners, fax machines, personal space heaters, TV monitors), including strategy for advanced power strip purchases and use in city buildings	Use of high efficiency appliances, advanced power strips, and IT office appliance energy management systems, reducing office equipment energy use by 20%	Use of high efficiency appliances, advanced power strips, and IT office appliance energy management systems, reducing office equipment energy use by 30%	Use of high efficiency appliances, advanced power strips, and IT office appliance energy management systems, reducing office equipment energy use by 40%	Finance and Administrative Services (Purchasing); Community Development (Environmental Sustainability); IT (Information Technology)	Low	$15,000 (one-time policy development cost)	$10,000 to $20,000 based on estimate of cost of staff time to develop policy (1/10 to 1/5 FTE of $100,000 employee total cost)

Table C-3
Strategy F-3 Existing Building Energy Retrofit and Management

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
C. Consumption Data Collected per Facility ▪ Work with PG&E to install additional electricity and gas meters to support better facility-level energy use analysis ▪ After installation of additional meters, organize PG&E data by facility and city department (e.g., Meters 1, 2 and 3 represent MOC #1) ▪ Prepare regular energy use reports by facility and department to more accurately track energy use and improvements and identify usage anomalies ▪ Investigate feasibility of using an Energy Management System (EMS) to more easily track building energy use and identify and correct problems	Incorporation of advanced energy metering, retro-commissioning, and energy efficiency improvement upgrades in all buildings: Electricity -> 20% reduction in Ventilation, Cooling, and Miscellaneous energy use intensities; 10% reduction in Motors, Process, Refrigeration, and Air Compressor energy use intensities; 25% reduction in interior and exterior lighting energy use intensities in all buildings; cool roof installation on 35% of city buildings; 7% reduction in cooling and ventilation energy use intensities Natural Gas -> 20% reduction in Heating energy use intensities; 10% Water Heating energy use intensities	Incorporation of advanced energy metering, retro-commissioning, and energy efficiency improvement upgrades in all buildings: Electricity -> 30% reduction in Ventilation, Cooling, and Miscellaneous energy use intensities; 25% reduction in Motors, Process, Refrigeration, and Air Compressor energy use intensities; 33% reduction in interior and exterior lighting energy use intensities in all buildings; cool roof installation on 53% of city buildings; 7% reduction in cooling and ventilation energy use intensities Natural Gas -> 30% reduction in Heating energy use intensities; 25% Water Heating energy use intensities	Incorporation of advanced energy metering, retro-commissioning, and energy efficiency improvement upgrades in all buildings: Electricity -> 40% reduction in Ventilation, Cooling, and Miscellaneous energy use intensities; 40% reduction in Motors, Process, Refrigeration, and Air Compressor energy use intensities; 40% reduction in interior and exterior lighting energy use intensities in all buildings; cool roof installation on 70% of city buildings; 7% reduction in cooling and ventilation energy use intensities Natural Gas -> 40% reduction in Heating energy use intensities; 10% Water Heating energy use intensities	Public Works (Fleet and Facilities)	Low	$16,000 (one-time installation cost, excludes on-going maintenance)	Assumes installation of 40 meters and a cost of $400 per meter installed. http://www.pge.com/tariffs/tm2/pdf/ELEC_SCHEDS_E-EUS.pdf
D. Retro-commissioning Program ▪ Develop program that requires all major systems (e.g., HVAC) in existing buildings to be retro-commissioned at 5-year intervals ▪ Synchronize regular retro-commissioning efforts with services provided by existing building systems maintenance contracts				Public Works (Fleet and Facilities)	Medium	$28,000 (annual cost, assumptions are amortized over five year period)	Assumes retro-commissioning cost of $0.70 per square foot performed on 200,000 square feet of city buildings with 5 years between retro-commissions http://www.usgbciowa.org/PDFs/ImprovingBuildingPerformancethroughRetro-Cx.pdf
E. Employee Information/Education ▪ Investigate installing energy-use dashboards in City Hall and primary municipal buildings (e.g., public-facing and high energy use). As needed, work with PG&E to install individual building meters, as necessary, to allow building-specific energy use reporting ▪ Consider setting department-level energy-use reduction targets and encourage employees to participate in achieving the targets				Community Development (Environmental Sustainability)	Low	$20,000 (one-time cost for program development, plus annual implementation cost)	~ $20,000 based on estimate of cost of staff time to develop and implement program per year (1/5 FTE of $100,000 employee total cost)

Table C-4
Strategy F-4 New Building Energy Performance

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
A. Green Building Standard – Energy Performance Requirement ▪ Define explicit energy efficiency performance levels or design features to be achieved/included as part of the City's green building standards for public buildings, including consideration for passive energy design and solar ready construction, where feasible	Supporting Action – Not quantified at this time			Community Development (Environmental Sustainability)	Low	$15,000 (one-time cost for building standards revision)	Cost for staff or consultant to revise green building standard for municipal buildings

Table C-5
Strategy F-5 Public Realm Lighting Efficiency

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
A. Parking Lot Lighting Retrofits ▪ Develop plan to retrofit all remaining municipal parking lot lights to high-efficiency technology	100% of streetlights are retrofitted to induction or LED	100% of streetlights are retrofitted to induction or LED	100% of streetlights are retrofitted to induction or LED	Public Works (Public Services)	Very High	$1.22 million (one-time cost to implement program; excludes utility rebates and operational savings)	Assumes 0% of streetlights in 2010 were LED 2010 energy use in street lighting = 2,100 MWh = 2,100,000 kWh 1-125W high pressure sodium (HPS) cobra head lights at 11 hrs/day = 400,000 watt hrs/yr = 500 kWh/yr per bulb 2,100,000 kWh/yr energy use in street lighting = approx. 4,200 lights 100% retrofit of street lighting = 4,200 bulbs/ballasts to upgrade Case Study first cost to upgrade 1,000 HPS cobra head lights to LED luminaries = $290,000 (excluding utility rebates) = $290/light Cost to upgrade 4,200 lights = approx. $1.22 million Case Study: http://www.leotek.com/education/documents/Leotek.LED.Streetlight.Guide.V7-101613.pdf

Table C-5
Strategy F-5 Public Realm Lighting Efficiency

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
B. Park Facility Lighting Retrofits ▪ Implement remaining lighting retrofits in Cuesta Park ▪ Evaluate BMPs for court and ball field lighting; implement upgrades if effective lighting alternative is found ▪ Explore opportunities to upgrade facility lighting at Whisman Sports Center and Graham Reservoir and Sports Complex	50% of park lights are retrofitted to induction or LED. 50% of court and sports fields lighting is retrofitted	50% of park lights are retrofitted to induction or LED. 50% of court and sports fields lighting is retrofitted	50% of park lights are retrofitted to induction or LED. 50% of court and sports fields lighting is retrofitted	Public Works (Fleet and Facilities)	High	$125,000 (one-time cost to implement program; excludes utility rebates and operational savings)	2010 energy use in park lighting = 348 MWh = 348,000 1-100W high pressure sodium (HPS) cobra head lights at 11 hrs/day = 400,000 watt hrs/yr = 400 kWh/yr per bulb 348,000 kWh/yr energy use in park lighting = approx. 870 park lights 50% retrofit of park lighting = 435 bulbs/ballasts to upgrade Case Study first cost to upgrade 1,000 HPS cobra head lights to LED luminaries = $290,000 (excluding utility rebates) = $290/light Cost to upgrade 435 lights = $126,150 Case Study: http://www.leotek.com/education/documents/Leotek.LED.Streetlight.Guide.V7-101613.pdf
C. Parking Garage Lighting Retrofits ▪ Complete parking lot lighting upgrades at 850 California Street garage in FY 2015/2016 to switch from high-pressure sodium bulbs to LED technology ▪ Continue to review new lighting technologies and consider appropriate applications in city-owned parking garages	Supporting Action – Not quantified at this time			Public Works (Fleet and Facilities)	Supporting Action – Not quantified at this time		

Table C-6
Strategy F-6 Landscape Water Conservation

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
A. Green Grounds Policy ▪ Continue use/expansion of recycled water system to irrigate parks, medians, and other public vegetation ▪ Adopt formal Green Grounds Policy that specifies the city's existing practices in landscape water conservation and green waste collection strategies, including development of a formal policy on low-water use plant selection for non-turf areas (e.g., planting strips, medians) ▪ Consider development of future irrigation water use targets, as scope of park system expansion is realized	10% reduction in landscape water use over 2010 baseline use	34% reduction in landscape water use over 2010 baseline use	58% reduction in landscape water use over 2010 baseline use	Public Works (Parks)	Low	$15,000 (one-time cost for policy development)	~ $15,000 based on estimate of cost of staff time to develop policy (1/7 FTE of $100,000 employee total cost)

Table C-7
Strategy VF-1 Efficient Vehicles

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
A. Fuel-Efficient Vehicle Procurement Policy ▪ Establish vehicle fleet target: (A) Total vehicle fleet composed of X% zero- or lower-carbon vehicles (consider CNG as a bridge technology in near-term); or (B) Total vehicle fleet carbon reduction target (can be achieved through reduced VMT, technology, mode shift, etc.) ▪ Develop vehicle procurement policy that implements vehicle fleet target, and defines what lower-carbon vehicles means (i.e., what technologies can be used to achieve vehicle fleet target)	10% of passenger gasoline vehicles upgraded to fuel-efficient models; 10% of light-duty gasoline trucks upgraded to fuel-efficient models	18% of light-duty gasoline trucks upgraded to fuel-efficient models; 25% of heavy-duty diesel trucks upgraded to fuel-efficient models	25% of light-duty gasoline trucks upgraded to fuel-efficient models; 50% of heavy-duty diesel trucks upgraded to fuel-efficient models	Public Works (Fleet and Facilities)	Low	$15,000 (one-time cost for policy development)	~ $15,000 based on estimate of cost of staff time to develop policy (1/7 FTE of $100,000 employee total cost)
B. Fuel-Efficient Operational and Maintenance Policies ▪ Establish vehicle fleet efficiency (i.e., operation and maintenance) policy that includes formal vehicle maintenance check-list targeting fuel efficiency tune-ups and fuel-efficient driving training (e.g., no speeding, idling, excessive tools/gear in vehicles)	Supporting Action – Not quantified at this time			Public Works (Fleet and Facilities)	Low	$15,000 (one-time cost for program development)	~ $15,000 based on estimate of cost of staff time to develop policy (1/7 FTE of $100,000 employee total cost)

Table C-8
Strategy VF-2 Alternative Fuel Vehicles

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
A. Municipal Fleet Emissions Target ▪ Develop a long-term fuel-based target to reduce city municipal fleet emissions Note: Implementation of this action is budget- and technology-dependent	Supporting Action – Not quantified at this time			Public Works (Fleet and Facilities)	Low	$15,000 (one-time cost for policy development)	~ $15,000 based on estimate of cost of staff time to develop policy (1/7 FTE of $100,000 employee total cost)

Table C-8
Strategy VF-2 Alternative Fuel Vehicles

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
B. Vehicle Fleet Plan ▪ Adopt targets for percentage of non-emergency passenger vehicles in municipal fleet to be EV, hybrid, or other alternative technologies; increase targets as achievements are made ▪ At time of replacement, replace all diesel vehicles with CNG (when feasible based on operational needs and vehicle options available) and passenger vehicles with EV, CNG, or Hybrid models Note: Implementation of this action is budget- and technology-dependent	25% of gasoline passenger vehicles are switched to EV and 5% are switched to CNG; 10% of light duty gasoline trucks are switched to CNG and 5% are switched to EV; 30% of heavy duty diesel and gasoline trucks are switched to CNG; Assumes no change in exempt police and fire vehicles	63% of gasoline passenger vehicles are switched to EV and 17% are switched to CNG; 18% of light duty gasoline trucks are switched to CNG and 28% are switched to EV; 65% of heavy duty diesel and gasoline trucks are switched to CNG; Assumes no change in exempt police and fire vehicles	100% of gasoline passenger vehicles are switched to EV; 25% of light duty gasoline trucks are switched to CNG and 50% are switched to EV; 100% of heavy duty diesel and gasoline trucks are switched to CNG; Assumes no change in exempt police and fire vehicles	Public Works (Fleet and Facilities)	Medium	$30,000 (one-time cost for policy development)	~ $37,500 based on estimate of cost of staff time to develop policy (1/5 FTE of $150,000 employee total cost)
C. CNG Fueling Stations ▪ Continue to research opportunities for development of municipal CNG refueling station; look for partnerships with neighboring cities for cost-share opportunities of joint-use facility ▪ Pending results of CNG feasibility study, develop CNG refueling station for municipal and public use; transition municipal fleet diesel vehicles to CNG, as appropriate	Supporting Action – Not quantified at this time			Public Works (Fleet and Facilities)	Very High	$1,000,000 (one-time installation cost, excludes on-going maintenance)	Department of Energy estimates are up to $2.0 million. Assume more than $500,000, which is Very High cost ranking classification http://www.afdc.energy.gov/fuels/natural_gas_infrastructure.html
D. Electric Vehicle Charging Stations ▪ Evaluate opportunities for additional EV vehicle charging stations ▪ Develop funding plan for additional EV vehicle charging stations ▪ Install additional EV vehicle charging stations	Supporting Action – Not quantified at this time			Community Development (Environmental Sustainability)	High	$173,000 (one-time installation cost, excludes on-going maintenance)	Assumes installation of 10 electric vehicle charging units, and that (on average) a charging station costs: •$4,000 for materials and equipment, including the charger itself; •$2,000 for design and permitting fees; •$800 for general contractor supervision of the installation; •$500 for contracting and construction administration; and •$3,000 to $16,000 for associated installation costs, including concrete work and boring for electrical utilities (this cost element varies greatly depending on the length of the electrical run required); assumed $10,000 for this calculation.

Table C-9
Strategy VF-3 Behavior / Fuel Optimization

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
A. Telematics ▪ Evaluate developing a telematics program for the City fleet, which would allow the City to optimize vehicle routes and operation and dispatch help to disabled vehicles more promptly	Telematics system reduces passenger and light duty vehicle fuel use by 4.6% of baseline use	Telematics system reduces passenger and light duty vehicle fuel use by 5.0%	Telematics system reduces passenger and light duty vehicle fuel use by 5.3%	Public Works (Fleet and Facilities)	Cost Savings	$45,000 (one-time cost would be recouped within 3-6 months) $55,000 (annual subscription)	Baltimore case study demonstrates simple-payback for hardware within 3 months from fuel and staff time savings; annual cost savings exceed monthly subscription fees http://www.government-fleet.com/channel/gps-telematics/article/story/2013/12/telematics-case-study-managing-public-works-vehicles.aspx
B. Fuel Saving Recognition Program for Employees/Departments ▪ Consider establishing an inter-departmental fuel savings recognition program that tracks annual fuel use by department and provides employee rewards for annual improvement	Supporting Action – Not quantified at this time			Community Development (Environmental Sustainability)	Very Low	$10,000 (annual cost of program development and implementation)	~ $10,000 based on estimate of cost of staff time to develop and implement program per year (1/10 FTE of $100,000 employee total cost)

Table C-10
Strategy SW-1 Waste Reduction

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
A. Green Procurement Specifications ▪ Develop Green Procurement Specifications handbook to serve as user-friendly resource to guide city purchases of "green" products, such as furniture, carpeting/flooring, paints, packaging materials, etc. ▪ Design Green Procurement Specifications handbook to give preference to recycled products, recyclable and compostable products, products derived from renewable materials, and other products that produce lower waste across the product's lifecycle ▪ Include reference to city's Energy Efficient Procurement Policy, or include as part of new Green Procurement Specifications to provide one comprehensive guidance document	Supporting Action – Not quantified at this time			Finance and Administrative Services (Purchasing)	Low	$15,000 (one-time cost for policy development)	~ $15,000 based on estimate of cost of staff time to develop policy (1/7 FTE of $100,000 employee total cost)
B. Waste Reduction and Diversion Goals ▪ Establish zero-waste goal for municipal operations (define zero waste: 90% or 100% waste diversion); target to be included in Zero Waste Strategy ▪ In conjunction with municipal waste audits, establish waste reduction/diversion goals by building or department (whichever is easier to track) as means to achieving overarching zero-waste goals; re-evaluate building or department goals as part of regular waste audits	80% diversion of municipally-generated food waste and 20% diversion of municipally-generated compostable paper	85% diversion of municipally-generated food waste and 20% diversion of municipally-generated compostable paper	90% diversion of municipally-generated food waste and 20% diversion of municipally-generated compostable paper	Public Works (Solid Waste)	Medium	$34,000 (one-time cost for policy development)	~ $34,000 based on estimate of cost of staff time to develop policy (1/3 FTE of $100,000 employee total cost)
C. Waste Audits/Surveys and Diversion Rate Tracking at Municipal Facilities ▪ Perform waste audits at various city facilities to: determine type/quantity of waste being produced, measure effectiveness of existing waste diversion practices, identify opportunities for new waste diversion practices, establish baseline data for measuring progress towards waste reduction and diversion goals ▪ Establish regular waste audit cycle to track implementation of various waste reduction practices	Supporting Action – Not quantified at this time			Public Works (Solid Waste)	Low	$15,000 (one-time cost for policy development)	~ $15,000 based on estimate of cost of staff time to develop policy (1/7 FTE of $100,000 employee total cost)

Table C-11
Strategy SW-2 Recyclable Paper Diversion

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
A. Paperless Office Policy / Program ▪ Address IT Department's technical issues regarding office supply vendor's printer-tracking software installations to allow full use of printer analytics; assign IT staff member to review all departments and address software problems ▪ Conduct analysis of paper procurement and use per department to establish data trends ▪ Establish city operations paper use reduction goals based on paper procurement and/or use analysis ▪ Meet with individual departments to discuss results of analysis and identify opportunities for printing reduction	30% reduction in municipally generated paper waste over baseline levels	50% reduction in municipally generated paper waste over baseline levels	70% reduction in municipally generated paper waste over baseline levels	IT (Information Technology)	Low	$15,000 (annual cost of program development and implementation)	~ $15,000 based on estimate of cost of staff time to develop and implement program per year (1/7 FTE of $100,000 employee total cost)

Table C-12
Strategy SW-3 Landscape Waste Diversion

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
A. Municipal Landscape Waste Composting Program ▪ Evaluate which parks would be appropriate for a green waste bin ▪ Add the collection of the green waste bins from the selected parks to the commercial organics program route	80% diversion of municipally generated green waste over baseline levels	85% diversion of municipally generated green waste over baseline levels	90% diversion of municipally generated green waste over baseline levels	Public Works (Parks)	Low	$20,000 (one-time program development cost)	~ $20,000 based on estimate of cost of staff time to develop program (1/5 FTE of $100,000 employee total cost)

Table C-13
Strategy SW-4 Construction and Demolition Waste Diversion

Actions and Implementation Steps	Goals			Department Responsible	Cost Estimates - 2020		
	2020	2035	2050		Cost Ranking	Cost	Assumptions
A. Municipal Construction and Demolition Standards ▪ Amend the City's Standard Provisions to require 75% diversion of C&D waste in all municipal construction projects and major retrofits	80% of municipal construction projects divert 80% of their C&D waste	90% of municipal construction projects divert 90% of their C&D waste	90% of municipal construction projects divert 90% of their C&D waste	Public Works (Solid Waste)	Low	$15,000 (one-time policy development cost)	~ $15,000 based on estimate of cost of staff time to develop policy (1/7 FTE of $100,000 employee total cost)

Appendix D

Strategy Quantification

Emissions Reduction Strategy Quantification Methodology

The table in this appendix presents parameters and data inputs used to quantify the 2020 emission reduction estimates shown under "Scenario 2" of Table 3.2 in Chapter 3, with the exception of Strategy F-1, which was quantified as shown under "Scenario 1" of Table 3.2. The emission reduction estimates provided in this appendix represent the raw calculated values, which were then rounded to the nearest ten for use in Chapter 3. Raw calculated values of less than 10 were rounded to the nearest one.

The table is organized according to the emission reduction strategies and actions described in Chapter 3, and show calculations at the action level. In most instances, the calculations begin with the year 2020 unmitigated values to show the scenario for what consumption and emission levels would be if the strategies and actions were *not* implemented. Various parameters are then provided (e.g., participation rate, percent reduction in end use), which are applied to the unmitigated values to calculate the mitigated values (i.e., the resultant consumption and/or emission levels if the strategies and actions are implemented). The final action-level emission reduction calculations are the difference between the unmitigated and mitigated scenarios. In some instances, the unmitigated values are multiplied by a reduction parameters to calculate an End Use Reduction for numerous sub-components (e.g., F-3 Actions C, D, and E), such as different building energy end uses. In these cases, the sub-component End Use Reductions are summed to calculate the total action-level emission reductions.

Many energy-related calculations use a future 2020 emissions factor ***estimate*** to calculate potential reductions. This 2020 emissions factor was estimated by PG&E, and should be re-evaluated as 2020 approaches to ensure that the best possible electricity-related emissions factor is used in emission reduction calculations. The 2020 emissions factor estimate can be found at:

http://www.pge.com/includes/docs/pdfs/shared/environment/calculator/pge_ghg_emission_factor_info_sheet.pdf

FACILITIES SECTOR			
F-1 Low Carbon Grid Electricity			
A. Utility Green Electricity Option	Parameters	Value	Units
	2020 Projected Electricity - Unmitigated	*12,707,895.75*	*kWh/year*
	2020 Electricity Emission Factor (PG&E)	*0.133*	*MT CO_2e/MWh*
	2020 Electricity Emissions	*1,694.25*	*MT CO_2e/year*
	Participation Rate (amount of electricity demand affected)	*100%*	*Percent*
	Percent of Carbon Reduction of Grid Electricity (compared to unmitigated scenario)	*100%*	*Percent*
	2020 Electricity Emission Factor - Mitigated	*0.00*	*MT CO_2e/MWh*
	2020 Electricity Emissions - Mitigated	*0.00*	*MT CO_2e/year*
	Reduction	***1,694.25***	***MT CO_2e/year***
B. Community Choice Energy	Parameters	Value	Units
	2020 Projected Electricity - Unmitigated	*12,707,895.75*	*kWh/year*
	2020 Electricity Emission Factor (PG&E)	*0.133*	*MT CO_2e/MWh*
	2020 Electricity Emissions	*1,694.25*	*MT CO_2e/year*
	Participation Rate (amount of electricity demand affected)	*100%*	*Percent*
	Percent of Carbon Reduction of Grid Electricity (compared to unmitigated scenario)	*100%*	*Percent*
	2020 Electricity Emission Factor - Mitigated	*0.00*	*MT CO_2e/MWh*
	2020 Electricity Emissions - Mitigated	*0.00*	*MT CO_2e/year*
	Reduction	***1,694.25***	***MT CO_2e/year***
C. Large-Scale Renewable Energy Generation	Parameters	Value	Units
	Generation Amount	*5.00*	*MW*
	Solar Rating	*15.00*	*Watts/Sq Ft*
	Efficiency	*15%*	*Percent*
	Area (Calculated from Generation Amount and Solar Rating)	*333,333.33*	*Sq Ft*
	Electricity Generated per Sq Ft	*0.47*	*kWh/Sq Ft/year*
	*Electricity Generated (Efficiency * Area * Elec/Sq Ft * 365 days)*	*8,613,040.85*	*kWh/year*
	2020 Electricity Emission Factor (PG&E)	*0.133*	*MT CO_2e/MWh*
	Reduction	***1,128.31***	***MT CO_2e/year***
F-2 Renewable / Low-Carbon Electricity Generation			
A. Solar PV Installations on City Buildings, Parking Lots, Land	Parameters	Value	Units
	Generation Amount	*1.00*	*MW*
	Solar Rating	*15.00*	*Watts/Sq Ft*
	Efficiency	*15%*	*Percent*
	Area (Calculated from Generation Amount and Solar Rating)	*66,666.67*	*Sq Ft*
	Electricity Generated per Sq Ft	*0.47*	*kWh/Sq Ft/year*
	*Electricity Generated (Efficiency * Area * Elec/Sq Ft * 365 days)*	*1,722,608.17*	*kWh/year*
	2020 Electricity Emission Factor (PG&E)	*0.133*	*MT CO_2e/MWh*
	Reduction	***225.66***	***MT CO_2e/year***
B. Solar Hot Water Installations in City Facilities	Parameters	Value	Units
** Note 'schools' building type was used as proxy for civic facilities*	*Large Office - Hot water heater energy - Unmitigated*	*18,506.97*	*therms*
	Large Office - Water Heating Solar Fraction	*50%*	*Percent*
	Large Office - Participation Rate (% of units)	*0%*	*Percent*
	Large Office - Hot Water Heater Energy - Mitigated	*18,506.97*	*therms*
	School - Hot water heater energy - Unmitigated	*2,128.42*	*therms*
	School - Water Heating Solar Fraction	*50%*	*Percent*
	School - Participation Rate (% of units)	*100%*	*Percent*
	School - Hot Water Heater Energy - Mitigated	*1,064.21*	*therms*
	Small Office - Hot water heater energy - Unmitigated	*1,456.73*	*therms*
	Small Office - Water Heating Solar Fraction	*50%*	*Percent*
	Small Office - Participation Rate (% of units)	*0%*	*Percent*
	Small Office - Hot Water Heater Energy - Mitigated	*1,456.73*	*therms*
	Unrefrigerated Warehouse - Hot water heater energy - Unmitigated	*2,142.46*	*therms*
	Unrefrigerated Warehouse - Water Heating Solar Fraction	*50%*	*Percent*
	Unrefrigerated Warehouse- Participation Rate (% of units)	*0%*	*Percent*
	Unrefrigerated Warehouse - Hot Water Heater Energy - Mitigated	*2,142.46*	*therms*
	Total Hot Water Heater Energy Saved	*1,064.21*	*therms*
	Natural Gas Emission Factor	*0.005303*	*MT CO_2e/therm*
	Reduction	***5.64***	***MT CO_2e/year***
F-3 Existing Building Energy Retrofit and Management			
A. Energy Efficiency Fund	Parameters	Value	Units
	Supporting		
B. Energy Efficiency Procurement Policy	Parameters	Value	Units
** assumes procurement policy will affect office equipment only*	*Office Equipment - Electricity Use - Unmitigated*	*1,675,201.21*	*kWh/year*
	Participation Rate (amount of end use affected)	*100%*	*Percent*
	Percent Reduction in End Use Electricty Use	*20%*	*Percent*
	End Use Electricity Reduced	*335,040.24*	*kWh/year*
	2020 Electricity Emission Factor (PG&E)	*0.133*	*MT CO_2e/MWh*
	Reduction	***44.67***	***MT CO_2e/year***

C. Consumption Data Collected per Facility, D. Retro-Commissioning Program, and E. Employee Information / Education	Parameters	Value	Units
	Air Compressors - Electricity Use - Unmitigated	29,566.30	kWh/year
	Participation Rate (amount of end use affected)	100%	Percent
	Percent Reduction in End Use Electricty Use	10%	Percent
	End Use Electricity Reduced	2,956.63	kWh/year
	2020 Electricity Emission Factor (PG&E)	0.133	MT CO_2e/MWh
	End Use Reduction - Mitigated	0.39	MT CO_2e/Year
Advanced Analytics>>	Cooling - Electricity Use - Unmitigated	1,121,583.25	kWh/year
	Participation Rate (amount of end use affected)	100%	Percent
	Percent Reduction in End Use Electricty Use	20%	Percent
	End Use Electricity Reduced	224,316.65	kWh/year
	2020 Electricity Emission Factor (PG&E)	0.133	MT CO_2e/MWh
	End Use Reduction - Mitigated	29.91	MT CO_2e/Year
Cool Roofs>>	Cooling - Electricity Use - Unmitigated	1,121,583.25	kWh/year
	Participation Rate (amount of end use affected)	35%	Percent
	Percent Reduction in End Use Electricty Use	7%	Percent
	End Use Electricity Reduced	27,478.79	kWh/year
	2020 Electricity Emission Factor (PG&E)	0.133	MT CO_2e/MWh
	End Use Reduction - Mitigated	3.66	MT CO_2e/Year
	Exterior Lighting - Electricity Use - Unmitigated	310,796.60	kWh/year
	Participation Rate (amount of end use affected)	100%	Percent
	Percent Reduction in End Use Electricty Use	25%	Percent
	End Use Electricity Reduced	77,699.15	kWh/year
	2020 Electricity Emission Factor (PG&E)	0.133	MT CO_2e/MWh
	End Use Reduction - Mitigated	10.36	MT CO_2e/Year
	Interior Lighting - Electricity Use - Unmitigated	1,756,226.99	kWh/year
	Participation Rate (amount of end use affected)	100%	Percent
	Percent Reduction in End Use Electricty Use	25%	Percent
	End Use Electricity Reduced	439,056.75	kWh/year
	2020 Electricity Emission Factor (PG&E)	0.133	MT CO_2e/MWh
	End Use Reduction - Mitigated	58.54	MT CO_2e/Year
	Miscellaneous- Electricity Use - Unmitigated	305,740.72	kWh/year
	Participation Rate (amount of end use affected)	100%	Percent
	Percent Reduction in End Use Electricty Use	20%	Percent
	End Use Electricity Reduced	61,148.14	kWh/year
	2020 Electricity Emission Factor (PG&E)	0.133	MT CO_2e/MWh
	End Use Reduction - Mitigated	8.15	MT CO_2e/Year
	Motors - Electricity Use - Unmitigated	105,682.39	kWh/year
	Participation Rate (amount of end use affected)	100%	Percent
	Percent Reduction in End Use Electricty Use	20%	Percent
	End Use Electricity Reduced	21,136.48	kWh/year
	2020 Electricity Emission Factor (PG&E)	0.133	MT CO_2e/MWh
	End Use Reduction - Mitigated	2.82	MT CO_2e/Year
	Process - Electricity Use - Unmitigated	1,301.69	kWh/year
	Participation Rate (amount of end use affected)	100%	Percent
	Percent Reduction in End Use Electricty Use	10%	Percent
	End Use Electricity Reduced	130.17	kWh/year
	2020 Electricity Emission Factor (PG&E)	0.133	MT CO_2e/MWh
	End Use Reduction - Mitigated	0.02	MT CO_2e/Year
	Refrigeration - Electricity Use - Unmitigated	203,846.42	kWh/year
	Participation Rate (amount of end use affected)	100%	Percent
	Percent Reduction in End Use Electricty Use	10%	Percent
	End Use Electricity Reduced	20,384.64	kWh/year
	2020 Electricity Emission Factor (PG&E)	0.133	MT CO_2e/MWh
	End Use Reduction - Mitigated	2.72	MT CO_2e/Year
	Ventilation - Electricity Use - Unmitigated	1,051,826.99	kWh/year
	Participation Rate (amount of end use affected)	100%	Percent
	Percent Reduction in End Use Electricty Use	20%	Percent
	End Use Electricity Reduced	210,365.40	kWh/year
	2020 Electricity Emission Factor (PG&E)	0.133	MT CO_2e/MWh
	End Use Reduction - Mitigated	28.05	MT CO_2e/Year
	Water Heating - Electricity Use - Unmitigated	64,850.95	kWh/year
	Participation Rate (amount of end use affected)	100%	Percent
	Percent Reduction in End Use Electricty Use	10%	Percent
	End Use Electricity Reduced	6,485.09	kWh/year
	2020 Electricity Emission Factor (PG&E)	0.133	MT CO_2e/MWh
	End Use Reduction - Mitigated	0.86	MT CO_2e/Year
	Heating - Natural Gas Use - Unmitigated	171,036.41	therms
	Participation Rate (amount of end use affected)	100%	Percent
	Percent Reduction in End Use Natural Gas Use	20%	Percent
	End Use Natural Gas Reduced	34,207.28	therms
	Natural Gas Emission Factor	0.00531	MT CO_2e/MWh
	End Use Reduction - Mitigated	181.65	MT CO_2e/Year
Quantification of this strategy is continued next page			

	Water Heating - Natural Gas Use - Unmitigated	*23,469.78*	*therms*
	Participation Rate (amount of end use affected)	*100%*	*Percent*
	Percent Reduction in End Use Natural Gas Use	*10%*	*Percent*
	End Use Natural Gas Reduced	*2,346.98*	*therms*
	Natural Gas Emission Factor	*0.00531*	*MT CO_2e/therm*
	End Use Reduction - Mitigated	*12.46*	*MT CO_2e/Year*
	Reduction	***339.59***	***MT CO_2e/Year***
F-4 New Building Energy Performance			
A. Enhanced Green Building Standard	Parameters	Value	Units
	Supporting		
F-5 Public Realm Lighting Efficiency			
A. Parking Lot Lighting Retrofits	Parameters	Value	Units
	Street Lighting - Electricity Use - Unmitigated	*2,100.37*	*MWh/year*
	Percent Reduction in End Use Electricty Use	*40%*	*Percent*
	End Use Electricity Reduced	*840.15*	*MWh/year*
	2020 Electricity Emission Factor (PG&E)	*0.133*	*MT CO_2e/MWh*
	End Use Reduction - Mitigated	*112.01*	*MT CO_2e/Year*
	Parking Lot Lighting - Electricity Use - Unmitigated	*121.15*	*MWh/year*
	Percent Reduction in End Use Electricty Use	*40%*	*Percent*
	End Use Electricity Reduced	*48.46*	*MWh/year*
	2020 Electricity Emission Factor (PG&E)	*0.133*	*MT CO_2e/MWh*
	End Use Reduction - Mitigated	*6.46*	*MT CO_2e/Year*
	Reduction	***118.47***	***MT CO_2e/Year***
B. Park Facility Lighting Retrofits	Parameters	Value	Units
	Park Lighting - Electricity Use - Unmitigated	*348.10*	*MWh/year*
	Percent Reduction in End Use Electricty Use	*40%*	*Percent*
	End Use Electricity Reduced	*139.24*	*MWh/year*
	2020 Electricity Emission Factor (PG&E)	*0.133*	*MT CO_2e/MWh*
	Reduction	***18.56***	***MT CO_2e/Year***
C. Parking Garage Lighting Retrofits	Parameters	Value	Units
	Supporting		
F-6 Landscape Water Conservation			
A. Green Grounds Policy	Parameters	Value	Units
	Outdoor/Landscape Water Electricity Use - Unmitigated	*44,182.00*	*kWh/year*
	Participation Rate (amount of landscape area affected)	*100%*	*Percent*
	Percent Reduction in Outdoor/Landscape Water Electricty Use	*10%*	*Percent*
	Electricity Reduced	*4,418.20*	*kWh/year*
	2020 Electricity Emission Factor (PG&E)	*0.133*	*MT CO_2e/MWh*
	Reduction	***0.59***	***MT CO_2e/Year***
Reductions from the Renewable Portfolio Standard			
	Electricity-Related Emissions BAU (2020)	*2,581.58*	*MT CO_2e/year*
	Electricity-Related Emission w/ RPS (2020)	*2,011.23*	*MT CO_2e/year*
	Percent of Electricity Generation Portfolio from Renewables in Baseline Year	*14%*	*Percent*
	Percent of Electricity Generation Portfolio from Renewables in 2020	*33%*	*Percent*
	Reduction	***570.35***	***MT CO_2e/Year***
VEHICLE FLEET SECTOR			
VF-1 Efficient Vehicles			
A. Fuel-Efficient Vehicle Procurement Policy	Parameters	Value	Units
	Passenger Vehicles - Annual Fuel Usage - Unmitigated	*65,054.94*	*Gallons*
	Emission Factor - Gasoline	*8.81*	*kg CO_2/gallon*
	Baseline Emissions	*603.30*	*MT CO_2e/year*
	Percent of Cars Upgraded	*10%*	*Percent*
	Percent Average Increase in Fuel Efficiency	*40%*	*Percent*
	Percent of Fuel Reduced by Changing to Fuel Efficient Vehicles	*4%*	*Percent*
	Amount of Fuel Reduced per Vehicle Class	*2,729.39*	*Gallons*
	Reduction per Vehicle Class - Mitigated	*25.31*	*MT CO_2e/year*
	Light Duty Vehicles - Annual Fuel Usage - Unmitigated	*39,091.06*	*Gallons*
	Emission Factor - Gasoline	*8.81*	*kg CO_2/gallon*
	Baseline Emissions	*362.52*	*MT CO_2e/year*
	Percent of Cars Upgraded	*10%*	*Percent*
	Percent Average Increase in Fuel Efficiency	*25%*	*Percent*
	Percent of Fuel Reduced by Changing to Fuel Efficient Vehicles	*3%*	*Percent*
	Amount of Fuel Reduced per Vehicle Class	*1,025.05*	*Gallons*
	Reduction per Vehicle Class - Mitigated	*9.51*	*MT CO_2e/year*
	Reduction	***34.82***	***MT CO_2e/Year***
B. Fuel-Efficient Operational and Maintenance Policies	Parameters	Value	Units
	Supporting		

VF-2 Alternative Fuel Vehicles			
A. Municipal Fleet Emissions Target	Parameters	Value	Units
	Supporting		
B. Vehicle Fleet Plan	Parameters	Value	Units
	Passenger Vehicles - Annual Fuel Usage - Unmitigated	*65,054.94*	*Gallons*
	Emission Factor - Gasoline	*8.81*	*kg CO_2/gallon*
	Baseline Emissions	*603.30*	*MT CO_2e/year*
	Percent of Cars Switched to EV	*25%*	*Percent*
	Amount of Fuel Replaced by Electricity per Vehicle Class	*17,058.71*	*Gallons*
	Emissions Reduced through Reduced Fuel Use per Vehicle Class	*158.20*	*MT CO_2e/year*
	Emission from Additional Electricity Use per Vehicle Class	*75.96*	*MT CO_2e/year*
	Reduction per Vehicle Class - Mitigated	*82.23*	*MT CO_2e/year*
	Light Duty Vehicles - Annual Fuel Usage - Unmitigated	*39,091.06*	*Gallons*
	Emission Factor - Gasoline	*8.81*	*kg CO_2/gallon*
	Baseline Emissions	*362.52*	*MT CO_2e/year*
	Percent of Cars Switched to EV	*5%*	*Percent*
	Amount of Fuel Replaced by Electricity per Vehicle Class	*2,050.09*	*Gallons*
	Emissions Reduced through Reduced Fuel Use per Vehicle Class	*19.01*	*MT CO_2e/year*
	Emission from Additional Electricity Use per Vehicle Class	*9.13*	*MT CO_2e/year*
	Reduction per Vehicle Class - Mitigated	*9.88*	*MT CO_2e/year*
	Passenger Vehicles - Annual Fuel Usage - Unmitigated	*65,054.94*	*Gallons*
	Emission Factor - Gasoline	*8.81*	*kg CO_2/gallon*
	Baseline Emissions	*603.30*	*MT CO_2e/year*
	Percent of Cars Switched to CNG	*5%*	*Percent*
	Amount of Fuel Replaced by CNG per Vehicle Class	*3,411.74*	*Gallons*
	Emissions Reduced through Reduced Fuel Use per Vehicle Class	*31.64*	*MT CO_2e/year*
	Emissions from Additional CNG Use per Vehicle Class	*23.57*	*MT CO_2e/year*
	Reduction per Vehicle Class - Mitigated	*8.07*	*MT CO_2e/year*
	Light Duty Vehicles - Annual Fuel Usage - Unmitigated	*39,091.06*	*Gallons*
	Emission Factor - Gasoline	*8.81*	*kg CO_2/gallon*
	Baseline Emissions	*362.52*	*MT CO_2e/year*
	Percent of Cars Switched to CNG	*10%*	*Percent*
	Amount of Fuel Replaced by CNG per Vehicle Class	*4,100.18*	*Gallons*
	Emissions Reduced through Reduced Fuel Use per Vehicle Class	*38.02*	*MT CO_2e/year*
	Emissions from Additional CNG Use per Vehicle Class	*28.32*	*MT CO_2e/year*
	Reduction per Vehicle Class - Mitigated	*9.70*	*MT CO_2e/year*
	Heavy Duty Vehicles - Annual Fuel Usage - Unmitigated	*18,026.80*	*Gallons*
	Emission Factor - Diesel	*10.15*	*kg CO_2/gallon*
	Baseline Emissions	*192.60*	*MT CO_2e/year*
	Percent of Cars Switched to CNG	*30%*	*Percent*
	Amount of Fuel Replaced by CNG per Vehicle Class	*14,721.97*	*Gallons*
	Emissions Reduced through Reduced Fuel Use per Vehicle Class	*157.29*	*MT CO_2e/year*
	Emissions from Additional CNG Use per Vehicle Class	*115.56*	*MT CO_2e/year*
	Reduction per Vehicle Class - Mitigated	*41.73*	*MT CO_2e/year*
	Reduction	***151.62***	***MT CO_2e/year***
C. CNG Fueling Stations	Parameters	Value	Units
	Supporting		
D. Electric Vehicle Charging Stations	Parameters	Value	Units
	Supporting		
VF-3 Behavior / Fuel Optimization			
A. Telematics	Parameters	Value	Units
	Annual Baseline Vehicle Fleet Gas Usage	*104,282.71*	*Gallons*
	Emission Factor - Gasoline	*8.81*	*kg CO_2/gallon*
	Baseline Emissions	*967.08*	*MT CO_2e/year*
	Annual Baseline Vehicle Fleet Diesel Usage	*76,822.46*	*Gallons*
	Emission Factor - Diesel	*10.15*	*kg CO_2/gallon*
	Baseline Emissions	*820.79*	*MT CO_2e/year*
	Percent Reduction in Fuel Usage	*5%*	*Percent*
	Amount of Gasoline Reduced	*4,797.00*	*Gallons*
	Amount of Diesel Reduced	*3,533.83*	*Gallons*
	Amount of Gasoline Emissions Reduced	*42.26*	*MT CO_2e/year*
	Amount of Diesel Emissions Reduced	*35.87*	*MT CO_2e/year*
	Reduction	***78.13***	***MT CO_2e/year***
B. Fuel Saving Recognition Program	Parameters	Value	Units
	Supporting		

SOLID WASTE SECTOR			
SW-1 Waste Reduction			
A. Green Procurement Specifications	Parameters	Value	Units
	Supporting		
B. Waste Reduction and Diversion Goals	Parameters	Value	Units
	2020 Total Waste - Unmitigated	*2,264.09*	*Tons*
	2020 Total Waste Emissions - Unmitigated	*574.19*	*MT CO_2e/year*
	Paper Products Percent of Total Waste	*39.4%*	*Percent*
	Food Waste Percent of Total Waste	*9.8%*	*Percent*
	Plant Debris Percent of Total Waste	*17.0%*	*Percent*
	Wood/Textile Percent of Total Waste	*6.7%*	*Percent*
	All Other Waste Percent of Total Waste	*27.1%*	*Percent*
	2020 Tons of Paper Waste - Unmitigated	*892.05*	*Tons*
	Percent of Waste Type Diverted	*20%*	*Percent*
	Tons of Paper Waste Diverted	*178.41*	*Tons*
	2020 Tons of Food Waste - Unmitigated	*221.88*	*Tons*
	Percent of Waste Type Diverted	*80%*	*Percent*
	Tons of Food Waste Diverted	*177.51*	*Tons*
	2020 Total Waste - Mitigated	*1,908.18*	*Tons*
	Emissions Reduction Factor (2020 Percent of Total Waste Tons Remaining after Mitigation)	*84%*	*Percent*
	Reduction	***90.26***	***MT CO_2e/year***
C. Waste Audits / Surveys and Diversion Rate Tracking	Parameters	Value	Units
	Supporting		
SW-2 Recyclable Paper Diversion			
A. Paperless Office Policy / Program	Parameters	Value	Units
	2020 Total Waste - Unmitigated	*2,264.09*	*Tons*
	2020 Total Waste Emissions - Unmitigated	*574.19*	*MT CO_2e/year*
	Paper Products Percent of Total Waste	*39%*	*Percent*
	Food Waste Percent of Total Waste	*10%*	*Percent*
	Plant Debris Percent of Total Waste	*17%*	*Percent*
	Wood/Textile Percent of Total Waste	*7%*	*Percent*
	All Other Waste Percent of Total Waste	*27%*	*Percent*
	2020 Tons of Paper Waste - Unmitigated	*892.05*	*Tons*
	Percent of Waste Type Diverted	*30%*	*Percent*
	Tons of Paper Waste Diverted	*267.62*	*Tons*
	2020 Total Waste - Mitigated	*1,996.48*	*Tons*
	Emissions Reduction Factor (2020 Percent of Total Waste Tons Remaining after Mitigation)	*88%*	*Percent*
	Reduction	***67.87***	***MT CO_2e/year***
SW-3 Landscape Waste Diversion			
A. Municipal Landscape Waste Composting Program	Parameters	Value	Units
	2020 Total Waste - Unmitigated	*2,264.09*	*Tons*
	2020 Total Waste Emissions - Unmitigated	*574.19*	*MT CO_2e/year*
	Paper Products Percent of Total Waste	*39%*	*Percent*
	Food Waste Percent of Total Waste	*10%*	*Percent*
	Plant Debris Percent of Total Waste	*17%*	*Percent*
	Wood/Textile Percent of Total Waste	*7%*	*Percent*
	All Other Waste Percent of Total Waste	*27%*	*Percent*
	2020 Tons of Plant Debris Waste - Unmitigated	*384.90*	*Tons*
	Percent of Waste Type Diverted	*80%*	*Percent*
	Tons of Plant Debris Waste Diverted	*307.92*	*Tons*
	2020 Total Waste - Mitigated	*1,956.18*	*Tons*
	Emissions Reduction Factor (2020 Percent of Total Waste Tons Remaining after Mitigation)	*86%*	*Percent*
	Reductions	***78.09***	***MT CO_2e/year***
SW-4 Construction and Demolition Waste Diversion			
A. Municipal Construction and Demolition Standards	Parameters	Value	Units
	2020 Total Waste - Unmitigated	*2,264.09*	*Tons*
	2020 Total Waste Emissions - Unmitigated	*574.19*	*MT CO_2e/year*
	Paper Products Percent of Total Waste	*39%*	*Percent*
	Food Waste Percent of Total Waste	*10%*	*Percent*
	Plant Debris Percent of Total Waste	*17%*	*Percent*
	Wood/Textile Percent of Total Waste	*7%*	*Percent*
	All Other Waste Percent of Total Waste	*27%*	*Percent*
	2020 Tons of Wood/Textile Waste - Unmitigated	*151.69*	*Tons*
	Assumed Wood/Textile Waste Diversion Rate from Qualified Projects	*80%*	*Percent*
	Qualified Percent of Projects	*80%*	*Percent*
	Percent of Waste Type Diverted	*64%*	*Percent*
	Tons of Wood/Textile Waste Diverted	*97.08*	*Tons*
	2020 Tons of All Other Waste - Unmitigated	*613.57*	*Tons*
	Assumed All Other Waste Diversion Rate from Qualified Projects	*80%*	*Percent*
	Qualified Percent of Projects	*80%*	*Percent*
	Percent of Waste Type Diverted	*64%*	*Percent*
	Tons of All Other Waste Diverted	*392.68*	*Tons*
	2020 Total Waste - Mitigated	*1,774.33*	*Tons*
	Emissions Reduction Factor (2020 Percent of Total Waste Tons Remaining after Mitigation)	*78%*	*Percent*
	Reductions	***124.21***	***MT CO_2e/year***