City of Mountain View

Climate Protection Roadmap

Final | September 2015

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City of Mountain View

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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
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

The City of Mountain View has developed a Climate Protection Roadmap (CPR) as part of its multifaceted approach to addressing climate change. This Introduction provides summary information about the CPR's impetus and structure, the current and future state of greenhouse gas (GHG) emissions in the City, past and current city GHG reduction efforts, the State and regional policy context, CPR methodology, and potential reduction scenarios pending the implementation of the recommended mechanisms. Following this Introduction are three technical chapters. The first two technical chapters focus on the two largest contributors to the City's GHG emissions, Building Energy and Transportation. The third technical chapter covers Solid Waste, the third largest GHG contributor, and summarizes the City's current waste reduction initiatives (i.e., zero waste).

CPR Background and Purpose

This section outlines the background and purpose of the CPR, including its origin, and how it relates to various other city GHG reduction plans, documents, and efforts.

CPR Background

In November 2009, the City Council adopted the following voluntary, absolute communitywide GHG emission reduction targets:

- 5% below 2005 baseline levels by 2012
- 10% below 2005 baseline levels by 2015
- 15–20% below 2005 baseline levels by 2020
- 80% below 2005 baseline levels by 2050

Absolute targets call for a reduction in total communitywide greenhouse gas emission levels, *and do not allow for increased emissions due to population growth*. Together the targets put the community on a trajectory toward achievement of meaningful contributions to State, national, and international climate protection efforts.

In 2012, the City adopted a Greenhouse Gas Reduction Plan (GGRP) to mitigate the emissions associated with future development allowed in the 2030 Mountain View General Plan.[1] At the time, Bay Area Air Quality Management District (BAAQMD) guidelines required qualified greenhouse gas reduction plans to contain a target for 2020 and provide substantial evidence that the plan's reduction actions would achieve the selected target. The BAAQMD guidelines allowed cities to use either an absolute or an efficiency-based target.[2] During development of the GGRP, it became clear that it would be very difficult to achieve the adopted communitywide 2020 emission reduction target due to high levels of future development and emissions growth, and the general political and economic infeasibility of implementing aggressive emission reduction policies and programs. For this reason, the City chose to use a BAAQMD-approved emissions efficiency target within the GGRP, i.e., a per-capita target that would result in a community emissions efficiency of below 6.0 metric tons of carbon dioxide equivalent per service population. (Service population is defined as residents and employees.) This means that Mountain View may continue to grow and increase its overall absolute GHG emissions while striving to reduce its "per-capita" emissions.

While the GGRP defines actions that will improve community greenhouse gas efficiency in 2020 and 2030, it does not contain actions strong enough to achieve the City's adopted absolute targets. The City recognized the incongruence of the efficiency targets used within the GGRP with its previously adopted absolute targets and sought to resolve the issue by conducting a study to evaluate the feasibility of achieving the adopted targets. The City initiated the CPR project for this purpose.

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[1] Per Section 15183.5 of the California Environmental Quality Act, page 199 of the 2014 CEQA Statute and Guidelines http://resources.ca.gov/ceqa/docs/2014_CEQA_Statutes_and_Guidelines.pdf

[2] Absolute targets require a reduction in total emissions below a reference level (the baseline year), whereas efficiency-based targets require the level of emissions per capita (or per service population) to be reduced below a reference level. It should be noted that efficiency targets allow a community's total emissions to increase while efficiency improves.

In addition to the GGRP, the City has also developed a Municipal Operations Climate Action Plan (MOCAP) to define the actions that the City can implement to reduce greenhouse gas emissions resulting from its own operations (e.g., government buildings, facilities, and vehicle fleets). While municipal emissions account for only about 2% of the community's total emissions, the MOCAP details strategies and actions that demonstrate the City's commitment to climate protection. These actions will assist in the achievement of the 2050 community-wide GHG reduction target.

CPR PURPOSE

As shown in Figure 1.1 below, the community's greenhouse gas emissions are anticipated to increase to 68% above 2005 levels by 2050. The City's adopted absolute target is to reduce community emissions 80% below 2005 levels by 2050. Considerable activities will therefore need to occur within Mountain View and elsewhere to achieve this target.

The CPR seeks to evaluate mechanisms through which the community could achieve the 2050 emission reduction target and identify various roles the City might play in facilitating such reductions. The first step of the analysis was to identify the array of technological, behavioral, and/or other system transitions that could reduce emissions within the community. The second step was to identify the most important transitions (referred to as core strategies within the document). The third step was to identify actions (referred to as implementation mechanisms) within the City's authority that could contribute to these transitions.

The CPR is not a plan in and of itself, but an analysis that may be used by City officials to evaluate the potential for long-term communitywide emission reduction initiatives moving forward. Due to the high-level nature of the analysis, the CPR does not explicitly direct implementation of any specific city actions. However, it outlines viable options for future city programs, policies, and actions that could be pursued following additional feasibility analysis.

Moving toward achieving the community emission reduction targets, the City should conduct detailed analysis of the included mechanisms, and develop and implement appropriate and effective programs, policies, and/or actions. Over time, the City should monitor and evaluate the effectiveness of the programs, policies, and/or actions and make adjustments as necessary.

As part of this CPR, the City is encouraged to adopt additional community emission reduction targets for every five-year period between 2020 and 2050. These interim targets would help keep the City on track to achieve its long-term 2050 reduction target. The following additional targets are recommended:

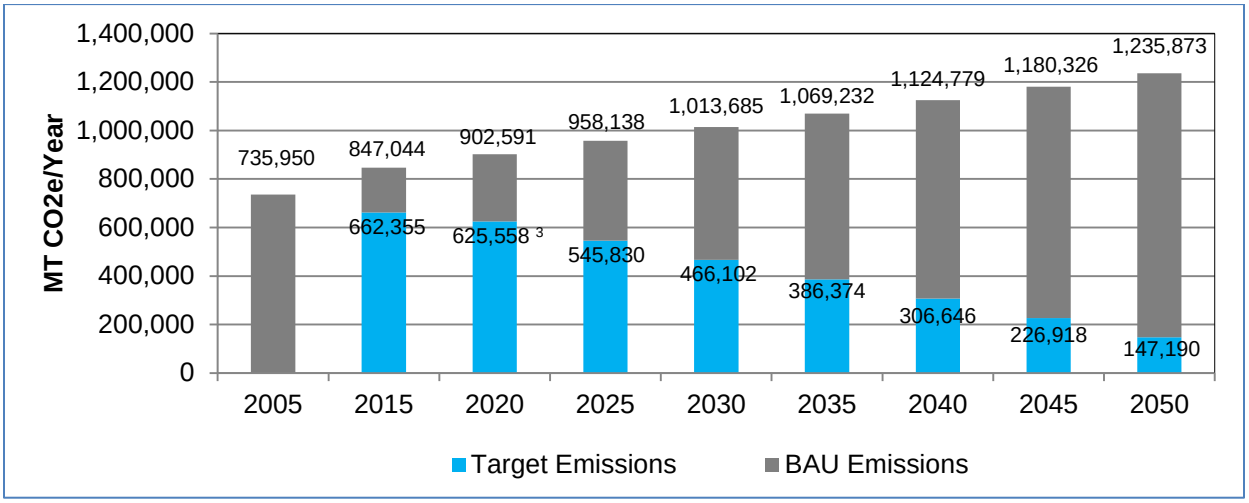
- 26% below 2005 baseline levels by 2025
- 37% below 2005 baseline levels by 2030
- 48% below 2005 baseline levels by 2035
- 58% below 2005 baseline levels by 2040
- 69% below 2005 baseline levels by 2045

Achievement of these targets will demonstrate the City's commitment to the State's climate protection efforts.

While the CPR analysis was focused on GHG emission reductions, implementation of the included mechanisms will likely enable the City of Mountain View to be more *resilient* in

addressing the impacts of climate change. In addition, some of the mechanisms offer health and social benefits, such as improved heath and sense of "community" from walking and biking more, improved air quality, more comfortable homes and commercial buildings, etc.

Figure 1.1: Community Emission Projections and Reduction Targets, 2005-2050 3



THE CITY'S COMMITMENT TO CLIMATE PROTECTION AND SUSTAINABILITY

The City has a long history of programs that demonstrate a commitment to sustainability overall and climate protection specifically. As an example, the City has had a robust curbside recycling program since 1987, which has helped to divert thousands of tons of materials away from landfills. In October 2007, the Council voted to endorse the U.S. Mayors Climate Protection Agreement, joining nearly 700 cities across the United States to commit to working to reduce GHG emissions.

The City of Mountain View has implemented numerous efforts to reduce CO2 emissions locally and contribute to the regional and national efforts to address the challenges of climate change. Under the City Council's leadership, the City has implemented numerous programs, policies, ordinances, and actions to help improve energy efficiency, conserve energy, and promote living and transportation alternatives that benefit the environment. The City of Mountain View has garnered awards and recognitions for many of these projects, demonstrating how local governments can make a difference toward addressing global environmental challenges.

Following is a brief description of the City's more recent major sustainability activities and programs.:

2008 Environmental Sustainability Task Force Report

In October 2008, the City Council accepted the final report of the Environmental Sustainability Task Force (ESTF), containing 89 recommendations outlining policies, strategies, and actions to conserve resources and reduce the community's carbon footprint. The recommendations were

[3] Note that the 2020 community target calls for a 15% to 20% reduction below 2005 levels. A 15% reduction is show in Figure 1.1.

prioritized within 11 topic areas, from short-term to long-term, and included approximate implementation costs and greenhouse gas (GHG) reduction potentials.

2009 and 2012 Environmental Sustainability Action Plans

The City's two Environmental Sustainability Action Plans (ESAPs) represent short-term "road maps" for strategic investment in environmental sustainability initiatives. They contain numerous actions across different topic areas, but lack detailed GHG reduction estimates. The ESAPs are reviewed periodically and updated by the Council Environmental Sustainability Committee (CESC) and City Council to include additional Task Force recommendations, to address new regulatory requirements, and to track the City's progress in achieving its GHG reduction targets. They contain both quick payback actions that reduce the City's operational expenses and bigger, longer-term projects that will reduce community GHG emissions. The ESAPs also set forth actions that establish a policy framework to embed sustainability practices in the community and City organization.

2009 and 2010 GHG Reduction Targets

As described earlier, in November 2009 and March 2010 the City Council adopted voluntary, absolute GHG reduction targets for the community as a whole and for City operations, respectively. The targets were consistent with the policies of most other local cities and efforts worldwide to address climate change. These absolute targets do not consider growth in employment and population, as mitigating climate change requires a stabilization of, and ultimately a reduction in, global emissions.

2030 General Plan

A General Plan describes a community's vision and identifies strategies for managing the City's development and preservation in order to guide future growth. The 2030 General Plan establishes goals, policies, and actions related to climate change, and the 2030 General Plan Action Plan (GPAP) tracks specific actions that implement the General Plan's goals and policies.

Greenhouse Gas Reduction Program

Highlighted earlier, the City's GGRP implements General Plan policies related to climate change, sustainability, and GHG emissions. A key purpose of the GGRP is to describe how to mitigate the 2030 General Plan GHG impacts to meet CEQA requirements.

A limitation of the GGRP is that it is primarily a mitigation strategy in order to be considered a "qualified plan" by the Bay Area Air Quality Management District (BAAQMD) and comply with CEQA requirements. As a mitigation strategy, the policies and actions need to be realistic, quantifiable, and achievable. Therefore, some actions identified in the General Plan have not been included in the GGRP because there is not enough information to forecast their GHG emissions reduction potential at this time. Examples include the Citywide shuttle system, an updated Transit-Oriented Zoning Designation, or a district-level approach to achieving higher sustainability in the North Bayshore Area. The GGRP is updated every three to five years to include GPAP actions, to assess if it is achieving its goal of reducing GHG emissions, and to review the City's overall strategy for GHG emission reductions.

State Policy and Regulatory Context

Many strategies for addressing climate change have emerged at the international, national, state, and local levels. California remains a leader in the effort to reduce greenhouse gas emissions through a diversity of mitigation strategies. This section highlights the primary State legislation and guidance that directs emission mitigation efforts at the local government level.

With the passage of Assembly Bill 32 (AB 32)—also known as the California Global Warming Solutions Act—California is the first state in the U.S. to mandate emissions reductions across its entire economy. To support AB 32, California has developed policy and legislation that seeks to control emissions of gases that contribute to climate change. These efforts include regulatory approaches such as mandatory reporting for significant sources of emissions and caps on emission levels, as well as market-based mechanisms, such as cap-and-trade. While the majority of the State's policies have been directed at industry, some legislation directs action at the local government level. Descriptions of legislation most relevant to local governments are provided below.

Executive Order S-3-05

Recognizing California's vulnerability to reduced snowpack, exacerbation of air quality problems, and sea level rise resulting from a changing climate, Governor Arnold Schwarzenegger signed Executive Order S-3-05 (EO S-3-05) in 2005. This EO established targets to reduce emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80% below 1990 levels by 2050.

Assembly Bill 32 – California Global Warming Solutions Act

In 2006, California became the first state to adopt a GHG reduction target through Assembly Bill 32 (AB 32), thereby making EO S-3-05 legally binding. AB 32 requires California to reduce Statewide emissions to 1990 levels by 2020. AB 32 directs the California Air Resources Board (CARB) to serve as the lead agency to implement this legislation. Mandatory actions under the legislation to be completed by CARB include:

- Identification of early action items that can be quickly implemented to achieve emission reductions. These early action items were adopted by CARB in 2007 and include regulations affecting landfill operations, motor vehicle fuels, car refrigerants, and port operations, among other regulations.

- Development of a Scoping Plan to identify the most technologically feasible and cost-effective measures to achieve the necessary emissions reductions to reach 1990 levels by 2020. The Scoping Plan contains a variety of reduction measures that include direct regulations, alternative compliance mechanisms, different types of incentives, and voluntary actions, as well as a market-based Cap-and-Trade Program. The Scoping Plan identifies local governments as strategic partners to achieving the State goal and translates the Statewide GHG reduction goal to a local goal of 15% of current emissions by 2020. The initial Scoping Plan was developed in 2008, and the first update to the Scoping plan was completed in 2014. The update highlights California's progress toward meeting the near-term 2020 emission reduction goals defined in the initial Scoping Plan. It also evaluates how to align the State's longer-term GHG reduction strategies with other State policy priorities for Water, Waste, Natural Resources, Clean Energy, Transportation, and Land Use.

- Creation and adoption of regulations to require the State's largest industrial emitters of GHGs to report and verify their emissions on an annual basis.

SENATE BILL 97 – CALIFORNIA ENVIRONMENTAL QUALITY ACT GUIDELINE AMENDMENTS

Senate Bill 97 (SB 97) was adopted in 2007 and directed the Governor's Office of Planning and Research (OPR) to amend the California Environmental Quality Act (CEQA) Guidelines to include the analysis and mitigation of emissions as part of the CEQA process (which is to identify the significant environmental impacts of proposed projects and to avoid or mitigate those impacts, if feasible). The CEQA Guidelines prepared by OPR were adopted by the Natural Resources Agency in December 2009 and went into effect March 18, 2010. Under these guidelines, project proponents are required to analyze emissions of proposed projects, and if the emissions are determined to be significant, proponents are required to consider a range of mitigation measures to reduce these emissions.

General Plans or other development plans (e.g., Specific Plans) are considered projects under CEQA and therefore the lead agency (i.e., the City) is required to examine potential emissions that could result from the adoption of the plan. Additionally, future development projects accommodated within the plan must conduct an evaluation of potential emissions and will likely need to mitigate its impact. Local governments have the opportunity to streamline the analysis of emissions at the project level by using an adopted Climate Action Plan (or similar plan) as long as it is consistent with CEQA Guidelines. Consistency with CEQA Guidelines means that the Climate Action Plan (CAP) accomplishes the following:

- Quantifies and analyzes emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area.

- Establishes an emissions level, based on substantial evidence, below which the contribution to emissions from activities covered by the plan would not be cumulatively considerable.

- Specifies measures or a group of measures, including performance standards that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level.

- Establishes a mechanism to monitor the plan's progress toward achieving the specified emissions level, and requires an amendment to the plan if it is not achieving the specified levels.

- Is adopted in a public process following environmental review.

BAAQMD expanded and incorporated these Statewide requirements into its own guidelines. All projects and plans prepared in the district are reviewed by the agency for compliance with these requirements. Additional guidance from the State Attorney General's Office and OPR has indicated that mitigation efforts within CAPs must put a community on a trajectory toward contributing to the State's long-term 2050 emission reduction target (i.e., 80% below 1990 levels). Although the State has not defined what a local government's specific emission reduction target should be, it is assumed that considerable reductions in community emissions would need to be demonstrated.

SB 375 – Sustainable Communities and Climate Protection Act

Senate Bill 375 (SB 375), also known as the Sustainable Communities and Climate Protection Act of 2008, builds upon AB 32 and aims to reduce Transportation-related greenhouse gas emissions via coordinated Transportation and Land Use planning. It required CARB to set reduction targets for emissions from passenger vehicle use for each region governed by the State's Metropolitan Planning Organizations (MPOs), and directs the MPOs to include a Sustainable Communities Strategy (SCS) in its Regional Transportation Plan (RTP) to achieve these targets. The emission reduction target for the San Francisco Bay Area is a 7% per capita reduction by 2020 and a 15% per capita reduction by 2035 from passenger vehicle use. In 2013, the Metropolitan Transportation (MTC), in collaboration with the Association of Bay Area Governments (ABAG) adopted Plan Bay Area, a long-range integrated Transportation and Land Use/Housing strategy through 2040, which includes the region's SCS and the 2040 RTP. Plan Bay Area demonstrates how the region will achieve the emissions reduction targets set by CARB. While there are no explicit requirements for cities to comply with the RTP, it is possible that regional Transportation funds could be withheld from cities that do not comply with the Plan's objectives.

While current State guidelines are currently voluntary, more emphasis is being placed on monitoring and reporting emissions to demonstrate the effectiveness of policies and local consistency with State reduction goals. Future CEQA, General Plan, and CAP guidelines are anticipated to define additional requirements for local governments. While the CPR is not a climate action plan, it will help the City analyze opportunities to considerably reduce community emissions in a way that contributes to the State's long-term emission reduction goal.

CPR Planning Framework and Methodology

The intent of the framework is to provide a high-level but comprehensive overview of the likely transitions that will need to occur within the community to achieve the 2050 target and then to identify the initiatives the City could implement to facilitate such transitions. It should be noted that many of the transitions are dependent on anticipated advances in technology or changes in market conditions. The City may only be able to influence some of these transitions at the periphery. That said, the proposed implementation mechanisms will likely contribute to such transitions occurring locally, regionally, and nationally.

The planning framework used to develop the Climate Protection Roadmap consisted of four phases including: (1) development of a 2050 emission forecast, (2) an activity-based emissions impact analysis, (3) a core strategy analysis, and (4) a review of best practice City-level implementation mechanisms.

2050 Emission Forecast

Understanding the magnitude and type of emissions is a critical component of any climate protection planning effort. In the first phase of the project, the City developed a 2050 emission forecast. To obtain an estimate of 2050 emissions, activity growth was linearly extrapolated from the GGRP 2020 and 2030 emission forecasts to this later 2050 horizon. In the Business-As-Usual (BAU) forecast activity intensities and emission factors were held constant. The Adjusted

Business-As-Usual (ABAU) forecast reflects the reduction in building sector emissions resulting from the implementation of the State of California's Renewable Energy Portfolio Standard.[4]

ACTIVITY-BASED EMISSIONS IMPACT ANALYSIS

After the 2050 emission forecast was completed, an activity-based emissions impact analysis was performed to identify the types of macro-level changes in emissions generating activity that could create sizable reductions in community emissions. This high-level analysis provided insights into the ways emissions in the Energy, Transportation, and Solid Waste sectors could be reduced and the importance of different technology and other system transitions (e.g., energy efficiency improvements, fuel switching, increased waste diversion, etc.). In this analysis, it became clear that fuel switching and enhanced low-carbon and renewable energy generation would be critical to achieving the 2050 GHG emission reduction target. Please see the section *"Predominant Focus on Fuel Switching"* toward the end of the chapter for additional discussion of fuel switching and its predominance in this CPR.

CORE STRATEGY ANALYSIS

The emission impact analysis served as an important input into the third phase of the CPR study, the core strategy analysis. This analysis included a review of the effectiveness and feasibility of specific emission reduction strategies (technological and other systems transitions) that could reduce community emissions. A strategy was identified as a "core strategy" if it had considerable greenhouse gas emission reduction potential and fewer technical feasibility (e.g., cost of technology) and other barriers (e.g., remote environmental externalities). Staff from relevant City departments reviewed and provided comments regarding the draft list of core strategies.

BEST PRACTICE REVIEW

In the final phase of the CPR study, implementation mechanisms were identified for each core strategy. Implementation mechanisms are defined as policies, programs, or other actions that the City could take to facilitate the implementation of a core strategy within the community. An extensive literature review was conducted to identify best practices from cities around the world. Implementation mechanisms appropriate to Mountain View's scale and context were included. For each mechanism a description, case studies, and potential implementation challenges and opportunities are provided in the chapters to follow.

[4] The Adjusted Business-As-Usual emission forecast does not reflect the impacts to State vehicle efficiency standards (e.g., Pavley I and II). While this is common practice in nearer-term (e.g., 2020 and 2030) climate action plans, the CPR excluded these reductions to avoid inaccurate Transportation emission reduction estimates once high levels of fuel switching to EV and CNG vehicles are included.

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Chapter 2

GREENHOUSE GAS INVENTORIES AND FORECASTS

This chapter describes the emission forecast for the City of Mountain View's community greenhouse gas emissions from 2005 to 2050. It presents the 2005 and 2012 emission inventories and the magnitude of each emission sector, and then discusses the 2020 and 2030 Business-As-Usual emission forecasts that were used within the City's GGRP. These forecasts were then used within the CPR to extrapolate the BAU 2050 emission forecast. A description of the Adjusted Business-As-Usual forecast is provided that reflects the future emission reduction potential of existing State and Federal policies and regulations. And, the chapter concludes by presenting a summary of the strategies and mechanisms being proposed to reduce emissions and reach the City's 2050 GHG reduction target.

2005 Baseline Emissions Inventory

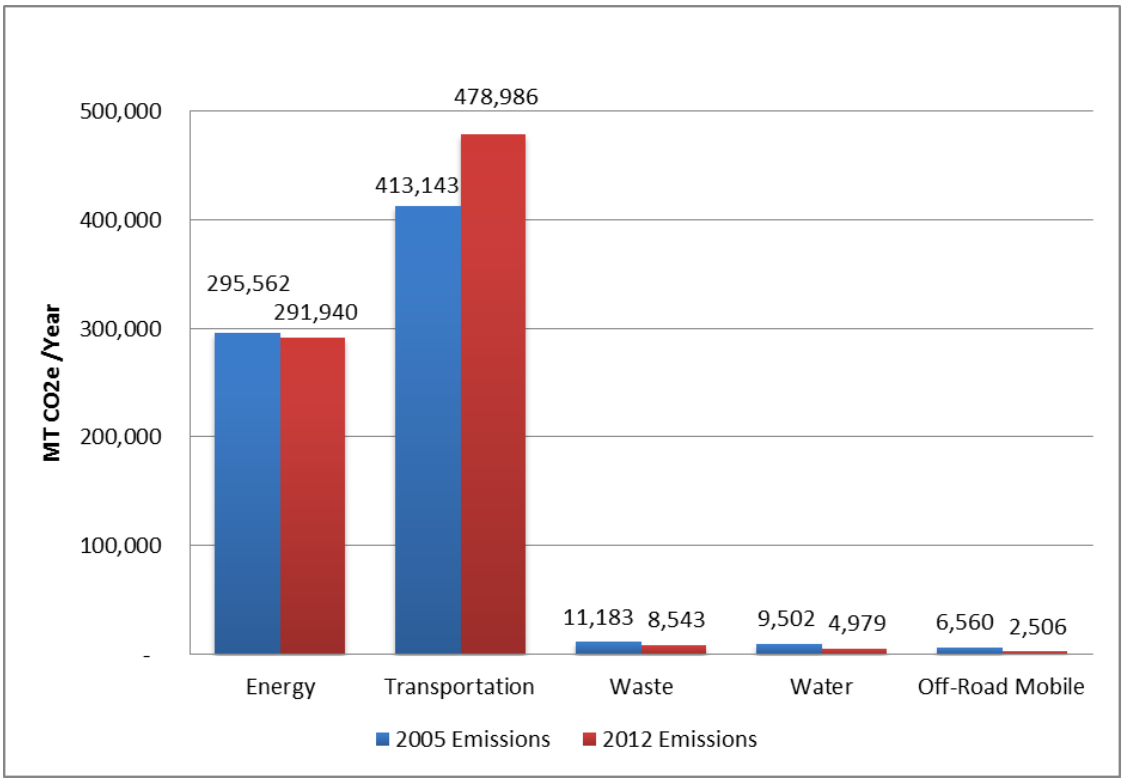
As part of the GGRP development process, the City developed a baseline emissions inventory that addressed the following emission sectors: Energy, Transportation, Solid Waste, Water, Wastewater Treatment, and Off-Road Transportation. The inventory identified that the community generated a total of 735,950 metric tons of carbon dioxide equivalent emissions (MT CO_2e) in 2005. As shown in Table 1.1, Transportation emissions constitute more than half of Mountain View's communitywide emissions, followed by building and facilities Energy (residential, commercial, and industrial), Solid Waste, Water use, and Wastewater treatment, and Off-Road Mobile sources. The inventory makes it clear that addressing Transportation- and Energy-related emissions will be critical to the achievement of the 2050 GHG reduction target.

2012 Emissions Inventory

In order to evaluate the City's progress against its 2012 GHG reduction target, staff conducted a 2012 GHG emissions inventory, as shown in Figure 2.1, Figure 2.2, and Table 2.1.

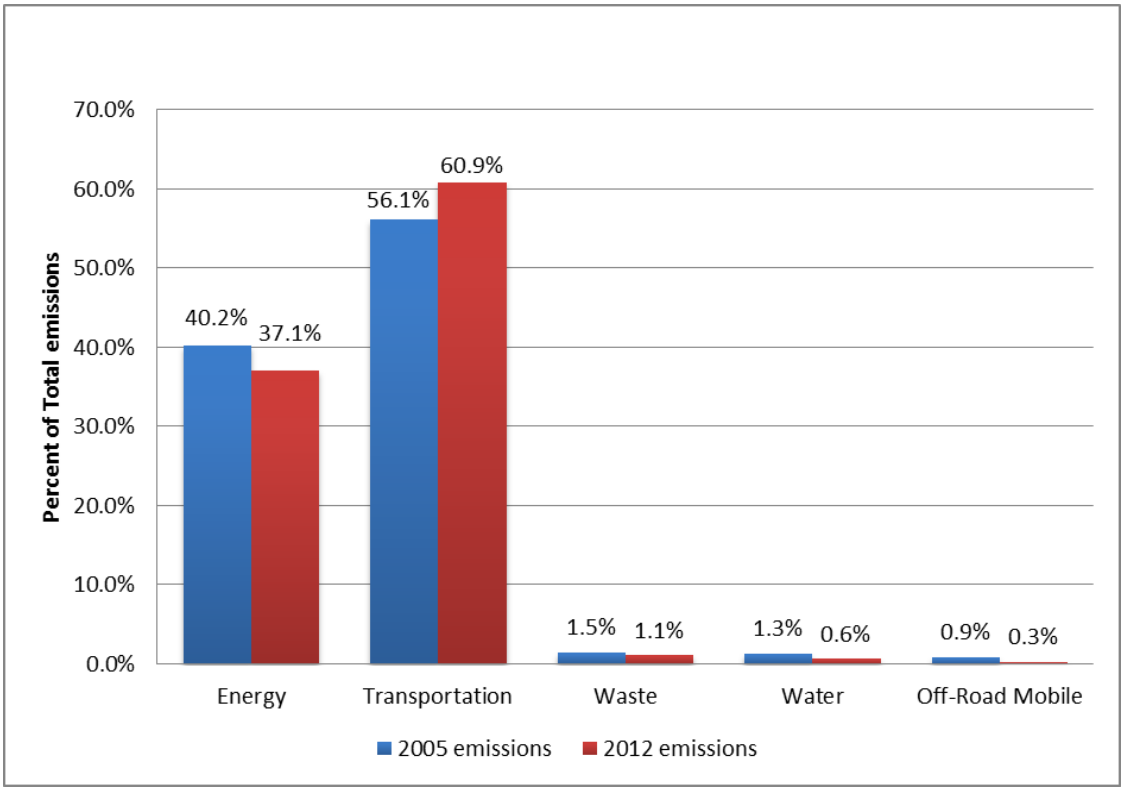
Between 2005 and 2012, Mountain View's community-wide GHG emissions increased 6.9 percent to 786,954 metric tons of carbon dioxide equivalent (MT CO_2e) annually. When compared to the City's 2012 reduction target of a 5 percent decrease from 2005 levels, this puts the City approximately 12% short of its goal.

Figure 2.1: 2005 Baseline and 2012 Community Emissions by Sector (MT CO2e/Year)



Mountain View's emissions are broken down into the following five sectors: Energy, Transportation (On-Road), Waste, Water, and Off-Road Mobile. Among these sectors, Energy, Transportation, and Waste comprised 99% of community-wide emissions in 2012, as shown in Figure 2.2. A more detailed comparison of sector emissions between 2005 and 2012 is shown in Table 2.1.

Figure 2.2: 2005 Baseline and 2012 Community Emissions by Sector (%)



When comparing 2005 and 2012 emissions, it's important to examine the changes in each sector in order to see the whole picture.

Energy

From 2005 to 2012, electricity usage increased 0.6% and natural gas usage increased 2.5%, but energy-related emissions overall decreased 1.2% due to the use of 9% cleaner energy sources in 2012. Energy emissions comprised 40% of total community emissions in 2005 and 37% in 2012.

Transportation (On-Road)

Gasoline consumption increased 13% from 2005 to 2012, while diesel consumption increased 11% during this same period. Transportation-related emissions increased about 16% from 2005 to 2012 due to increases in fuel demand and local transportation conditions that change year to year. Transportation emissions comprised 56% of total community emissions in 2005 and 61% in 2012.

Waste

The total volume of waste disposed in landfills increased 17% between 2005 and 2012, primarily due to an increase in building development activity. Construction and demolition processing residue is often used as alternative daily cover at landfills, thus increasing disposal tonnage. However, waste-related emissions decreased about 24% from 2005 to 2012 due to differences in waste characterization and how emissions were accounted for in 2005 and 2012[5]. Waste emissions comprised 1.5% of total community emissions in 2005 and 1.1% in 2012.

Water

The total volume of water consumed (from water demand and wastewater treatment plant processing) decreased by about 10% between 2005 and 2012 due to City and public water conservation efforts. However, water-related emissions decreased about 48% due to the use of more accurate methods in accounting for water and wastewater emissions in 2012 than in 2005[6]. Emissions from water comprised 1.3% of total community emissions in 2005 and 0.6% in 2012.

Off-Road Mobile

Total off-road mobile emissions produced by construction and mining and lawn and garden activities decreased about 62% between 2005 and 2012. This decrease was due to recession-induced declines in both sectors, and the fact that lawn and garden equipment became substantially more efficient, thus reducing fuel consumption. Off-road mobile emissions comprised 0.9% of total community emissions in 2005 and 0.3% in 2012.

5 In 2005, Waste sector emissions were overestimated by using less accurate emissions accounting methods than in 2012, and as a result the percentage decrease in emissions between 2005 and 2012 is artificially large.

6 In 2005, Water sector emissions were overestimated by using less accurate emissions accounting methods than in 2012, and as a result the percentage decrease in emissions between 2005 and 2012 is artificially large.

Table 2.1: Community GHG Emissions Inventories, 2005 and 2012

Sector	Subsector	2005 Emissions (MT CO_2e/Yr)	2005 Emissions (%)	2012 Emissions (MT CO_2e/Yr)	2012 Emissions (%)	2005-2012 Change (%)
Energy – Residential	Electricity	36,307	4.9%	31,518	4%	-13%
	Natural Gas	64,065	8.7%	63,219	8%	-1%
Energy – Non Residential	Electricity	108,220	14.7%	102,952	13.1%	-5%
	Natural Gas	52,005	7.1%	60,935	7.7%	17%
Energy – Industrial	Electricity	4,308	0.6%	NA[2]	NA[2]	--
	Natural Gas	5,066	0.7%	NA[2]	NA[2]	--
Energy – Direct Access	Electricity	25,591	3.5%	33,315	4.2%	30%
	Subtotal[1]	**295,562**	**40.2%**	**291,940**	**37.1%**	**-1.2%**
Transportation	***Subtotal***[1]	**413,143**	**56.1%**	**478,986**	**60.9%**	**15.9%**
Solid Waste	Solid Waste	11,113	1.5%	7,224	0.9%	-35%
	Alternate Daily Cover	70	0.0%	1,319	0.2%	1,794%
	Subtotal[1]	**11,183**	**1.5%**	**8,543**	**1.1%**	**-23.6%**
Water	Water Demand	4,384	0.6%	2,363	0.3%	-46%
	Wastewater Treatment	5,117	0.7%	2,616	0.3%	-49%
	Subtotal[1]	**9,502**	**1.3%**	**4,979**	**0.6%**	**-47.6%**
Off-Road Mobile	Construction	4,793	0.7%	1,788	0.2%	-63%
	Lawn & Garden Equip.	1,767	0.2%	718	0.1%	-59%
	Subtotal[1]	**6,561**	**0.9%**	**2,506**	**0.3%**	**-61.8%**
TOTAL		**735,950**	**100.0%**	**786,954**	**100.00%**	**6.9%**

Notes:

[1] Columns may not sum to total shown due to rounding.

[2] Industrial energy usage was unavailable from PG&E in 2012.

2020 AND 2030 BUSINESS-AS-USUAL EMISSION FORECASTS

For the purposes of the GGRP, community emissions forecasts were developed for the years 2020 and 2030. The BAU forecasts for non–Transportation sector emissions were developed using urban development (i.e., the construction of new residential units and non-residential square footage) as the driving factor of emissions-generating activity growth. Estimates of future development contained within the endorsed 2030 General Plan were multiplied by baseline year activity intensities (e.g., energy use, waste generation, and water consumption per residential unit or commercial square foot) to calculate future year emissions estimates. Transportation emissions were developed through a separate process that evaluated the vehicle travel impacts of the endorsed Land Use plan and changes to the community's roadway network. 2020 emission estimates were developed by linear interpolation between the 2005 baseline year and the 2030 values.

As shown in Table 2.2, community emissions were estimated to increase by 166,641 MT CO2e per year (a 23% increase) between 2005 and 2020, and by 277,735 MT CO_2e per year (a 38% increase) between 2005 and 2030. The magnitude of community emissions growth from 2005 to 2020 and 2030 is directly related to the anticipated increase in population and employment

growth (and their consumption activities). In 2020 and 2030, Transportation and Energy-related emissions remain the two largest sectors.

Table 2.2: Community Emissions Forecasts, 2020 and 2030

Sector	2005 Emissions (MT CO_2e/Year)	2020 Emissions (MT CO_2e/Year)	Increase from 2005 (MT CO_2e/Year)	2030 Emissions (MT CO_2e/Year)	Increase from 2005 (MT CO_2e/Year)
Energy	295,562	359,336	63,774	401,852	106,290
Transportation	413,143	512,943	99,800	579,477	166,333
Waste	11,183	11,424	241	11,585	402
Water	9,502	10,722	1,220	11,535	2,033
Off-Road Mobile	6,561	8,166	1,605	9,236	2,676
TOTAL	**735,950**	**902,591**	**166,641**	**1,013,685**	**277,735**
% Increase	**-**	**-**	**23%**	**-**	**38%**

2050 BUSINESS-AS-USUAL EMISSION FORECAST

To complete the 2050 forecast, the City extrapolated emission growth to 2050 based on the annual average rate of emission growth that is anticipated to occur between the baseline year and 2030. This forecasting method was selected because the General Plan does not provide development projections beyond 2030. Additionally, the City does not have established population and employment forecasts for 2050. Use of the extrapolation forecasting method is justifiable given these data limitations. It should be noted that the method assumes that a similar amount of development will occur between 2030 and 2050 as the General Plan expects to occur between 2010 and 2030.

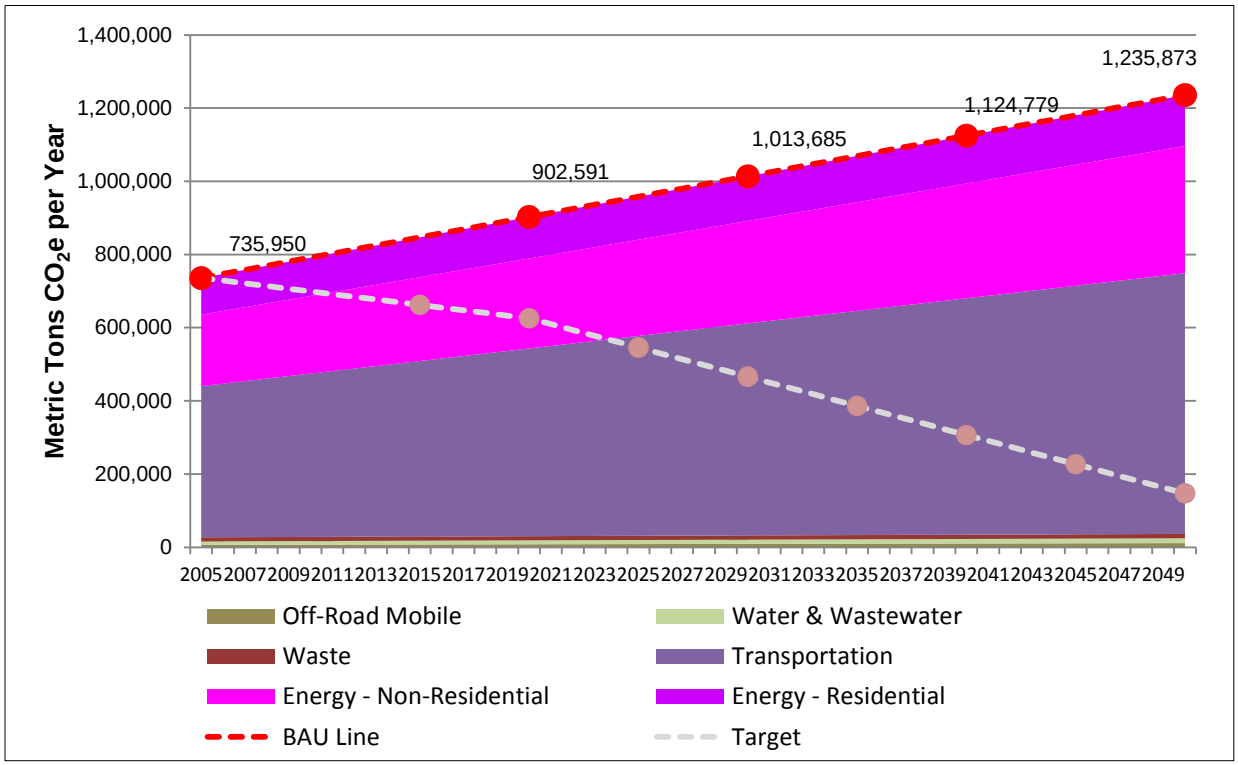
Table 2.3 and Figure 2.3 show that community emissions are expected to increase by approximately 499,923 MT CO_2e between 2005 and 2050 to a level of 1,235,873 MT CO_2e per year. This considerable increase in emissions (about 68% above 2005 levels) would be a significant challenge to achieving the City's adopted emissions target of reducing emission to 80% below 2005 levels by 2050. Luckily State and Federal policies and regulations will reduce the scale of the reductions needed. These State and Federal actions are described below under the ABAU forecast.

Table 2.3: Business-As-Usual Community Emissions Forecast, 2050

Sector	Subsector	Emissions ($MT CO_2e$/Year)	Emissions (%)
Energy – Residential	Electricity	49,739	4.0%
	Natural Gas	89,561	7.2%
Energy – Non Residential	Electricity	218,920	17.7%
	Natural Gas	98,807	8.0%
Energy – Industrial	Electricity	1,961	0.2%
	Natural Gas	2,306	0.2%
Energy – Direct Access	Electricity	25,591	2.1%
	Subtotal	**486,884**	**39.4%**
Transportation	***Subtotal***	**712,543**	**57.7%**
Solid Waste	Solid Waste	11,833	1.0%
	Alternate Daily Cover	74	0.0%
	Subtotal	**11,907**	**1.0%**
Water	Water Demand	6,142	0.5%
	Wastewater Treatment	7,020	0.6%
	Subtotal	**13,162**	**1.1%**
Off-Road Mobile	Construction	8,567	0.7%
	Lawn & Garden Equipment	2,811	0.2%
	Subtotal	**11,377**	**0.9%**
TOTAL		**1,235,873**	**100.0%**

Note: Columns may not sum to total shown due to rounding.

Figure 2.3: Business-As-Usual Community Emissions by Sector, 2005–2050



2050 ADJUSTED BUSINESS-AS-USUAL EMISSION FORECAST

In general, the largest anticipated reductions are from State and Federal vehicle fuel efficiency improvements to passenger vehicles and light-duty trucks.[7] As residents and businesses replace older vehicles with newer ones, people will consume less fuel and generate fewer emissions per vehicle mile traveled. California's low-carbon fuel standard will also reduce Transportation-related emissions in Mountain View by requiring a transition away from fossil fuels (i.e., gasoline and diesel) toward lower-carbon bio-fuels (e.g., ethanol). California's Renewable Portfolio Standard (RPS) law also requires utilities to obtain 33% of their electricity from renewable energy sources by 2020. In 2005, about 12% of Pacific Gas & Electric's (PG&E's) portfolio was from renewable sources. This increase in renewable generation under the RPS will reduce Mountain View's electricity-related emissions. The medium- and heavy-duty vehicle efficiency improvements program and 2008 California Energy Code (Title 24) requirements for new construction will create smaller, but still important, community-wide emission reductions.

As shown in Table 2.4 and Figure 2.4, with implementation of State and Federal policies and regulations, community emissions are projected to be 899,645 MT CO_2e per year in 2050. These State and Federal actions are expected to reduce 336,228 MT CO_2e per year and will make it considerably easier for the community to achieve the 2050 emission reduction target. That said, 2050 emissions are still expected to be 22% above 2005 levels under an ABAU scenario, and therefore achieving the 2050 reduction target (80% below 2005 levels) will require extensive transformations in how the community uses energy in its buildings and transportation. The following section of this report outlines the core transformations that will be necessary and what the City of Mountain View can do to facilitate them.

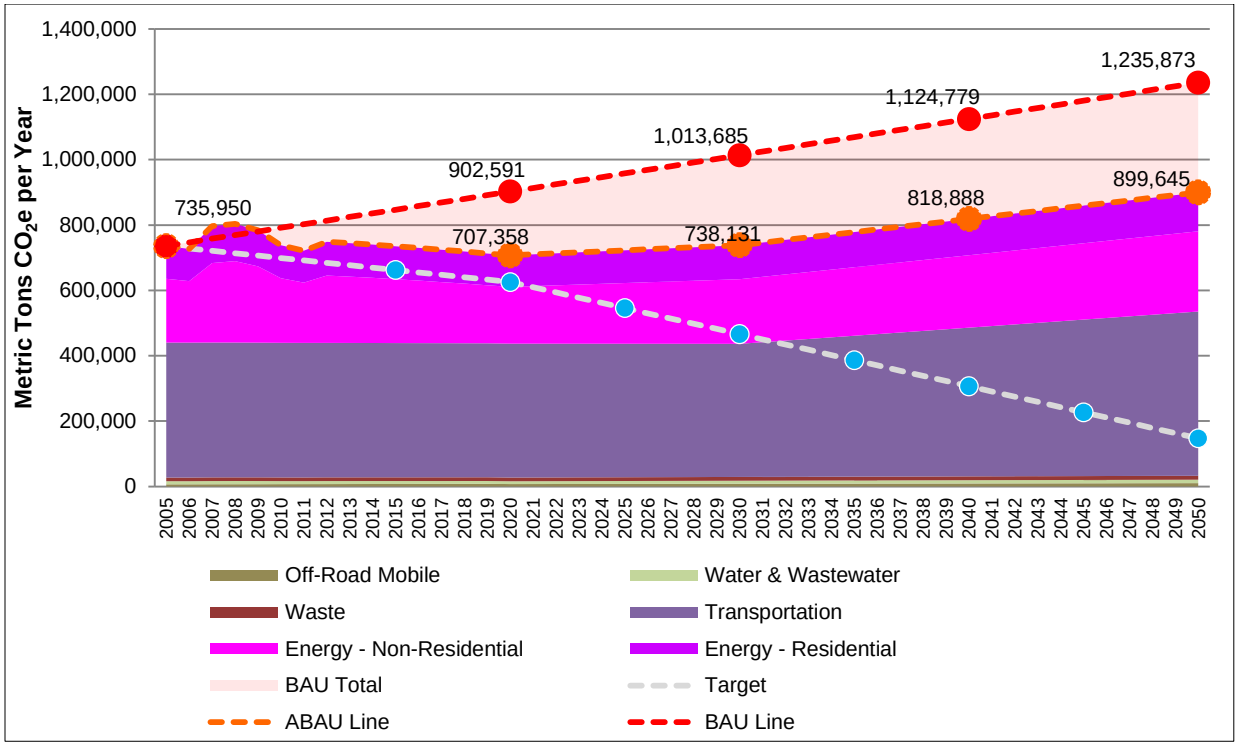
Table 2.4: Adjusted Business-As-Usual Community Emissions Forecast, 2050

Sector	Subsector	Emissions (MT CO_2e/Year)	Emissions (%)
Energy – Residential	Electricity	29,146	3.2%
	Natural Gas	89,561	10.0%
Energy – Non Residential	Electricity	128,282	14.3%
	Natural Gas	98,807	11.0%
Energy – Industrial	Electricity	1,149	0.1%
	Natural Gas	2,306	0.3%
Energy – Direct Access	Electricity	14,996	1.7%
	Subtotal	**364,247**	**40.5%**
Transportation	***Subtotal***	**502,711**	**55.9%**
Solid Waste	Solid Waste	11,833	1.3%
	Alternate Daily Cover	74	<0.1%
	Subtotal	**11,907**	**1.3%**
Water	Water Demand	4,207	0.5%
	Wastewater Treatment	6,333	0.7%
	Subtotal	**10,541**	**1.2%**
Off-Road Mobile	Construction	7,710	0.9%
	Lawn & Garden Equipment	2,529	0.3%
	Subtotal	**10,239**	**1.1%**
TOTAL		**899,645**	**100.0%**

Note: Columns may not sum to total shown due to rounding.

[7] See Appendix B for more detailed descriptions of the State and Federal actions.

Figure 2.4: Adjusted Business-As-Usual Community Emissions by Sector, 2005–2050 [8]



IMPLICATIONS OF STATE AND FEDERAL ACTIONS

Implementation of State and Federal policies and regulations will effectively reduce emissions within the Mountain View community. Table 2.5 provides emission reduction estimates for these State and Federal policies and regulations used within the CPR analysis.[9] These reductions are applied to the Business-As-Usual forecast to derive an "Adjusted Business-As-Usual" forecast.

Table 2.5: Estimated Emission Reductions from State and Federal Actions, 2050

State/Federal Action	Reductions in 2050 (MT CO_2e/Year)	% of Total State/Fed Actions
Renewable Portfolio Standard	125,258	37%
Vehicle Fleet Fuel Efficiency Standard, Low Carbon Fuel Standard	210,970	63%
TOTAL	**336,228**	**100%**

See Appendix B for more detailed descriptions of the State and Federal actions.

[8] The curve in the Adjusted Business-As-Usual line seen in Figure 2.4 (between 2005 and 2012) is the result of a dynamic electricity emission factor. Fluctuation in electricity emissions factors have occurred frequently in the past based on variables such as available sources of energy, energy cost, and climate variability.

[9] Not all State and Federal reductions were applied within the CPR analysis due to potential double counting between CPR-identified City actions and State and Federal actions.

Emission Reduction Strategies and Mechanisms

While State and Federal actions will substantially help reduce emissions, other significant transformations will need to occur in order for the City to achieve its 2050 community emission reduction target. Tables 2.6, 2.7, and 2.8 below outline the potential scale of reductions that may be achieved if the identified strategies and associated mechanisms for Building Energy, Transportation, and Solid Waste are implemented by the City and realized within the community. These strategies and mechanisms are discussed in more detail in Chapters 3-5.

The estimated GHG reductions in Tables 2.6, 2.7, and 2.8 use the following scale in MT CO_2e:
Low (2,000-25,000), Medium (25,000-50,000), High (50,000-100,000), Very High (over 100,000)

Table 2.6: Building Energy Strategies and Mechanisms – Summary

Strategy	Mechanism	Est. GHG Reduction in 2050 (MT CO_2e/Yr)
A) Lower-Carbon Electricity	A.1. Community Choice Energy Policy	High
	A.2. Large-Scale Renewable Electricity Generation	
B) Renewable Energy Generation – Solar Photovoltaic	B.1. Mandatory Solar Photovoltaic Requirements for New Construction	High
	B.2. Solar Power Districts Policy and Program	
C) Renewable Energy Generation – Solar Hot Water	C.1. Solar Hot Water Campaign	Low
	C.2. Mandatory Solar Hot Water Policy	
D) Fuel Switching – Heating and Hot Water: From Natural Gas to Electric Heat Pumps	D.1. Heat Pump Promotional Campaign	High
	D.2. Heat Pump Permit Streamlining	
	D.3. Mandatory Electric Heat Pump Policy	
E) Energy Efficiency – Existing Buildings	E.1. Advanced Energy-Use Analytics Promotion	Low
	E.2. Energy-Management Systems Promotion	
	E.3. Commercial District Partnerships	
	E.4. Building Benchmarking and Disclosure Policy	
	E.5. Point-of-Sale Energy Rating Policy	
	E.6. Building Commissioning Promotion	
	E.7. Mandatory Retro-Commissioning Policy	
F) Energy Efficiency – New Construction	F.1. Zero-Energy Building Code	Low
	F.2. Passive Home Energy Design Policy	
	F.3. Energy -Efficient Appliance Policy	
G) Business Green Upgrades *	G.1. Business Green Upgrades Promotion	Unknown
H) PACE Programs *	H.1. PACE Programs Evaluation/Adoption	Unknown
I) Community Outreach *	I.1. Community Outreach and Assistance	Unknown
	TOTAL:	**156,000 - 375,000**

** Added based on Study Session feedback, but without additional research, which can be conducted in the future.*

Table 2.7: Transportation Strategies and Mechanisms – Summary

Strategy	Mechanism	Estimated GHG Reduction in 2050 (MT CO_2e/Yr)
A) Fuel Switching – Compressed Natural Gas (CNG)	A.1. Publicly Accessible CNG Fueling Stations	Very High
	A.2. Shared Commercial CNG Fueling Station Outreach Program	
B) Fuel Switching – Electric Vehicles (EV)	B.1. Community EV Adoption Campaign	Very High
	B.2. Publicly-Accessible EV Charging Facilities	
	B.3. Parking Facility EV Charging Standards	
	B.4. Residential Multi-Family EV Charging Standards	
	B.5. Residential Single-Family E V Charging Standards	
C) Fuel Switching – Second Generation Biofuels	C.1. Encourage Development of Biofuel Stations	High
	C.2. Waste-To-Biogas Facility for Fleet Vehicles	
D) Hydrogen Fuel *	D.1. Hydrogen Fuel Exploration	Unknown
E) Transportation Policies *	E.1. Regional Transportation Policies	Unknown
F) Community Outreach *	F.1. Community Outreach and Assistance	Unknown
	TOTAL:	**300,000 - 350,000**

** Added based on Study Session feedback, but without additional research, which can be conducted in the future.*

Table 2.8: Solid Waste Strategies and Mechanisms – Summary

Strategy	Mechanism	Estimated GHG Reduction in 2050 (MT CO_2e/Yr)
A) Reduce Landfilled Waste	A.1. Target Materials for Diversion	Low
	A.2. Promote Waste Reduction and Material Re-Use	
	A.3. Explore Future Processing Technologies	
	TOTAL:	**2,000 - 25,000**

As outlined in Table 2.9 below, the proposed CPR strategies and mechanisms will likely produce GHG emission reductions in the range of 458,000-750,000 MT CO_2e per year, depending on the level of implementation and other factors.

If full implementation of the core strategies in the Building Energy, Transportation, and Solid Waste sectors is achieved, it is likely that the City will achieve about 100% of its target of reducing emissions 80% below 2005 levels by 2050. Additional reductions from the Land Use and Transportation strategies identified in the General Plan and from decreasing emissions from waste in the Shoreline Landfill will also contribute toward the community's goal.

Table 2.9: Emission Reductions Achieved by CPR in 2050 under ABAU

	GHG Emissions Level (MT CO_2e/Year)	% of Required Reductions Achieved
2005 Baseline	735,950	
80% Below Baseline	147,190	
2050 ABAU Level	899,645	
Reductions Required to Reach 80% Below 2005 under ABAU	752,455	
Reductions from CPR (low end of range)	458,000	61%
Reductions from CPR (middle part of range)	604,000	80%
Reductions from CPR (high end of range)	750,000	100%

PREDOMINANT FOCUS ON FUEL SWITCHING

Energy-related emissions can be reduced through three primary methods: *conservation* (using less energy through a change in behavior or the designed environment), *efficiency* (using energy more effectively through technological improvements), and *fuel switching* (using a different form of energy to achieve the same result). Tables 1.6 and 1.7 demonstrate the important role that fuel switching will likely play in the achievement of the 2050 community emission reduction target. Each of the core Building Energy and Transportation strategies with a "High" or "Very High" emission reduction potential is a form of fuel switching. The CPR's emphasis on fuel switching strategies over other types of strategies is related to the scale of emission reductions needed to achieve the 2050 community target, and the reality that conservation and efficiency have more cultural/technical limits as compared to fuel switching. While concerted local, State, and Federal actions will be required to reduce existing barriers to fuel switching, it offers reduction potential of the scale needed.

Note: The emissions reduction potential of hydrogen was not modeled as a future transportation fuel because (a) it is still speculative that hydrogen will achieve mass adoption [only Japan has anything close to market-scale hydrogen], and (b) its level of emissions depends greatly on the fuel source of the hydrogen (e.g., clean electricity generation, natural gas, etc.) and it is therefore difficult to model hydrogen's emission reduction potential. That said, the CPR includes Transportation Strategy D to further investigate hydrogen as a fuel source. For more information, see Chapter 4.

Within the CPR core strategy analysis and development process, the likely technical potential of each strategy was evaluated. While conservation and efficiency will play important roles in transforming the community's emissions, technical/cultural limitations were identified that limited their emission reduction potential compared to fuel switching strategies. For example, energy conservation is limited by the cultural limits of the proportion of the population willing to make do with less energy consumption and/or the proportion of the community's homes and jobs that can be located in walkable or transit-oriented areas. Similarly, efficiency depends on the technological limits of internal combustion engines and building equipment performance. The primary limitations to fuel switching strategies are price barriers, and most of these are anticipated to decrease during the 35-year horizon of the CPR. Remaining barriers to fuel switching could be overcome with local, regional, and State regulation and/or financial incentives.

Within the Transportation sector, it should be noted that the core strategies do not include bike and pedestrian infrastructure improvements, Transportation Demand Management (TDM) requirements, or Transit Oriented Development (TOD). While these types of strategies will contribute to emission reductions and are important for other sustainability reasons, they are not likely to create the same magnitude of reductions as fuel switching.

A considerable issue facing Mountain View is that most of the City consists of a relatively low-density suburban residential Land Use pattern, and while there is an effort to increase density and diversity in certain corridors, most of the City will remain as it is today. Low-density suburban residential areas are likely to remain auto-dependent unless there are outside influences, such as considerable fuel or travel cost (e.g., cordon pricing, tolls) increases. This assumption is supported by Fehr and Peer's (F&P) analysis of trip and vehicle miles traveled (VMT) reductions related to the recently-adopted General Plan. Even with the numerous mixed-use and TDM techniques that the City aims to utilize, the F&P analysis identified only a ~1% reduction in VMT from a BAU scenario, which will not provide the large reductions needed to achieve the 2050 target.

Thus, while fuel switching is a deviation from current emission reduction efforts, the CPR analysis supports that such strategies will be essential to achieving the community's 2050 target. The City will benefit by using the CPR to direct subsequent evaluation of the actions it can take to promote fuel switching.

SOLID WASTE EMISSIONS AND IMPLEMENTATION MECHANISMS

Chapter 5 of the CPR contains potential Solid Waste strategies and implementation mechanisms that could form part of a roadmap that enables Mountain View to reach its 2050 GHG reduction target. In 2050, Solid Waste emissions will be the third largest source in the City (1.3%).

The potential implementation mechanisms are organized around the primary goal of adopting a Zero Waste Plan (ZWP). The ZWP will target a significant reduction in landfilled waste by focusing on a whole system approach to the use of resources. It will include specific strategies to target materials for diversion, promote waste reduction and material re-use, and explore future processing technologies, with an overall goal of reaching a 90% diversion level.

Chapter 5 introduces the high-level mechanisms that will form the foundation of the ZWP, and provides an estimated GHG reduction range based on reaching a 90% diversion level. Additional strategies, mechanisms, policies, and actions will be detailed in the ZWP.

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Chapter 3

BUILDING ENERGY STRATEGIES

This chapter contains potential Building Energy strategies and implementation mechanisms that could form part of a roadmap enabling Mountain View to reach its 2050 greenhouse gas (GHG) reduction target. Buildings make up the second largest source of GHG emissions in the City (~37% as of 2012). Considerable emission reductions must therefore occur within this sector to achieve an 80% reduction in community emissions by 2050.

Table 3.1 below divides Building Energy sector carbon reduction opportunities into nine core strategies and identifies potential mechanisms (policies and programs) that the City could adopt to implement each strategy. A brief description is provided for each mechanism, followed by a list of potential barriers and precedent examples of cities where similar policies, projects, or programs exist.

Of the three sectors in the CPR (Building Energy, Transportation, and Solid Waste), the Building Energy sector has the largest number of strategies and mechanisms aimed at reducing GHG emissions, since most of the strategies, taken alone, have marginal effects on GHG reductions. It is only when multiple strategies are implemented together that greater GHG mitigation is achieved. As an example, conducting building optimization prior to installing a rooftop solar photovoltaic (PV) system ensures that the appropriate system is deployed. In addition, implementation of one strategy can beneficially influence and enable the deployment and development of others. For instance, extensive community-based solar could free rooftops for installation of solar thermal water heating.

Further, each of the strategies listed here have a demonstrable track record of actual implementation and GHG emission reduction potential. Although the up-front cost can create a barrier to implementation, over a number of years the majority of these strategies pay for themselves through energy cost reductions. Cost and payback periods vary for each strategy, and therefore should be evaluated on a case-by-case basis. Payback periods for solar PV systems may be 10 years or longer, while outlay for energy-efficiency measures may be recouped within months.

Table 3.1: Building Energy Strategies and Mechanisms – Details

Strategy	Mechanism	Sector	Bldg. Type	Estimated Cost	Est. GHG Reduction in 2050 (MT CO_2e/Yr)	Implementing Entity
A) Lower-Carbon Electricity	A.1. Community Choice Energy Policy	Res & Comm & Muni	New & Existing	Cost Neutral	High	City
	A.2. Large-Scale Renewable Electricity Generation	Comm & Muni	New & Existing	Very High		City, Developers
B) Renewable Energy Generation – Solar Photovoltaic	B.1. Mandatory Solar Photovoltaic Requirements for New Construction	Res & Comm	New	Low	High	City, Developers
	B.2. Solar Power Districts Policy and Program	Res & Comm	New & Existing	Medium		City
C) Renewable Energy Generation – Solar Hot Water	C.1. Solar Hot Water Campaign	Res & Comm	New & Existing	Medium (with Rebates High)	Low	City
	C.2 Mandatory Solar Hot Water Policy	Res & Comm & Muni	New & Existing	Low		City
D) Fuel Switching – Heating and Hot Water: From Natural Gas to Electric Heat Pumps	D.1. Heat Pump Promotional Campaign	Res & Comm	New & Existing	Medium (with Rebates High)	High	City
	D.2. Heat Pump Permit Streamlining	Res & Comm	New & Existing	Low		City
	D.3. Mandatory Electric Heat Pump Policy	Res & Comm	New & Existing	Low		City
E) Energy Efficiency – Existing Buildings	E.1. Advanced Energy-Use Analytics Promotion	Res & Comm	New & Existing	Medium	Low	City
	E.2. Energy-Management Systems Promotion	Comm	New & Existing	Medium		City
	E.3. Commercial District Partnerships	Comm	New & Existing	Medium		City, Commercial Entities
	E.4. Building Benchmarking and Disclosure Policy	Res & Comm	New & Existing	Low		City
	E.5. Point-of-Sale Energy Rating Policy	Res & Comm	New & Existing	Low		City
	E.6. Building Commissioning Promotion	Res & Comm	New & Existing	Medium		City
	E.7. Mandatory Retro-Commissioning Policy	Res & Comm	Existing	Low		City
F) Energy Efficiency – New Construction	F.1. Zero-Energy Building Code	Res & Comm	New	Medium	Low	City
	F.2. Passive Home Energy Design Policy	Res	New	Medium		City
	F.3. Energy-Efficient Appliance Policy	Res & Comm	New & Existing	Medium		City
G) Business Green Upgrades *	G.1. Business Green Upgrades Promotion	Comm	New & Existing	Unknown	Unknown	City, Businesses
H) PACE Programs *	H.1. PACE Programs Evaluation/Adoption	Res & Comm	New & Existing	Unknown	Unknown	City
I) Community Outreach *	I.1. Community Outreach and Assistance	Res & Comm	New & Existing	Unknown	Unknown	City
				TOTAL:	**156,000 – 375,000**	

** Added based on Study Session feedback, but without additional research, which can be conducted in the future.*

***Sector**: Res = Residential; Comm = Commercial; Muni = Municipal*

***Estimated Cost**: these would be costs incurred by the City, and are based on a rough assessment of initial cost, operations and maintenance cost, cost savings and revenue. Any costs or revenue to entities outside the city government were not considered in these estimates.*

Low ($10,000-$30,000), Medium ($30,000-$100,000), High ($100,000-$300,000), Very High (over $300,000)

***Estimated GHG Reduction in 2050 (MT CO_2e/Yr)**:*

Low (2,000-25,000), Medium (25,000-50,000), High (50,000-100,000), Very High (over 100,000)

A) Lower-Carbon Electricity

In order to achieve an 80% reduction in energy-related GHG emissions by 2050, Mountain View, as a community, would need to transition to very low carbon electricity.[10] The State of California's Renewable Portfolio Standard (RPS) will achieve important reductions in emissions, creating electricity that is approximately 70% carbon free. However, the community will need to implement strategies in addition to the RPS and utilize electricity that is approximately 85% carbon-free or higher.

A.1: Community Choice Energy Policy

Description

Community Choice Energy (CCE) districts, also known as Community Choice Aggregation, provide communities with local energy choices. A CCE allows a specific community or city to leverage its aggregate energy demand to negotiate preferred rates from renewable energy generators. Utility companies continue to deliver the purchased electricity via existing transmission and distribution infrastructure. Creation of a CCE would allow the community to purchase renewable energy in amounts that exceed PG&E's mandated portfolio of carbon-free electricity. Partnerships between jurisdictions may be necessary to increase feasibility.

Barriers

- *Community Involvement: CCE districts require a proactive community, willing to adopt certain risks and uncertainties associated with non-traditional energy contracts. Price disparity between the CCE and PG&E could lead to consumer opt-out. Additionally, there are risks associated with commodity price volatility and cost responsibility surcharge volatility. Finally, energy contracts are complex, requiring consideration of supply volumes, procedural concerns (e.g., opt-out protocols), and coordination/prioritization of stakeholders. Because of these factors, education, outreach, and awareness programs are essential for the success of a CCE.*

- *Complexity of Energy Pricing: Negotiating energy prices requires an understanding of wholesale energy prices as well as a market understanding of potential future energy costs. Evaluating the full costs and benefits of a CCE can be a nuanced and time-intensive endeavor. It may be difficult to fully define provisions for disclosure and due process in rate setting and to allocate costs for participants, including exit fees. The California Public Utilities Commission sets the exit fees that are paid by consumers when they leave the service of a utility to enter a CCE. The exit fee serves to offset energy the utility has already purchased on behalf of those consumers.*

Precedents

- *Marin County, CA: The community of Marin County established Marin Clean Energy, California's first CCE program, providing customers the choice of having 50% to 100% of their purchased power provided by renewables. The service is a partnership with PG&E to provide billing and electric delivery services. The program was launched in May 2010 and serves approximately 125,000 customers (including some consumers in the City of Richmond).*

[10] At least 80% to 85% of the electricity would need to be from carbon-free sources.

- *Sonoma County, CA: The Sonoma County Water Agency has established Sonoma Clean Power (SCP), a CCE. SCP operates under an 'opt-out' regime, automatically enrolling residents within its service area. Service began in May 2014, with an initial customer base of 20,000. Customers currently opt out at a rate of 5.4%. SCP provides two levels of service: its CleanStart package offers a renewable energy mix of approximately 33%, and the EverGreen package offers 100% renewable energy. Based on residential energy prices effective May 1, 2014, SCP estimates monthly costs for 500 kWh to total $75.80 (CleanStart) or $93.30 (EverGreen). By 2016, the SCP is expecting to secure nearly 500,000 MWh of electricity from both renewable and non-renewable sources.*

A.2: LARGE-SCALE RENEWABLE ELECTRICITY GENERATION

Description

Develop a utility-scale renewable electricity generation facility (or facilities) to supply electricity for municipal and/or community use. Utility-scale renewable energy, as defined by California Energy Commission's renewable energy program, is considered to be equal to 10 MW or larger. Since available land in Mountain View is decreasing, and a utility-scale facility would need a large amount of land, Mountain View could develop such a facility in conjunction with another city (or cities) that has more available land through a "community-based solar" model. Under such a model, Mountain View residents or businesses could pay and get credit for renewable energy generated outside of the City's borders.

Barriers

- *Available Space: Utility-scale renewable generation requires large amounts of land and should be located near the primary sources of energy demand. For instance, PV installations require approximately 8 acres (installed) per MW. Identifying concentrations of buildings with sufficient energy demand near appropriate undeveloped and unconstrained acreage may prove difficult.*

- *Price Parity: The United States Energy Information Administration (EIA) estimates that for the next 10–15 years, natural gas will be near $5 per mBTU.*[11] *This creates a very competitive energy market with depressed prices. There have also been some concerns regarding the underpricing of solar panels by Chinese manufacturers, indicating that the actual cost of PV installations may experience a cost increase.*

- *Transmission Capacity: Accessing additional sources of renewable electricity may require new and updated transmission and distribution infrastructure. Enhancing linear transmission capacity is an expensive endeavor with complex permitting concerns. Transmission lines often cross multiple jurisdictions, and due to the linear length of the projects, often encroach on sensitive populations, ecosystems, or infrastructure assets. In addition, previously designated transmission corridors are typically at capacity with existing transmission lines.*

[11] http://www.eia.gov/analysis/

Precedents

- *Los Angeles, CA: Early in 2014 the City of Los Angeles signed an agreement with the energy company Constellation to design, build, and operate a 27 MW renewable energy power plant. The plant will be built at the Los Angeles Bureau of Sanitation's Hyperion Treatment Plant, which is among the ten largest wastewater treatment plants in the world. Its sewage treatment process produces a Class 1 renewable fuel, anaerobic digester gas12. This gas will be used in the biogas co-generation power plant and will supply electricity to the wastewater treatment facility.*

B) Renewable Energy Generation – Solar Photovoltaic

Solar photovoltaic (PV) panels are able to convert sunlight into usable clean electricity. While PV panels can have high up-front costs for the consumer if purchased outright, solar lease programs enable consumers to install solar systems with little or no up-front costs. With a solar system, consumers can receive nearly free electricity for decades rather than paying the fluctuating costs of a utility provider. Grid-tied electricity systems also offer the potential for owners to make a profit by selling electricity that is not used on-site back to the utility.

B.1: Mandatory Solar Photovoltaic Requirements for New Construction

Description

Require new residential and commercial construction to either pre-wire for, or install, solar PV systems. If the latter, establish minimum generation requirements by use category and establish off-site community solar requirements for sites without proper solar access.

Installing solar energy conduit/wiring or PV systems as part of a new development is often cheaper than retrofitting the site at a later date. Establishing requirements for new construction to install low- or zero-carbon technologies to generate a certain percentage of the energy demand can be an effective way to catalyze market transformation for renewables. A solar energy mandate provides a clear signal to manufacturers and installers that there will be a demand for their product and services going forward. It also encourages developers to incorporate PV in the most cost-effective way possible into their development. A mandate for installation could be preceded by requiring a feasibility study for the integration of possible alternative fuel technologies into each project. This could include examining the potential for a district energy solution and/or the potential for the project to tap into an existing energy network.

Barriers

- *Price Parity: The United States EIA estimates that for the next 10–15 years, natural gas will be near $5 per mBTU. There have also been some concerns regarding the underpricing of solar panels by Chinese manufacturers, indicating that the actual cost of PV installations may experience a cost increase.*

- *Installation Costs: For some new construction projects, the added cost of installing solar power (and thus the pre-wiring) may not make economic sense. Costs include the*

[12] http://www.constellation.com/about-constellation/news/pages/news.aspx?a=8615

hardware and panels, as well as the soft-costs of consulting, design, permitting, and installation.

- *Developer Resistance: Although new buildings with solar electricity may be more attractive to buyers due to reduced energy expenses and would increase the value of the property, developers may resist a policy that requires them to go beyond pre-wiring, and install a PV system, due to the increased cost that they would have to pass along to the buyer through a higher sales price.*

Precedents

- *San Francisco, CA: San Francisco's Green Building Ordinance requirements began in 2008. California quickly followed with its own green building requirements while San Francisco continued to press for standards beyond the state requirements. San Francisco energy efficiency requirements have continually been 10-15% beyond those required by the state, and there are current discussions surrounding requirements for solar panels on all new homes.*[13]

- *London, England: Since the London Plan was published in 2004, major development (all new non-residential developments above a threshold of 1,000 square meters) is required to include on-site renewable energy generation sized to provide a 10% reduction in carbon emissions over an established baseline. The latest version of the London Plan (published in 2011) contains an updated policy on reducing carbon emissions, and requires that standards above code be achieved. The updated policy and standards require an energy assessment detailing how targets have been met through energy efficiency measures, through the use of decentralized energy systems such as combined heat and power, and through on-site renewables. The current target is for a 40% improvement over the 2010 UK building regulations energy code and for zero-carbon emissions between 2016 and 2031 (depending on building type).*

B.2: Solar Power Districts Policy and Program

Description

Commercial and industrial areas of a city offer large roof spaces for installation of mid-size PV systems (50 kW to 1 MW). Installing PV panels on buildings situates renewable energy generation in high demand areas, thereby reducing the need for additional transmission and distribution infrastructure.

Solar generation is often associated with a number of environmental consequences due to the large amount of land required to produce solar energy at economic prices. Locating PV installations in highly developed areas reduces the risks to other environmentally sensitive areas. Also, local corporations may be able to capture several tax benefits by purchasing a PV system.

By working directly with the commercial sector, cities are able to identify areas (e.g., parking lots, building rooftops) within the community that have a high potential for PV installation. Cities can also work to reduce barriers to installation by streamlining building codes and permitting, and offering financial incentives.

[13] http://sfdbi.org/green-building-ordinance

Barriers

- *Price Parity: The United States EIA estimates that for the next 10–15 years, natural gas will be near $5 per mBTU. This creates a very competitive energy market with depressed prices. There have also been some concerns regarding the underpricing of solar panels by Chinese manufacturers, indicating that the actual cost of PV installations may experience a cost increase.*

- *Transmission Capacity: If a PV facility over-generates for the needs of the commercial facility, such as on weekends and holidays, offloading electricity may require new and updated transmission and distribution infrastructure. Enhancing linear transmission capacity is an expensive endeavor with complex permitting concerns.*

- *Uncertainty Regarding Net Metering: Net metering is a rate structure that encourages solar development. Consumers with approved solar facilities can feed excess energy onto the grid, offsetting electricity later provided by the electric utility to the consumer. Net metering programs are currently facing political instability and their future is uncertain. Additionally, PG&E has a cap in place for accepting excess solar-generated power. This cap is currently 5% of PG&E's aggregate customer peak demand.*

- *Incentive Costs: A city that offers financial incentives for such a program will have to identify and reserve adequate funding over several years, unless the city can partner with another agency that can fully or partially provide the funding.*

Precedents

- *Los Angeles, CA: The Los Angeles Department of Water and Power (LADWP) encourages the development of both residential and commercial solar systems through the Solar Incentive Program, providing an incentive payment to LADWP customers who purchase and install their own solar power PV systems. As of February 2014, the LADWP Solar Incentive Program was still available for non-residential customers. Presently $5.9 million remains for new non-residential solar incentive applications. Additionally, LADWP is currently developing a Feed-in Tariff Program to allow customers to sell renewable energy produced from their own systems.*[14]

- *New York, US: The New York State Energy Research and Development Authority (NYSERDA) offer customer information and incentive programs for commercial PV installations. Through a cash incentive program, NYSERDA encourages installation of new commercial grid-connected PV systems that are 200 kW or less. Incentives are granted on a first-come, first-served basis, and must be installed by program-qualified installers. NYSERDA's PV incentive is accepting applications through December 31, 2023, or until funds are fully committed. In addition, NYSERDA is now offering low-interest rate financing options for PV systems.*

[14] As a municipally controlled utility, LADWP has different capabilities and incentives than PG&E, which is investor owned. This offers some flexibility in their incentive programs that may not be available to PG&E.

C) Renewable Energy Generation – Solar Hot Water

According to the United States EIA, water heating for California residences typically accounts for 25% of the energy consumed in a home.[15] Additionally the American Council for an Energy Efficient Economy estimates that commercial water heating accounts for 7% of energy consumption in buildings.[16] Water heaters currently use either electricity or natural gas. Solar water heaters are uncommon, but have potential for GHG reductions, depending on the current type of water heater and the chosen replacement. Conventional or storage tank water heaters keep water at a consistent temperature 24 hours per day, and additional energy is lost in situations where the storage tank is uninsulated. In relation to water heating options, installing a solar water heater will provide the highest GHG reductions.

C.1: Solar Hot Water Campaign

Description

Through an orchestrated City campaign, Mountain View can encourage increased adoption of solar hot water (SHW) systems. Homeowners could be encouraged to install them through group purchasing models and simplified permitting requirements.

A successful program would require partnerships with regional non-profits, system installers, and financial entities, as well as collaboration at a local and regional level between regulatory agencies and government departments.

Barriers

- *Competing Technologies: Solar PV installation has higher public visibility and "green roofs" are also becoming increasingly popular. Given limited residential roof space, there is competition between these technologies for market penetration.*

- *Cost: Depressed natural gas prices have limited the cost effectiveness of solar thermal hot water systems. Generally, as a system gains popularity and adoption, installation prices are reduced. Without successful campaigns and policies, it is possible that solar hot water (also known as "solar thermal") will not experience these market efficiencies and will take longer to reach price parity with electric and gas hot water systems.*

Precedents

- *California, US: The California Solar Initiative (CSI)—Thermal Program offers cash rebates for solar water heating systems on qualifying single-family, multi-family, and commercial properties. The rebate program is overseen by the California Public Utilities Commission and funding comes from ratepayers of multiple California utilities including PG&E.*

[15] http://www.eia.gov/consumption/residential/reports/2009/state_briefs/pdf/ca.pdf

[16] http://aceee.org/topics/water-heating

C.2: MANDATORY SOLAR HOT WATER POLICY

Description

This policy would require new, single-family, townhouse, and City-owned buildings to install solar thermal water heaters. Policy and program development related to solar thermal often lags behind policy development promoting solar PV systems.

It should be noted that a mandate for installation could be preceded by requiring a feasibility study for the integration of alternative fuel technologies into projects.

Barriers

- *Overshadowing by Solar PV: Solar hot water systems have a potential to reduce GHG emissions and energy use. However, solar PV system market penetration has overshadowed SHW systems.*

- *System Sizing: It is easy to calculate the number of gallons of hot water produced by a typical 4 foot by 8 foot solar hot water collector in a variety of climates, but these systems typically overproduce for the number of gallons actually used by homeowners. Hot water is produced even on days when there is no use and there is currently no system for transmitting or distributing this water to other sources of demand.*

Precedents

- *Hawaii, US: In June 2008, Hawaii enacted legislation (SB 644) with the intent to require installation of solar hot water systems on all new single-family home construction. As of January 1, 2010, building permits are not issued for new single-family homes that do not include a solar hot water system.*

- *Barcelona, Spain: Barcelona adopted its Solar Thermal Ordinance in 2000, requiring new buildings and renovations (including complete change of use renovations) to install solar water heating systems that provide 30%-70% of domestic hot water requirements. Over 50 Spanish cities and towns have followed Barcelona's example. These local ordinances are now being supported further by the Spanish Technical Building Code. Enforced in 2006, the Code applies to all of Spain and stipulates that 30%-70% of domestic hot water must be obtained using solar energy.*

D) Fuel Switching – Heating and Hot Water: From Natural Gas to Electric Heat Pumps

Heat pumps and water heaters currently use either electricity or natural gas. The GHG reduction potential in switching the energy source depends on the current type of heating and the chosen replacement. Air- and ground-source heat pumps each offer this benefit. A very high percentage (greater than 80%) of buildings would need to switch from using natural gas for heating and hot water to the use of electric ground- or air-source heat pump systems to achieve an 80% reduction in the energy-related emissions by 2050.

Electric air-source heat pump water heaters work like a refrigerator in reverse. By using fans and an evaporator to pull warmth from the surrounding air, the heat pump transfers it to water in a storage tank. Because it uses warm ambient air temperature to heat, this is an efficient way to heat water.

Ground-source heat pumps are a related technology. As almost half of the solar energy our planet receives is absorbed by the ground, the area just below the earth's surface remains at a constant, moderate temperature year round. Ground-source heating and cooling systems utilize the stable underground temperature through a piping system. Water circulates in this system to exchange heat between a building, the ground-source heat pump, and the earth, providing heating, cooling, and hot water at remarkably high efficiencies.

D.1: HEAT PUMP PROMOTIONAL CAMPAIGN

Description

Multiple rebate and finance programs have been successfully used to encourage the development and adoption of new technologies, including electric cars and household PV systems. In the same fashion, a City campaign involving rebates and financing programs could encourage adoption of ground- and air-source heat pump systems for space and water heating in both residential and commercial settings. Ground-source heat pumps can provide long-term cost savings for users, while reducing GHG emissions in the process. Mountain View can work with energy service providers to explore creative solutions for financing and installation.

Barriers

- *Lack of Community Interest: A primary barrier to any promotional campaign is a lack of audience interest. However, this is also the reason for the campaign, and such a barrier can be overcome through proper research and creative marketing.*

- *Funding: Funding to plan, develop, and distribute the appropriate resources will be a barrier. Further, the up-front cost of a ground-source heat pump system remains a high deterrent for adoption, even though the long-term savings often creates a logical incentive for adoption.*

Precedents

- *Corvallis, OR: Energize Corvallis oversees numerous outreach programs to reduce residential energy consumption, including the Green Shares program. In addition to holding volunteer training sessions and distributing educational materials, the Green Shares program connects contractors with leads to increase sales of heat pump water heaters for residential energy savings.*

- *Seattle, WA: Through the Seattle City Light, consumers can receive a $500 rebate when they buy a qualified heat pump water heater. The program also offers consumers information on the technologies and guides them through the process of finding the right system and installer.*

D.2: HEAT PUMP PERMIT STREAMLINING

Description

Whether they are applied to an open- or closed-loop heat exchange system, multiple permits are required to ensure proper installation and minimize environmental and property impacts. To encourage adoption of this technology in both residential and commercial buildings, Mountain View can reduce the regulatory barriers to heat pump installation (similar to past PV streamlining programs). In addition to regulatory streamlining, the City can provide education about its building permits and inspections for heat pump systems.

Barriers

- *Regulatory Hurdles: Rule making and permitting requires time and oversight. Additionally, while streamlining the permitting process can reduce the barriers of individual adoption, regulators must still ensure that the permits achieve their initial goals of environmental and other protection.*

- *Environmental Hazards: The Department of Energy (DOE) indicates that some heat pump technologies can have high risks of environmental hazards, including ground and groundwater contamination. Therefore, the City should carefully research and consider all issues related to streamlining to ensure environmental risks are mitigated.*

Precedents

- *None found to date.*

D.3: MANDATORY ELECTRIC HEAT PUMP POLICY

Description

The benefits of electric heat pump systems are numerous, and multiple approaches should be undertaken to ensure widespread and efficient adoption in both residential and commercial buildings. Beyond implementing incentive programs, Mountain View can require the use of heat-pump systems (for heating and water heating) for all new residential and commercial construction. There are a number of potential approaches to ensure that a mandate meets the needs of the community, including the exemption of high thermal-load commercial uses from the heat pump requirement.

Barriers

- *Not All Solutions Are Universal: While heat pump systems can produce financial benefits in addition to emission reductions, such benefits are subject to a number of variables that may differ from property to property (i.e., the energy demand of a particular building and local climate and soil conditions). Each building is located in a slightly different region and must be assessed as an individual entity to ensure that these solutions are correct for the given instance. Any mandate must consider multiple possibilities or be flexible enough to ensure that appropriate technologies are being used for the right situation.*

Precedents

- *None found to date.*

E) Energy Efficiency – Existing Buildings

Energy efficiency is often seen and marketed as the "low hanging fruit" of GHG reductions. Residents and businesses can select technologies that provide short- to medium-term paybacks and yield long-term financial savings. Traditionally, building owners have selected technologies such as efficient lighting, efficient appliances, and increased insulation. As advancements are made in energy-efficient technologies and energy-management systems, additional savings are possible.

E.1: Advanced Energy-Use Analytics Promotion

Description

This program would encourage businesses and residents to utilize smart grid-enabled, high-resolution, real-time, remote energy-use analysis (advanced analytics), with the potential to identify inefficient energy systems and generate up to 30% reductions in operations-related energy use. Programs can be created with utility and other private sector stakeholders to encourage adoption of systems.

An important application of advanced analytics is better management of a building's plug load (i.e., energy used by appliances and electronics). Despite increased efficiency of building envelopes and Heating Ventilating and Air Conditioning (HVAC) systems, plug-load demand (driven by increasing intensity of electronics use) is anticipated to increase relative to total building energy demand. A 2010 American Council for an Energy-Efficient Economy (ACEEE) report states that plug loads can be reduced by 40%–60% at relatively low cost through the adoption of new technologies and operational/behavioral changes. The ACEEE report and other studies demonstrate that the primary barriers to reducing plug-load energy use are related to lack of information. Enhanced consumer understanding of plug-load reduction opportunities can be accomplished through outreach and education, and through the use of advanced analytics that engage consumers in real-time energy efficiency and demand management. Additional new technologies such as plug-load control devices (e.g., power-sensing plug strips, advanced occupancy sensors) and DC micro-grids or office applications could also contribute considerable reductions. Mountain View could develop a specific campaign to promote the uptake of plug-load reduction practices and systems (e.g., structured for matching specific outreach with targeted end-users) and facilitate the deployment of new advanced-analytics systems.

Barriers

- *System Availability for Residential Buildings: To date, advanced analytics has been utilized more in commercial buildings than residential buildings. Creating outreach and partnerships that facilitate the penetration of advanced analytics into the residential sector will be necessary.*

Precedents

- *Mountain View, CA: Through the City's Energy Upgrade Mountain View (EUMV) program, residents received a free, detailed analysis of their home energy use and customized recommendations for how they could reduce it. One of the most successful programs of its kind in the country, over 3.5 years EUMV served over 2,000 residents and is generating approximately 700 metric tons of GHG savings annually on an on-going basis. (On average, the top quartile of users reduced their energy bills by 21%, their electric use by 22%, and their natural gas use by 19%.)*

E.2: ENERGY-MANAGEMENT SYSTEMS PROMOTION

Description

For a building to operate efficiently, it is crucial that it be monitored and managed to optimize performance, according to design and function. Outreach programs can be created to encourage adoption of building-management systems in commercial buildings. Once building-management systems are installed, it is also critical that they be managed effectively, with an understanding of the facility's operation cycles and energy use. In order to achieve efficient building management, these outreach programs can be combined with advanced analytics (see E.1 above).

Barriers

- *Building-Management Autonomy: New building-management technology often works through remote centers and shared data. Facilities managers would require training on the technology in order to use it collaboratively and effectively. There may be resistance to the loss of on-site autonomy and some reluctance toward sharing a building's operational data.*

- *Time and Cost: Upgrading a building's management system can be an expensive and time-intensive endeavor. Tools should be provided that outline the business case for installation of energy-management systems, which could include incentive programs*

Precedents

- *No explicit community-scale precedents found to date.*

E.3: COMMERCIAL DISTRICT PARTNERSHIPS

Description

Commercial district associations can be formed to allow for information sharing and collaboration between members. This collaborative and "open-source" effort can serve to achieve dramatic reductions in energy use, GHG emissions, and water use from member buildings by changing how buildings and projects are planned, designed, and constructed. Eco-District pilots within the City could be identified where there is good potential for district energy solutions, and where all new development must achieve a certain percentage improvement over current code (implement a stretch code) in order to obtain planning permission. Ideally these

zones would also be mixed-use areas, with very good access to transit, public amenities, open space, etc. This type of pilot would work best for new, master-planned areas of the City, but could also work for appropriate infill development.

Barriers

- *Membership Motivation: Forming a coalition of several entities that agree to share previously labeled proprietary data is a difficult undertaking. The districts must develop methods to encourage trust and agreement.*

Precedents

- *Silicon Valley, CA: The Smart Energy Enterprise Development Zone (SEEDZ) Initiative Joint Venture has an objective to build a "two-way" power network that facilitates energy management and clean-energy deployment. Stakeholders include major corporations, research institutions, government entities, and investor-owned utilities. The SEEDZ decision-making process includes active consideration of stakeholder "gives" and "gets" related to collaborative energy solutions.*

- *Seattle, WA: The 2030 District initiative incentivizes property owners and managers to share utility data that is usually considered proprietary. This collaborative group has created the 2030 District Committee, intended to develop a baseline of districtwide energy use and collectively meet the challenges set by the 2030 District initiative. The committee aggregates and analyzes data to define current baselines. It also explores best practices for energy efficiency improvements, as well as incentive and financing plans for implementation.*

- *Washington, DC: The SW Ecodistrict area, among many other sustainability initiatives, is targeting zero-carbon production in the long term, and will be required to design to a high standard of energy efficiency using LEED Platinum as a baseline requirement (assuming an approximate 50% energy-use reduction, increasing over time). Leveraging the existing central plant to provide a district energy system will be an essential part of the low-carbon energy strategy and route to zero carbon, once this system can be converted to a long-term, zero-carbon fuel source.*

- *London, UK: The Mayor of London's low carbon zones program (RE: CONNECT) supports a community approach to cutting the capital's carbon footprint. The program was designed to show the potential of a complete approach to reducing a community's CO_2 emissions by involving local residents, communities, and businesses. Its aim is to cut carbon emissions locally, helping London meet its target of reducing CO_2 by 60% by 2025, and contributing to the Mayor's vision to make London the greenest big city in the world. Ten boroughs were chosen to receive funding and support from the Mayor and the Greater London Authority to create local, low-carbon zones. Each of the zones set a target to reduce carbon emissions by 20.12% by 2012 and each zone developed innovative delivery models to do so. According to the Energy Planning Report of 2013, the energy initiatives will reduce fossil fuel use and resulting CO_2 emissions by 36% more than required by Part L 2010 of the Building Regulations (reductions will be equivalent to approximately 49,474 tons CO_2 per annum).*

E.4: BUILDING BENCHMARKING AND DISCLOSURE POLICY

Description

Laws that mandate annual benchmarking and disclosure of their energy usage encourage more efficient building-management practices. This policy would require commercial building owners/managers to collect and disclose energy-use information to the City each year. The data allows the City and its partners to identify high-energy users and to target efforts. To facilitate adoption of such policies, some commercial uses (e.g., data centers) could be exempted, if deemed appropriate.

A mandatory disclosure ordinance would require owners of large buildings to measure and report their energy consumption annually. This requirement could take advantage of the US Environmental Protection Agency's (EPA) free online benchmarking tool. Additionally, outreach programs and cooperation with the real estate industry may advance the effort to institutionalize a recognized additional value proposition for energy-efficient buildings that have successful management systems in place.

Barriers

- *Time and Cost: Realtors, appraisers, loan officers, mortgage holders, and others may not want to spend the time or money needed to learn how to use benchmarking data. Building managers may not see the value in learning how to use benchmarking data.*

Precedents

- *San Francisco, CA: San Francisco's Existing Commercial Buildings Energy Performance Ordinance (EPO) and the San Francisco Environment Code, Chapter 20, Sections 2000 et seq. require an "Annual Energy Benchmark Summary" report by April 1 of each year for all non-residential building owners. Through an account with ENERGY STAR Portfolio Manager, the City helps building operators understand the process needed in order to achieve the benchmarking benefits. In turn, this ordinance requires the City to make building performance information available to the public.*

- *Seattle, WA: The Energy Benchmarking and Reporting Program in Seattle requires owners of non-residential and multi-family buildings (20,000 square feet or larger) to track energy performance and report annually.*

- *Austin, TX: The City of Austin's Energy Conservation Audit and Disclosure Ordinance (ECAD, Austin City Code, Chapter 6–7), updated in 2013, requires all commercial buildings served by Austin Energy to determine and submit an energy benchmark rating for their facilities (manufacturing buildings are exempt). Businesses are asked to self-rate their buildings using the EPA ENERGY STAR Portfolio Manager benchmarking tool and to submit those ratings to the City of Austin. Starting in mid-February of each reporting year, the online Portfolio Manager tool will allow businesses to release benchmark/rating data to the City of Austin. All improvements are voluntary. The rating system is designed as a starting point to help businesses evaluate their buildings in terms of energy efficiency. Austin Energy maintains a unit of energy-efficiency experts available to educate business owners in energy-efficiency measures and available rebates.*

- *New York, NY: Under Local Law 84, owners of properties in New York City are required to track and report annual benchmark data. New York is the first city in the nation to publicly disclose data for large, multi-family buildings, providing transparency and comparative analysis through access to energy and water use data.*

E.5: POINT-OF-SALE ENERGY RATING POLICY

Description

Point-of-sale or point-of-lease energy performance disclosure requirements ensure that energy consumption information is available during real estate transactions. With this information, operational energy costs are integrated into property values. The requirements may also motivate owners to improve the energy efficiency of their properties in order to make them more attractive to buyers or renters.

The mandatory disclosure requirement would cover all buildings, including smaller commercial and residential buildings, and would require owners to report the energy performance score to the City, buyers, and prospective buyers or renters at the point-of-sale or lease. A building's energy performance score would be determined using the EPA Portfolio Manager (for commercial or multi-family buildings), the Home Energy Rating System index (for residential), or an equivalent tool.

Barriers

- *Building Owner Resistance: Building owner associations may resist such a program due to added costs and administrative burdens. Integration of these associations into the program development process has helped programs in other cities.*

- *Cost Burden: In 2011, the Australian government analyzed the impact of its proposed Residential Building Mandatory Disclosure requirement for energy and water performance. Among other impacts, it evaluated the potential cost burden on home owners and real estate professionals that the requirement could create. Costs varied greatly depending on the assessment method selected, ranging from high costs associated with a full professional thermal performance simulation to low costs using an owner checklist of building components. The analysis demonstrated that requiring a full professional thermal performance simulation would place a high cost burden on real estate transactions and the community costs would exceed the community benefits. The analysis did however find that a simplified thermal performance assessment plus an evaluation of building components (the second most rigorous method evaluated) would create a considerably lower cost burden while generating the highest level of community benefits. This finding applied regardless of whether disclosure is mandated at point-of-sale and lease, or point-of-sale only. Therefore, the program would need to be designed to reduce cost burden, while achieving the desired result of quality energy performance data.*

- *Quality Control: The success of such a program will depend on the integrity of the performance ratings. The City would need to ensure that there are adequate numbers of certified auditors, and work with organizations such as the Building Performance Institute or the Residential Energy Services Network to ensure the availability of auditors and training courses. Auditors would submit findings to the City's Building Inspection Division staff and other appropriate parties, and the City would review the audits and verify portions of them through field checks.*

Precedents

- *Austin, TX: In 2007, the City of Austin established varying energy disclosure requirements for various types of buildings: residential single-family, residential multi-family, and commercial buildings. Notably, mandatory upgrades are required in cases where a multi-family building's energy use per square foot exceeds the average energy use in all of Austin's multi-family buildings by 150%. The requirements provide exemptions for mobile homes, condominiums, residences that can document recent efficiency investment, and commercial buildings for which existing rating systems do not work well (e.g., data centers).*

- *European Union: The European Union's (EU's) Directive on the Energy Performance of Buildings mandates that EU nations develop building energy performance measurement protocols and establish building energy certification programs for residential and commercial buildings. Building owners are required to provide energy performance certificates to prospective buyers and tenants during a sale or lease transaction, and during building construction. Buildings providing public services must also display an energy certificate.*

E.6: BUILDING COMMISSIONING PROMOTION

Description

During commissioning, a building's systems and subsystems (HVAC, plumbing, electrical, fire, lights, cogeneration, controls, security, building envelopes, etc.) are optimized for functional and energy-efficiency performance. This ensures that a building is operating according to its design, and offers opportunities to enhance building system and subsystem performance. A City-led outreach campaign would promote commissioning and retro-commissioning in newly constructed and existing commercial buildings. The program could explain the financial savings potential of commissioning and retro-commissioning, and identify service providers that work within the community.

Barriers

- *Cost: Costs related to documented benefits remains a significant barrier for building commissioning of new and modified construction projects. It can be a difficult negotiation to determine which party bears the financial burden for commissioning (e.g., buyer, seller, contractor, or tenant).*

Precedents

- *California, US: The California Commissioning Collaborative is a California non-profit public benefit corporation working to develop and promote building commissioning practices throughout the State. This includes working towards more affordable service delivery and providing outreach and education programs regarding the commissioning process.*

- *Pennsylvania, US: The Pennsylvania Department of Environmental Protection's Cambria office was the first certified LEED-NC v 2.0 Gold project in the United States. As with all LEED-certified buildings, commissioning was a requirement for this certification and the office stands as a high visibility project to raise public awareness.*

E.7: MANDATORY RETRO-COMMISSIONING POLICY

Description

Retro-commissioning of commercial buildings involves the identification and improvement of less-than-optimal energy performance of equipment and control systems in existing building equipment, so that they operate as efficiently as designed. It improves how building equipment and systems function together. Depending on the age of the building, retro-commissioning can often resolve problems that occurred during design or construction, or address problems that have developed throughout the building's life. Retro-commissioning improves a building's operations and maintenance procedures to enhance overall building performance. Retro-commissioning measures are typically low- or no-cost measures, often yielding a payback within a few months. Mountain View could require retro-commissioning of existing buildings for the purpose of ensuring optimal performance of building systems.

Barriers

- *Timeframe: Although retro-commissioning would provide opportunities to overhaul a building's systems and subsystems, there is no assurance that these opportunities are captured and maintained. System improvements can be lost within weeks of the commissioning process if corrections are not maintained by building staff.*

Precedents

- *Seattle, WA: Seattle is currently developing a voluntary retro-commissioning pilot program. Pending successful results from the pilot, the City will explore the expansion of retro-commissioning programs.*

F) Energy Efficiency – New Construction

The energy-efficiency mechanisms for new construction are similar to those for existing buildings. However, the permitting process for new construction creates an additional opportunity to implement construction codes (such as the code identified in F.1). Additionally, incorporating best practices in new construction can often be more cost effective than retrofitting existing buildings. This may allow better integration of building-management systems and control technologies.

F.1: ZERO-ENERGY BUILDING CODE

Description

The State of California has stated its intention to have all new residential homes (constructed after 2020) and all new commercial buildings (constructed after 2030) attain a zero-net energy usage factor. The building code would require high efficiency and renewable generation to offset remaining energy draw. The City could monitor the progression of this State initiative and seek to develop its own, should Statewide efforts fail. Additionally, the City could choose to accelerate a roll-out of the commercial requirement earlier than 2030.

Barriers

- *Code Compliance: A high percentage of new construction does not comply with energy code requirements, which is a major barrier to achieving the City's efficiency goals. To address this issue, the City adopted energy code compliance rules in 2010 that require a variety of progress inspections during construction. The City will need to evaluate the effectiveness of these compliance initiatives.*

- *Implementation Timing and 2050 Reductions: The timing of code implementation is critical to achieving the anticipated energy GHG reduction. The earlier more stringent codes can be adopted, the more efficient the City's building stock will be in 2050. New buildings constructed at a lower level of efficiency represent a lost reduction opportunity.*

- *Implementation Timing and Cost Burden: Code improvements need to consider the cost burden of the new requirements. Increases in efficiency are best implemented at a rate that accommodates aggressive, yet realistic, market transformation and that allows additional construction costs to be minimized.*

- *Limits to Prescriptive Code: According to DOE, it is not clear that a 50% improvement beyond 2006 International Energy Conservation Code (IECC) can be achieved through a refinement of the prescriptive IECC. This is in part due to the fact that IECC standards only regulate heating, cooling, water heating, and lighting end uses. Plug-load end uses are not included as they cannot be regulated prescriptively. Due to the National Appliance Energy Conservation Act of 1987, IECC's standards cannot apply to high-efficiency appliances or HVAC equipment. Therefore IECC needs to meet its goal using changes to the envelope, lighting systems, and distribution systems only. For these reasons, it is likely that a performance-based code is required. DOE has discussed several new approaches including: prescriptive baseline with a performance requirement, annual performance budget (BTU per square foot annual carbon budget or post-occupancy metering (outcome-based)). IECC may evolve toward a performance-based code. It is likely that Mountain View will need to adopt a performance-based code in order to achieve its targeted level of efficiency.*[17]

Precedents

- *California, US: Title 24, Part 6, of the California Code of Regulations, specifies energy efficiency requirements for buildings. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods. Each revision in California's energy code in 2002, 2005, and 2008 cut energy use by 10%–15% compared to the previous standard. The 2013 code cut energy use by an additional 25% above the 2008 code. The 2013 code is seen as the most energy-efficient state-level energy code in the nation. The California Energy Commission is pursuing a trajectory toward requiring net-zero-energy performance in residential buildings by 2020 and in commercial buildings by 2030.*

[17] The difference between a performance-based code and an outcome-based code: Performance-based code allows designers to use any efficiency to achieve a targeted level of performance. Compliance is evaluated using pre-occupancy building energy modeling to demonstrate the anticipated level of performance. Outcome-based codes differ by evaluating compliance through post-occupancy energy use analysis. Outcome-based codes are exciting because they are able to influence building plug loads. There are, however, inherent difficulties in designing and enforcing an outcome-based code.

- *Seattle, WA: The Seattle Energy Code (SEC) is based on Washington State's Energy Code and includes amendments that add stringency to energy code baseline requirements. The SEC is considered one of the most stringent energy codes in the nation, comparable to California Title 24. The State is planning to reduce energy use by 70% below 2006 SEC levels by 2031 through regular updates. Local governments can exceed the State code for commercial construction, but State legislative action is needed to increase or expand energy code requirements in the residential sector. The City of Seattle is considering the adoption of an outcome-based code program for commercial and multi-family construction. A desired benefit of the proposed outcome-based code program would be the ability to address plug loads, which contribute to a growing percentage of overall energy consumption.*

F.2: PASSIVE HOME ENERGY DESIGN POLICY

Description

Passive House is a building standard that emphasizes highly energy-efficient technologies and construction techniques for new construction and remodels. Following the standard can produce dramatic reductions in building energy use. In Europe, buildings meeting Passive House standards use 90% less energy than current building stock, and 75% less energy than average new buildings. While direct comparison is difficult, it appears that Passive House standards outperform current and near-term model codes (e.g., IECC). This advantage will, however, diminish as the model codes strengthen.

Passive solar energy design can reduce considerable amounts of space heating and cooling related to energy use. Mountain View could adopt a requirement that new development incorporate passive energy design systems (e.g., orientation, natural ventilation, etc.).

Barriers

- *Cost and Complexity: Designing a passive building requires significant analysis and a complex understanding of the location, geography, and micro-climates. This is an expensive process and could be cost prohibitive.*

- *Existing Infrastructure: It can be difficult to incorporate passive design features within areas that have already been developed. Existing infrastructure that has been designed according to other factors and orientations often proves limiting. Additionally, many passive design features may not meet local codes and ordinances.*

Precedents

- *Denmark: Saint-Gobain Isover, a Scandinavian insulation company, established a Comfort Houses pilot project consisting of the development and monitoring of 10 single-family houses constructed as passive houses. The project was conducted to provide data and knowledge regarding passive house performance for the building industry and other interested parties.*

- *European Union: The EU's Directive on Energy Performance of Buildings states that the commission intends to propose minimum performance requirements for new and renovated buildings that approach the level of passive houses by 2015. This statement is reiterated in the EC Energy Efficiency Action Plan.*

F.3: ENERGY-EFFICIENT APPLIANCE POLICY

Description

ENERGY STAR is a voluntary program with the US EPA that helps businesses and individuals reduce GHG emissions while saving money through energy efficiencies. A new building must undergo a process of inspections, tests, and verification to earn the ENERGY STAR label, but once this is achieved, the building maintains greater value in the future. Mountain View can create policies that encourage the procurement of energy-efficient appliances (e.g., ENERGY STAR rated) for new buildings. While questionable from a legal feasibility perspective, the City could also explore a mandatory standard for major appliances in new construction.

Barriers

- *Resistance to Up-Front Cost: Newer, more efficient appliances, including those with certified ENERGY STAR labels, often increase the cost of new construction, which potentially hinders their installation. While energy-efficient appliances generally pay off in the long term, requiring their utilization may pose a hurdle for some developers.*

- *Legality of Mandatory Measures: While there is precedent for mandatory efficiency standards for appliances at the municipal level, it is questionable if such requirements are legal. Federal commerce law may prevent cities from establishing such requirements. For this reason, a voluntary/promotion approach is likely more feasible.*

Precedents

- *Los Angeles, CA: Los Angeles has an aggressive green building code that is based on the 2013 California Green Building Standards Code, commonly known as CALGreen. Within the City's municipal code there is a requirement for ENERGY STAR (or equivalent) major appliances in new construction. Through these codes and standards Los Angeles ranks number one on EPA's list of cities with the most buildings with the ENERGY STAR label.*

- *Massachusetts, US: The Massachusetts Board of Building Regulations and Standards has developed the Stretch Energy Code as an appendix to the State's energy code. The Stretch Energy Code provides an option for cities and towns wanting to require energy efficiency greater than the base codes currently mandatory for municipalities across the Commonwealth. The Stretch Code Appendix offers a streamlined and cost-effective pathway to achieving approximately 20% greater energy efficiency in new residential and commercial buildings than is required by the base energy code. This is largely achieved by moving to a performance-based code, where developers are required to design buildings that reduce energy use by a given percentage below base code, rather than being required to install specific efficiency measures.*

G) Business Green Upgrades

Energy use in 2012 accounted for 37% of the City's GHG emissions, with 68% of those emissions coming from the commercial and industrial sectors and 32% from the residential sector. Therefore, for the City to reach its GHG reduction targets, Mountain View businesses must play a significant role in reducing their energy-related emissions.

G.1: Business Green Upgrades Promotion

Description

Green upgrades to buildings and facilities enable businesses to reduce their energy-related operating expenses and associated GHG emissions while also creating a more comfortable environment for employees, often based on projects with a quick payback. Through outreach and education, the City will encourage businesses to pursue "green" activities and facility upgrades, including becoming a Santa Clara County certified green business.

Barriers

- *Various: Although various barriers exist to making green upgrades to a building or facility, such as the capital needed and time to implement, the greatest barrier is often a lack of understanding about available options and technologies and the pros and cons of each.*

Precedents

- *Unknown: this strategy was added based on Study Session feedback, but additional research was not conducted.*

H) PACE Programs

Property Assessed Clean Energy (PACE) programs enable qualified Mountain View residents and businesses to take advantage of low-cost financing to make green improvements to their properties. Affordable fixed rates enable property owners to match repayments with dollar savings and to repay the financing over the life of the upgrade via the property tax bill.

H.1: PACE Programs Evaluation/Adoption

Description

There are multiple PACE programs operating in California, and Mountain View residents and businesses have access to PACE financing through the City's participation in CaliforniaFIRST. The City will evaluate other PACE programs and, as appropriate, recommend their adoption by the City Council.

Barriers

- *Time: The primary barrier to adopting additional PACE programs is the time needed to research, recommend, adopt, and market the new programs.*

Precedents

- *This strategy was added based on Study Session feedback. While additional research was not conducted, the City is aware that multiple PACE programs are allowed and operating within other California cities.*

I) Community Outreach

Ensuring that residents and businesses have access to unbiased information about new building technologies and operating procedures that save energy or generate renewable energy is a role suited to local government.

I.1: Community Outreach and Assistance

Description

By providing outreach and assistance, the City can encourage residents and businesses to adopt behavior changes and to explore various technologies (e.g., solar photovoltaic or hot water systems) that can reduce energy bills and GHG emissions.

Barriers

- *Time: A primary barrier is the time needed to research the pros and cons of available technologies and best practices, to generate the outreach materials, to conduct the outreach, to provide additional assistance, and to keep the information updated.*

- *Cost: Depending on the extensiveness of the program, cost of materials and staff time could hinder project implementation.*

Precedents

- *Unknown: This strategy was added based on Study Session feedback, but additional research was not conducted.*

Chapter 4

TRANSPORTATION STRATEGIES

This chapter contains potential Transportation strategies and implementation mechanisms that could form part of a roadmap enabling Mountain View to reach its 2050 Greenhouse Gas (GHG) reduction target. Transportation comprises the largest source of GHG emissions in the City (~61% as of 2012), and emissions must be reduced dramatically in this sector to achieve an 80% reduction in community emissions by 2050.

Table 4.1 below divides Transportation sector carbon reduction opportunities into six core strategies, then identifies potential mechanisms (policies and programs) that the City could adopt to implement each strategy. A brief description is provided for each mechanism, followed by a list of potential barriers and precedent examples from cities where similar policies or programs exist.

The core strategies focus on transitioning to alternative vehicle fuels (fuel switching). There will be necessary interplay between each strategy for transportation emission reductions, and adopting any one fuel type will influence the deployment and development of others. Achieving the ideal mix of fuels will depend on the type, size, and number of vehicles. While residents and businesses should be encouraged to adopt alternative fuels, some level of organic growth and market influence should occur to achieve an optimized distribution of alternative fuels.

Table 4.1: Transportation Strategies and Mechanisms – Details

Strategy	Mechanism	Sector	Estimated Cost	Est. GHG Reduction in 2050 (MT CO_2e/Yr)	Implementing Entity
A) Fuel Switching – Compressed Natural Gas (CNG)	A.1. Publicly Accessible CNG Fueling Stations	Comm & Muni	Cost Neutral	Very High	City, Commercial Property Owners
	A.2. Shared Commercial CNG Fueling Station Outreach Program	Comm	Low		City
B) Fuel Switching – Electric Vehicles (EV)	B.1. Community EV Adoption Campaign	Res & Comm	Medium	Very High	City
	B.2. Publicly-Accessible EV Charging Facilities	Res & Comm	Cost Neutral or Revenue Generating		City, Developers
	B.3. Parking Facility EV Charging Standards	Comm & Muni	Low		City
	B.4. Residential Multi-Family EV Charging Standards	Res & Comm	Low		City
	B.5. Residential Single-Family EV Charging Standards	Res	Low		City
C) Fuel Switching – Second Generation Biofuels	C.1. Encourage Development of Biofuel Stations	Comm	Medium	High	City
	C.2. Waste-To-Biogas Facility for Fleet Vehicles	Comm & Muni	Very High		City, Commercial Entities, Other Cities
D) Hydrogen Fuel *	D.1. Hydrogen Fuel Exploration	Res & Comm & Muni	Unknown	Unknown	City
E) Transportation Policies *	E.1. Regional Transportation Policies	Res & Comm & Muni	Unknown	Unknown	City
F) Community Outreach *	F.1. Community Outreach and Assistance	Res & Comm	Unknown	Unknown	City
			TOTAL:	**300,000 - 350,000**	

** Added based on Study Session feedback, but without additional research, which can be conducted in the future.*

***Sector**: Res = Residential; Comm = Commercial; Muni = Municipal*

***Estimated Cost**: these would be costs incurred by the City, and are based on a rough assessment of initial cost, operations and maintenance cost, cost savings and revenue. Any costs or revenue to entities outside the city government were not considered in these estimates.*

Low ($10,000-$30,000), Medium ($30,000-$100,000), High ($100,000-$300,000), Very High (over $300,000)

***Estimated GHG Reduction in 2050 (MT CO_2e/Yr)**:*

Low (2,000-25,000), Medium (25,000-50,000), High (50,000-100,000), Very High (over 100,000)

HYDROGEN AS A FUEL SOURCE

The CPR did not specifically evaluate and model the emission reduction potential of hydrogen fuel cell vehicles, since (a) emissions from hydrogen vary considerably based on the method of fuel production, and (b) market adoption of the technology has been limited to date.

Hydrogen can be produced from a variety of energy sources. If hydrogen is derived from electrolysis using renewable electricity, then the vehicles will produce very few greenhouse gas emissions. However, if the hydrogen is produced from natural gas or from electrolysis using a more carbon-intensive electricity supply, then the vehicle's emission reduction potential will be lower.

A study prepared by Argonne National Laboratory titled "*Fuel Choices for Fuel-Cell Vehicles: Well-to-Wheels Energy and Emission Impacts*," found that natural gas-derived hydrogen will likely provide a 54% emission reduction compared to conventional gasoline vehicles. Another study (August 2015) published in Energy & Fuels titled "*Comparison of Life Cycle Greenhouse Gases from Natural Gas Pathways for Light-Duty Vehicles,"* shows a more pessimistic view on natural gas-derived hydrogen (GH2) use in passenger vehicles. When engine manufacturing life-cycle energy is included, GH2 is only marginally better than conventional gasoline vehicles, much worse than gasoline/electric hybrids, and significantly worse than battery electric vehicles (BEVs) using natural gas-produced grid electricity, since the development of fuel cell engine components is very energy intensive.

Due to cost barriers of electrolysis, natural gas will likely be the source for hydrogen fuel in the near future, but changes in technology, market, or regulatory conditions could change this. For these reasons and the associated uncertainty, the CPR did not model the emission reduction impact of hydrogen vehicles. However, the CPR does include Strategy D to further investigate hydrogen as a transportation fuel source.

To date, plug-in electric vehicles have achieved considerably more market penetration in California than hydrogen vehicles. Recent efforts to increase adoption of hydrogen vehicles may reduce this difference, but key barriers exist in transitioning to hydrogen, including vehicle cost and fuel infrastructure development. That said, hydrogen fuel vehicles have characteristics that could be advantageous compared to electric vehicles. Specifically, the ability to store hydrogen fuel will allow longer driving ranges for medium-to-heavy vehicles, and hydrogen vehicles also offer similar air quality benefits to electric vehicles. As hydrogen technology evolves, the City will evaluate mechanisms to facilitate hydrogen vehicle adoption in the community.

A) Fuel Switching – Compressed Natural Gas

Compressed natural gas (CNG) presents an alternative fuel source for modified internal combustion engines (ICE), and CNG can play an important role in reducing carbon and particulate emissions in a variety of vehicles. Significantly fewer GHGs are emitted from the direct combustion of CNG compared to gasoline or diesel, and on a lifecycle basis CNG are still believed to produce fewer GHG emissions compared to traditional fuels. While there is concern that methane emissions lost during extraction could result in increased global GHG emissions despite reductions in local combustion, improvements in USEPA regulations and industry leak prevention systems mitigate the issue (though it is worth continued consideration). Further, CNG produces considerably lower particulate emissions and could contribute to local air quality goals.

CNG offers opportunities for lower fuel prices, less engine wear, and lower operation and maintenance costs compared to gasoline and diesel vehicles. CNG is currently optimal for medium to large fleets that drive many miles a day, including buses, construction vehicles, garbage trucks, and other public works vehicles. Due to centralized maintenance and fueling of these fleets, it is economical and beneficial to convert to natural gas. However, CNG fuel conversion faces several challenges. Up-front cost of CNG vehicles is typically higher than a gasoline- or diesel-powered equivalent. There is currently a lack of natural gas fueling infrastructure, and reduction GHG emissions from CNG combustion alone are not low enough to result in the target of 80% reduction in all vehicles. Finally, while CNG provides important air quality benefits and reduces GHG emissions when compared to traditional diesel engines, cleaner technologies exist.

Yet, if the challenges introduced above are overcome, CNG fueling infrastructure could serve as a stepping-stone to other alternative fuels including hydrogen. There are opportunities for use of renewable natural gas (biogas) in CNG vehicles and any associated CNG distribution infrastructure. Therefore, CNG is considered a moderate strategy for achieving the City's 2050 GHG emissions reduction target. Following is an overview of four recommended implementation mechanisms to encourage the adoption and deployment of CNG technology.

A.1: Publicly Accessible CNG Fueling Stations

Description

The carbon intensity of the region's transportation could be reduced if a considerable portion of the vehicles in the city adopt CNG as a primary transportation fuel source. However, achieving a large-scale transition will require an increase in publicly accessible CNG fueling stations on private or public property, which the City could help facilitate in conjunction with commercial or industrial property owners. CNG fueling stations open to public use can serve as a catalyst for community CNG vehicle adoption. If multiple cities in a region coordinate this effort, it would expand the public's fueling options, particularly if existing commercial fueling stations add CNG fueling capability. Expanding fueling infrastructure would also address a key market barrier, which is the perceived unreliability of a regional fueling system.

Barriers

- *Increased Liability Due to Boiling Liquid Vapor Explosion: Explosive properties of CNG represent a public health and safety risk.*

- *Permitting: CNG stations are likely to require an involved permitting process and there may be unforeseen issues with construction delays and availability of equipment.*

- *Upfront Capital Costs: Initial costs for municipal CNG fueling stations are large, though long-term operations and maintenance savings can offset these initial costs. If a suitable location(s) isn't available on existing public or private property, the cost to acquire land could be significant.*

- *Siting: Locating the fueling station(s) on City property could present challenges, since some locations are not easily accessible to the public, and existing commercial fueling stations may not choose to offer CNG in the future.*

- *Manufacturer Support: There is uncertainty and risk associated with whether auto manufacturers will continue to offer and develop new CNG vehicles for light duty and commercial use that are cost effective and supported for parts replacement.*

- *Environmental Concerns: While CNG may be cleaner-burning than gasoline or diesel, it is still a non-renewable fossil fuel. Further, there is significant leakage of methane (~25 times more potent a greenhouse gas than carbon dioxide) associated with extracting, processing, transporting, and distributing natural gas, and the use of fracking as an extraction technique can cause significant additional environmental damage.*

Precedents

- *Ontario, CA: Continuing into 2015, the City of Ontario is expanding its CNG fueling facility and invested in CNG vehicles for the municipal fleet. The CNG station is also open for public use seven days a week, twenty-four hours a day. The project includes installation of new and replacement fuel dispensers and provision of additional CNG fuel storage capacity. The City was awarded a grant fund from the Mobile Source Air Pollution Reduction Review Committee Local Government Match Program.*

A.2: SHARED COMMERCIAL CNG FUELING STATION OUTREACH PROGRAM

Description

Develop an outreach program to encourage local commercial fleet operators to develop publically available CNG fueling stations. A successful outreach campaign would identify market segments and develop outreach and financing solutions. This, combined with targeted outreach to commercial fleet owners and operators, could greatly improve awareness about the potential for improvements in the region's commercial fleets.

Barriers

- *Cultural: It may be difficult to shift commercial operations and private interest enough that it increases adoption of CNG vehicles and cooperation between businesses and other stakeholders.*

Precedents

- *Chicago, IL: Partnering with the Gas Technology Institute, Chicago Area Clean Cities Coalition, the State of Illinois, municipalities, and private companies, the City of Chicago has developed multiple alternative fueling stations, including 17 CNG fueling stations that are shared for public and private use on both public and private lands.*

B) Fuel Switching – Electric Vehicles

Electric vehicles (EV) utilize electric powertrains for propulsion and can be recharged from any external source of electricity. Extended range EVs may have an internal gasoline generator that is able to recharge the battery and extend the car's range. However, the typical operation of EVs does not produce GHG emissions on the road. Rather, emissions are accounted for at the electric generation source. Because California has a Renewable Portfolio Standard (RPS) of 33% renewable energy on its grid by 2030, charging and operating EVs generally produces a low level of GHG emissions. In addition, EVs produce little to no local air pollution, and increased adoption of EVs would contribute to regional air quality goals.

While a lack of charging infrastructure (range anxiety) and concerns regarding up-front purchase costs may dissuade potential buyers from adopting EV technology, aggressive outreach, technological advances, and a changing market are helping overcome these obstacles. Considerable improvements in battery technology are progressively reducing battery costs. In 2012, McKinsey and Company analyzed EV competiveness with internal combustion engine vehicles. The study looked at two core variables: battery cost and gasoline fuel price. According to the study, based on 2011 conditions, hybrid EVs were becoming competitive on a full ownership cost basis. By 2030, EVs will likely be directly competitive with ICEs.[18] It is likely that up-front costs for EVs will remain slightly higher than ICEs, but operations and maintenance costs over time will more than make up this premium. Other concerns ??are?? the battery technology required for EVs include the lifecycle impacts of the batteries, however, multiple studies, including one from the University of Chicago,[19] indicate that GHG emissions from this process are small enough to maintain EV's benefit of reduced global GHGs.

Further concerns over EVs arise due to inevitable decreases in revenue from gas taxes as a result of less gas consumption. However, this extremely minor setback is overcome through appropriate political will and proper maintenance of government budgets (i.e., raising other taxes through increasing the percent of the gas tax or taxing elsewhere).

Ultimately, EV characteristics make them well-suited for reducing transportation carbon emissions and addressing regional air quality issues. Industry support of these technologies as well as innovations to address the barriers above are evident in programs such as Tesla Motor's "Supercharger." The "Supercharger" program is rapidly expanding the infrastructure necessary for mainstream EV adoption. However, with every solution come new barriers. In the case of the "Supercharger," utilities have legitimate concern over increased electricity loads, like similar concerns when RPS was proposed including that of the ever present "Duck Curve," issues of higher loads and load timing will ultimately be mitigated through technology developments, infrastructure expansion and innovative management.

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[18] U.S. Department of Energy, Energy Information Administration reference case gasoline price forecasts and DOE and other industry battery price forecasts.

[19] http://www.transportation.anl.gov/pdfs/B/855.PDF

B.1: COMMUNITY EV ADOPTION CAMPAIGN

Description

As with many new technologies and programs, successfully implementing EV adoption programs will require concerted promotion and education. Outreach programs could include a "Clean Vehicles = Clean Air" marketing campaign, EV demonstration days, websites, and applications for mobile devices. Depending on the designated needs of the City, both residential and commercial programs could be beneficial.

Barriers

- *Preconceptions: Many residents have preconceptions that EVs cannot meet their daily travel needs. Range anxiety and lack of knowledge about charging options currently prevents a portion of the population from purchasing EVs. It would be essential to educate residents about the appropriateness and benefits of EVs in most Bay Area driving situations. Identifying potential EV adopters and developing the appropriate messaging would be required.*

- *First Cost: Currently, EVs are more expensive than base model gasoline vehicles. This will limit the portion of the market that will purchase EVs in the near-term. Given the large percentage of affluent residents/employees in the community, this should be less of a constraint than in other markets.*

Precedents

- *Santa Barbara, CA: Santa Barbara has a community-based outreach campaign that includes advertisement of EV infrastructure through its City and Air Pollution Control District website. During its Earth Day Festival, Santa Barbara hosts a Green Car Show, which includes a Ride & Drive Event, inviting potential customers to get behind the wheel of an EV. There are also demonstrations of a solar carport and information on publicly available charging stations.*

B.2: PUBLICLY-ACCESSIBLE EV CHARGING FACILITIES

Description

A comprehensive network of publicly-accessible charging stations will be required to extend the travel range of EVs and assure users that they will not be left stranded without the ability to charge. In municipally-controlled areas, additional EV charging stations will be necessary for mass adoption of EVs. Several parking studies have indicated that many residential developments provide less off-street parking than residents require. As more residents park on the streets, EV charging stations will be necessary on-street or at other viable publicly-accessible locations to further incentivize "first-movers" in adopting this technology. These publically-accessible locations include commercial areas and municipally controlled areas.

Barriers

- *Cost: Depending on electrician and permitting costs, an EV charging station can cost between $4,000 and $15,000 to install. This represents a significant initial cost to commercial parking facility owners. Rebates and other financial incentives may be necessary to reduce this hurdle.*

- *Demand and Supply: Installing EV chargers will help facilitate EV adoption. Because the infrastructure is costly, there is reluctance to install infrastructure until demand is proven, but without the chargers, demand may be depressed. Policies will be needed to break this impasse.*

- *Operational Issues: Potential for charger vandalism and ongoing operations and maintenance costs represent uncertain future risks.*

- *Parking Constraints: Spaces restricted to EVs could take away from already-limited parking spaces, especially given the current low EV market share.*

Precedents

- *Portland, OR: The City has developed a strategy to address the many issues around adoption of EV technology. "Electric Vehicles: The Portland Way" was adopted by the City Council on July 20, 2010. One of the key areas in the document addresses streamlining the permitting process for charging stations. Also, Portland is currently benefiting from The EV Project, a federally funded initiative that will install over 2,000 charging stations in the Willamette Valley. Of these stations, approximately 1,000 will be accessible to the public, enabling EV users to charge at destinations throughout the region.*

- *Chicago, IL: As of May 2013, there were 214 public charging stations in the Chicago metro area. Most of these stations are equipped with Level 2 chargers, and some are equipped with direct-current fast chargers. A free, user-friendly, online and mobile map identifies the locations of charging stations and displays in real-time whether they are in use. The map also differentiates between regular and high-power stations that can charge your car more quickly.*

- *Westminster, London, England: In 2006, the Westminster City Council installed two on-street EV charging stations as part of a pilot/demonstration project. The City established criteria for siting on-street chargers, including compliance with the Westminster Way Street design guidelines, suitability for disabled users, and compatibility with the majority of EVs used in London. Following this successful pilot project, the City has installed 33 on-street charging stations to date.*

- *Copenhagen, Denmark: The City Council has reserved 500 parking spaces for EV providers to set up and operate charging station*s for a period of ten years. To date, 106 charging stations, 218 parking spaces, one fast-charging station, a*nd one hydrogen fueling station have been set up. As relevant standards and legislation are made ready, the City of Copenhagen will offer long-term concessions to ensure the full-scale roll-out of infrastructure on public roads. This includes on-going cooperation with car manufactures and service providers who can contribute to creating a public infrastructure.*

B.3: PARKING FACILITY EV CHARGING STANDARDS

Description

To facilitate the broad adoption of EVs, the City will need to increase the number of "EV ready" spaces in public and private parking lots and garages. To accomplish this, the City could establish EV ready requirements for existing City parking spaces and for new private lots and garages. Additional policies could encourage retrofit of existing garages and lots.

Another potential policy mechanism to facilitate these retrofits would be a commercial parking tax applied to customers who park in facilities that do not have adequate EV charging infrastructure. The tax could be structured proportionate to the level of EV charging infrastructure in the facility. Revenues could be spent on funding or rebates for further EV charging infrastructure development.

Barriers

- *Demand and Supply: Installing EV chargers will help facilitate EV adoption. Because the infrastructure is costly, there is reluctance to install infrastructure until demand is proven, but without the chargers, demand may be depressed. Policies will be needed to break this impasse.*

- *Loss of Parking Spaces: There is a requirement to provide one EV charging space that is accessible, which means the loss of an additional parking space (and revenue) due to the loading/unloading aisle.*

Precedents

- *Bay Area, CA: The "Plug-in EV Readiness Plan" and "Ready, Set, Charge, California!" plans highlight strategies and guidance from research, analysis, and public input to help the Bay Area achieve the goal of increasing EV adoption over the next 10 years. This includes recommendations for design guidelines and codes for charging stations on commercial properties.*

- *Puyallup, WA: The City of Puyallup has adopted a municipal code addressing EV infrastructure, including charging stations in commercial development. The code intends to encourage the use of EVs and to set standards for, and expedite the establishment of, convenient, cost-effective EV infrastructure that is needed for such a transition.*

B.4: RESIDENTIAL MULTI-FAMILY EV CHARGING STANDARDS

Description

A large portion of current and future residences in Mountain View are and will be multi-family dwellings. Limited accessibility to at-home charging stations for residents in multi-family housing may be a barrier to EV adoption in the Bay Area. To help remove this barrier, the City could implement parking standard requirements for EV charging stations in new and renovated multi-family developments.

Barriers

- *Increased Cost of Development: Because EVs currently have low market penetration, adoption of EV pre-wiring requirements may slightly increase development costs in a region with an already expensive residential market and limited development opportunities.*

- *Property Owner/Developer Resistance: Building owners and developers may resist these requirements because current market adoption of EVs is low. Market research may be required to indicate that occupants of multi-level family housing would exhibit sufficient demand for charging stations.*

Precedents

- *Palo Alto and Cupertino, CA: The Bay Area "Plug-In EV Readiness Plan" and Bay Area "Ready, Set, Charge, California!" plan provide recommendations for local governments to offer guidance to the public and adopt regulations for expanding the number of charging stations available to residents. Municipalities such as Palo Alto and Cupertino have adopted codes requiring pre-wiring for charging stations at multi-family buildings. Cupertino is amending Chapter 16.58, Title 16 of its Municipal Code to require at least 5% of all multi-family parking be devoted to EV charging. On August 4, 2014, the Palo Alto City Council held its second reading of an ordinance to include Section 16.14.380 of the Palo Alto Municipal Code, adopting the local amendments to the California Green Building Standards Code requiring that all new multi-family residential and non-residential construction provide for the current and future installation of EV chargers. This complements the adoption of a 2013 Municipal Code, requiring new single-family residences to accommodate 240-volt Level 2 charging stations.*

- *Santa Clara County, CA: On December 17, 2013, the County Board of Supervisors adopted an ordinance (NS-1100.118) r*equiring *either pre-wiring or installation of charging stations for plug-in EVs in new buildings (i.e., residential, multi-family, and commercial) in the unincorporated areas. The ordinance requires that new buildings install conduit and ensure electrical panel capacity to enable the future installation of Level 2 EV charging equipment. For new non-residential and multi-family residential buildings that provide more than 100 new parking spaces, the ordinance requires the installation of Level 2 plug-in EV charging stations for 1% of the parking spaces. The purpose of this ordinance is to increase the availability of plug-in EV charging system infrastructure throughout the County, to encourage ownership of plug-in EVs, and to serve as a model for consideration and adoption by the County's fifteen municipalities.*

- *Vancouver, Canada: In 2009, the City of Vancouver, British Columbia, revised its building code to require a portion of parking stalls in new development to be EV ready. Section 13.2.1.1 of the Vancouver Code requires 20% of multi-family building parking stalls designated for use by building owners or occupants to accommodate EV charging equipment. Section 13.2.1.2 of the Code requires the electrical room in a multi-family building to include sufficient space for the future installation of electrical equipment necessary to accommodate EV charging for 100% of the parking stalls designated for use by building owners or occupants. The space required already exists in most homes and is minimal.*

B.5: RESIDENTIAL SINGLE-FAMILY EV CHARGING STANDARDS

Description

It is expected that most EV charging will initially take place at people's homes. Pre-wiring requirements for EV charging stations in new single-family residential development is an important policy to help encourage EV adoption. A report by the California Investor Owned Utilities Statewide Codes and Standards team recognizes that changes to the building code to make charging infrastructure more available, accessible, and affordable will be needed to facilitate adoption of plug-in EVs.

Barriers

- *Increased Cost of Development: Because EVs currently have low market penetration, adoption of EV pre-wiring requirements may slightly increase development costs in a region already facing an expensive residential market and limited development opportunities.*

- *Property Owner/Developer Resistance: Building owners and developers may resist these requirements because current market adoption of EVs is low. Market research may be required to indicate that occupants of multi-level family housing would exhibit sufficient demand for charging stations.*

Precedents

- *Palo Alto and Cupertino, CA: Refer to B.4 for a full description of Palo Alto and Cupertino's EV charger programs and policies.*

- *Sunnyvale, CA: The Bay Area "Plug-in EV Readiness Plan" and Bay Area "Ready, Set, Charge, California!" plan provide cities and consumers with information regarding installation of EV equipment. The City of Sunnyvale has taken action on these plans and established a code requiring pre-wiring for all new single-family housing units and pre-wiring for 12.5% of shared parking including condominiums and apartments.*

- *San Jose, CA: In 2012, the City of San Jose's Planning, Building, and Code Enforcement Department implemented a streamlined residential permitting process[20] to facilitate the installation of home charging systems and accelerate the adoption of EVs.*

- *Santa Clara County, CA: Refer to Section B.4 for a full description of Santa Clara's EV charger programs and policies.*

- *London, England: Since 2009, the City of London's building code has required residential, workplace, and retail development to install EV chargers, including 20% of new residential and workplace parking stalls and 10% of new retail parking stalls. The code requires an additional 20% of residential stalls and 10% of workplace and retail stalls to be EV ready.*

[20] http://www.sanjoseca.gov/DocumentCenter/View/1744

C) Fuel Switching – Second Generation Biofuels

Rapid increases in the use of crop-based (first-generation) biofuels have resulted in concerns over their impact on food supplies and ecosystems. Many first generation biofuels, including biodiesel, may result in remote environmental impacts, such as tropical forest clearing or increased food scarcity and prices. It is critical that overall lifecycle impacts are considered in biofuel selection. These concerns have led to an increased focus on the development of biofuels generated from non-food biomass feed stocks (second-generation).

The World Bank's 2010 report, *Second-Generation Biofuels - Economics and Policies,* acknowledges that these second-generation biofuels could significantly contribute to future energy supplies, but cost is a major barrier to commercial production in the near-to-medium term. Given the uncertainty about future technological breakthroughs that could make some second-generation biofuels cost competitive, policymakers need to carefully consider providing support to specific types of biofuels.[21]

Biofuels' characteristics make them well-suited for reducing transportation carbon emissions. This is especially true in medium- and heavy-duty trucks and in passenger vehicles needing longer range performance. Technology developments will likely make biofuels more cost competitive with conventional fuels in coming decades. Biofuels are a core strategy for achieving the City's 2050 GHG emissions reduction target.

C.1: Encourage Development of Biofuel Stations

Description

A comprehensive network of publicly accessible biofuel stations will need to be developed to serve medium- and heavy-duty vehicles in the community. Given that there is currently limited adoption of this technology, there is also limited market opportunity for private companies to develop the appropriate infrastructure to support the technology shift. Therefore, it will be necessary for the City to encourage private sector development of biofuel stations through coordination of key stakeholders, preferable zoning or other incentives.

Barriers

- *Adoption and Scalability: Biofuels are a great option for select vehicles including those in fleets with a central fueling station due to lack of more expansive infrastructure. This often results in the use with medium- and heavy-duty vehicles. Smaller vehicle classes will continue to have less of an advantage with these technologies if a lack of incentive for large build-outs of biofuel stations continues.*

- *Usability Issues: Although biofuel has been around for a number of years, there are several potential usability issues, such as (1) cold weather fuel system problems due to gelling of the biodiesel, (2) unregulated quality of the fuel, (3) an adequate number of facilities, (4) staffing to collect the raw product and refine it, (5) proper transport and storage of the raw and refined product, (6) diesel vehicles needing their lines flushed and rubber hoses/filters/gaskets changed prior to using biodiesel, and (7) high*

[21] http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-5406

maintenance costs associated with switching back and forth between diesel and biodiesel.

Precedents

- *Chicago, IL: Partnering with the Gas Technology Institute, Chicago Area Clean Cities Coalition, the State of Illinois, municipalities, and private companies, the City of Chicago has developed multiple alternative fueling stations, including 11 E-85 stations that are available for public and private use.*

- *Sao Paulo, Brazil: The city provides preferable tax rates of 12% for E100 compared to 25% for standard gasoline to incent the use of biofuels.*

C.2: WASTE-TO-BIOGAS FACILITY FOR FLEET VEHICLES

Description

Energy generation from waste is an ideal option for any sustainable infrastructure. It converts a previously unused substance that normally requires storage and management into something with utility and value. Therefore, as technologies, infrastructure, and management of resources improve, waste-to-energy projects become increasingly viable and popular. In partnership with other jurisdictions and commercial stakeholders, the City could develop or facilitate the development of a waste-to-biogas facility on city-owned or private land for use by municipal and commercial fleet vehicles. Organizing various waste streams and collecting various waste materials in the City to generate biogas to fuel municipal and commercial fleets would enable Mountain View to utilize a previously wasted resource.

Barriers

- *Coordination: Many biogas facilities produce a small quantity of fuel. It may not be economically feasible to process these small quantities or transport them to a useful location. Large-scale facilities are required in order to produce enough biogas to make such an arrangement scalable or economically feasible.*

- *Technology, Infrastructure, and Location: Waste-to-energy technology is becoming increasingly popular. One major factor determining the feasibility of a waste-to-energy project for a fleet is the distance from the fleet to the biogas fueling station(s). If the distance is too great, reductions in GHG emissions may not be possible.*

- *New Technology Uncertainties: Biogas is a newer technology, and not widely available today as a replacement for gasoline vehicles. Fleet managers have similar concerns with biogas as with biofuel; see item C.1: Usability Issues.*

Precedents

- *San Francisco, CA: Partnering with Recology, San Francisco continues to lead the nation in diverting material from landfills to achieve the highest use of all materials. Recently the City has investigated transitioning from a strategy of composting community food waste outside the City to generating biogas from the waste in anaerobic digesters within the City. Analysis indicates that from a lifecycle perspective, the use of biogas in City vehicles would reduce more GHG emissions than using the biogas for electricity and heat generation.*

D) Hydrogen Fuel

While hydrogen has not reached a point of mass adoption, and there are still relatively few hydrogen fuel vehicles in use, hydrogen vehicles have characteristics that could be advantageous compared to electric vehicles. Specifically, the ability to store hydrogen fuel will allow longer driving ranges for medium-to-heavy vehicles, and hydrogen vehicles also offer similar air quality benefits to electric vehicles.

D.1: HYDROGEN FUEL EXPLORATION

Description

Through monitoring the state of the hydrogen fuel industry and adopted best practices, the City will evaluate the benefits of hydrogen as a transportation fuel, including the possibility of installing one or more hydrogen fueling stations in Mountain View. This information will be shared with residents and businesses through the City's community outreach efforts.

Barriers

- *Fuel Cost: Generating hydrogen through electrolysis is a fairly costly endeavor, but improved technology and a drop in source-fuel prices could help lower the cost of hydrogen.*

- *Vehicle Cost: With very few hydrogen fuel vehicles available, their cost is still high compared to other alternative-fuel vehicles, such as electric vehicles.*

- *Fueling Infrastructure: With few hydrogen fuel vehicles on the road, there has been little demand for fueling stations, and thus the cost of developing a large fueling infrastructure will be high.*

Precedents

- *Emeryville, CA and Oakland, CA: While several hydrogen fueling stations are under development in the Bay Area, the only stations in operation are in Emeryville and Oakland, although the Oakland station is not open to passenger vehicles.*

E) Transportation Policies

With an award-winning transit center, free community and employee shuttles, dedicated bicycle paths and lanes, and bicycles for rent, the City has made significant efforts to provide alternatives to single-occupancy vehicle transportation. That said, transportation around the region remains a real problem, with a heavy toll on infrastructure, commute times, and quality of life. In addition to solutions provided by local governments, additional efforts are needed to address the problem at a regional level.

E.1: Regional Transportation Policies

Description

In conjunction with other cities and regional entities such as the Valley Transportation Authority (VTA), Caltrain, the Metropolitan Transportation Commission (MTC), and the Association of Bay Area Governments (ABAG), Mountain View can do more to help coordinate transportation initiatives and policies at the regional level.

Barriers

- *Numerous: This strategy was added based on Study Session feedback. While specific additional research was not conducted, multiple barriers exist, including cost, availability of resources and land, differing opinions on preferred solutions, political will, and Not-In-My-Backyard (NIMBY) opposition.*

Precedents

- *Plan Bay Area 2040: This is a state-mandated, integrated long-range transportation, land-use, and housing plan that works to identify areas within the region where people will live, and how smart growth land use patterns can be used to reduce greenhouse gas emissions from cars and light-duty trucks. A key component of the Plan is the designation of Priority Development Areas, locations within existing communities that present infill development opportunities, and are easily accessible to transit, jobs, shopping, and services.*

- *BART Expansion: The Silicon Valley Bay Area Rapid Transit (BART) extension is a set of three phases of expansion of BART from its current terminus in Fremont to Santa Clara County.*

- *High Speed Rail: The California High Speed Rail San Francisco-Silicon Valley corridor project will use the San Jose Diridon Station to integrate into existing Caltrain, light rail, and local bus systems. The improvements will create enhanced transit access and connectivity, and help mold the travel patterns of Bay Area residents into a more sustainable model.*

- *Bay Area Commuter Benefits Program: This program requires all Bay Area employers with 50 or more full-time employees to provide commuter benefits to their employees. To comply with the Program, employers must select one (or more) of four commuter benefit options, notify employees about how to take advantage of the benefit, and register with the program.*

F) Community Outreach

Ensuring that residents and businesses have access to unbiased information about new transportation technologies that save fuel, reduce GHG and particulate emissions, and improve air quality is a role suited to local government.

F.1: Community Outreach and Assistance

Description

By providing outreach and assistance, the City can encourage residents and businesses to purchase alternative fuel vehicles (e.g. hybrid, plug-in, or battery electric vehicles) that can be less expensive to operate and can help the City reduce its transportation-related GHG emissions, which at 61% are the largest contributor to community-wide emissions.

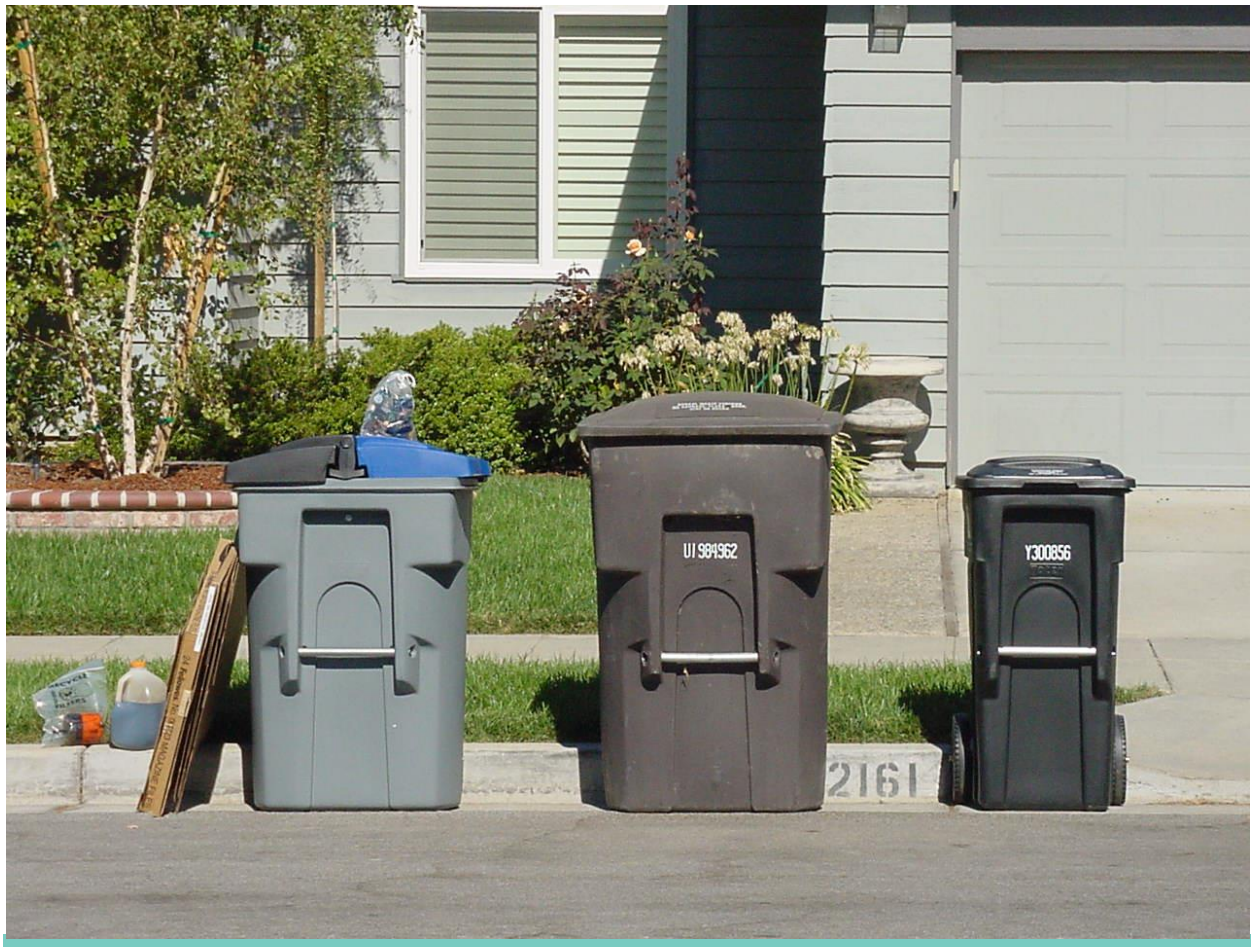
Barriers

- *Time: A primary barrier is the time needed to research the pros and cons of available technologies and best practices, to generate the outreach materials, to conduct the outreach, to provide additional assistance, and to keep the information updated.*

- *Cost: Depending on the extensiveness of the program, cost of materials and staff time could hinder project implementation.*

Precedents

- *Unknown: This strategy was added based on Study Session feedback, but additional research was not conducted.*



Chapter 5

SOLID WASTE STRATEGIES

This chapter contains potential Solid Waste strategies and implementation mechanisms that could form part of a roadmap enabling Mountain View to reach its 2050 GHG reduction target. Waste currently makes up the third largest source of GHG emissions in the City (~1.1% as of 2012), and includes emissions from waste generated in Mountain View that has been, and will be, placed in landfills (approximately 52,000 tons in 2013). As landfilled waste decomposes, methane is generated from organic materials such as food, wood, and paper. Methane is a very potent greenhouse gas, with 1 pound of methane considered to be as powerful as 25 pounds of carbon dioxide.

Although emissions from solid waste are relatively small in comparison to those from Transportation and Building Energy use, reducing the amount of waste deposited into the landfill through material reuse, reduction, recycling, and composting is an important strategy to reduce greenhouse gas emissions, particularly since the community has relatively direct control over its

waste production. In addition, buying and using products generates additional emissions "upstream," which are not easily captured in an inventory. Upstream from the consumer, fossil fuel energy is used to extract the raw materials, such as wood, metals, etc. from which products are made. Additional energy is needed to transport raw materials, manufacture goods in factories, transport finished products, and transport the waste that many products become. Therefore, reducing community-generated waste, especially through "reducing" and "reusing" activities, contributes to overall greenhouse gas emission reductions.

As shown in Table 5.1, the one Solid Waste strategy focuses on reducing landfilled waste through adoption and implementation of a Zero Waste Plan (ZWP) that identifies measures to decrease waste through increased recycling, composting, and materials management equivalent to a 90% diversion rate. The strategy identifies a few potential implementation mechanisms that the City will focus on. A brief description is provided for each mechanism, followed by a list of potential barriers and precedent examples from cities where similar policies or programs exist. The ZWP is currently under development and further details, including results of a waste characterization study and community input, can be found on the City's website in the Public Works Department section under Recycling and Zero Waste.

Table 5.1: Solid Waste Strategy and Mechanisms – Details

Strategy	Mechanism	Sector	Est. Cost	Est. GHG Reduction in 2050 (MT CO_2e/Yr)	Implementing Entity
A) Reduce Landfilled Waste	A.1. Target Materials for Diversion	Res & Comm	Very High	Low	City
	A.2. Promote Waste Reduction and Material Re-Use	Res & Comm			City
	A.3. Explore Future Processing Technologies	Comm & Muni			City
			TOTAL:	**2,000–25,000**	

Table 5.1 Notes:

Sector*: Res = Residential; Comm = Commercial; Muni = Municipal*

Estimated Cost*: these would be costs incurred by the City, and are based on a rough assessment of initial cost, operations and maintenance cost, cost savings and revenue. Any costs or revenue to entities outside the city government were not considered in these estimates.*

Low ($10,000-$30,000), Medium ($30,000-$100,000), High ($100,000-$300,000), Very High (over $300,000)

Estimated GHG Reduction in 2050 (MT CO_2e/Yr)*:*

Low (2,000-25,000), Medium (25,000-50,000), High (50,000-100,000), Very High (over 100,000)

A) Reduce Landfilled Waste

The primary strategy to reduce GHG emissions associated with waste is to reduce the amount of waste being landfilled. The various mechanisms to implement this strategy are defined in a Zero Waste Plan (ZWP). Mountain View has already committed to preparing such a plan as one of the goals included in the Environmental Sustainability Action Plan (ESAP) adopted by the City Council in February 2009. It is anticipated that the ZWP will be presented to the City Council for adoption in 2015.

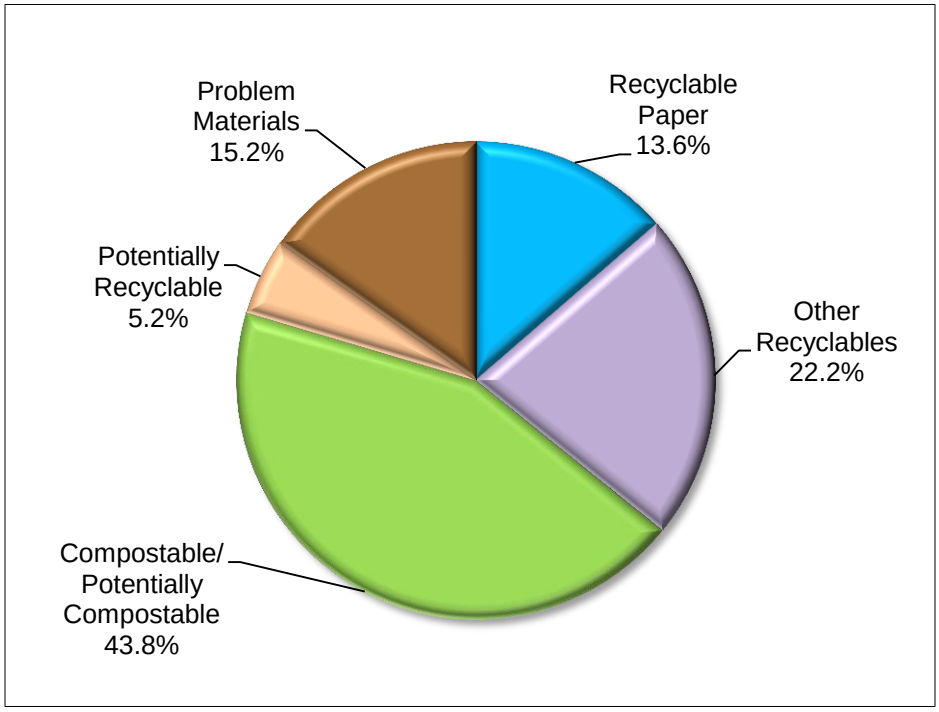
Examples of broad categories to be addressed in the ZWP are provided below, followed by a list of potential barriers and precedent examples of jurisdictions where similar policies, projects, or programs exist.

A.1: TARGET MATERIALS FOR DIVERSION

Description

In 2010, the City completed a waste characterization study to provide a detailed analysis of the types of waste being thrown away by residents and businesses. Through this analysis, the Zero Waste Plan can target opportunities for recycling or diverting waste. The study found that nearly 80% of waste (excluding construction and demolition waste) fell into the recoverability categories of recyclable paper, other recyclables, and compostable/potentially compostable; see Figure 4.1.

Figure 5.1: 2010 Waste Characterization Analysis



Since the Waste Characterization study was completed in 2010, several programs have been implemented to begin capturing more of the recyclable and compostable materials being thrown away. For example, all commercial customers in Mountain View now have access to a composting collection program that diverts food waste and compostable paper, with nearly 6,500 tons currently being diverted annually. In addition, all commercial and multi-family customers are being contacted to ensure they are recycling in compliance with State law. The City's waste hauler provides a staff person dedicated to City accounts to assist these customers in maximizing their waste diversion opportunities.

The City adopted an ordinance in 2008 mandating a minimum diversion rate of 50% for construction and demolition materials. The ordinance applies to projects 5,000 square feet or larger and requires verification of diversion efforts. Construction and demolition waste includes

easily recycled materials such as concrete, stones, dirt, asphalt, wood, metal, and dry wall, as well as other not-so-easily recycled materials like insulation, carpeting, and fixtures. All construction and demolition waste collected by the City's hauler is taken to the SMaRT Station®, where it is sorted to obtain an average overall 78% recovery rate. With robust construction and demolition recycling facilities located in Santa Clara County, it is not difficult for contractors to achieve a minimum 50% diversion rate for materials self-hauled to facilities other than the SMaRT Station.

Additional programs to further increase diversion in the future could target residential food waste, additional construction and demolition materials (especially wood since it is an organic material), special events, and mandatory residential recycling.

Barriers

- *Cost: Organic source separation programs increase operational and processing costs. Continuous outreach and education programs are required to maintain participation levels and can be costly, especially among transient apartment dwellers.*

- *Space Constraints: Some businesses and multi-family developments have space constraints that make it difficult to implement new source-separation programs, such as those to collect food waste.*

- *Participation: Hygiene concerns and confusion regarding the separation and collection process can lead to low participation in residential food waste programs.*

- *Infrastructure: Capacity for anaerobic digestion and organic composting must be developed to meet increased supply of organic materials. There will also need to be an expanded system for collection, transportation, and regulation.*

- *Political Resistance: It can be difficult to implement mandatory programs due to potential opposition by residents and businesses.*

Precedents

- *San Francisco, CA: The 2009 San Francisco Mandatory Recycling and Composting Ordinance is a local municipal ordinance requiring all residents and businesses in San Francisco to separate their recyclables, compostable organics, and landfill trash, and to participate in recycling and composting programs. It was the first municipal ordinance in the United States to universally require source separation of all organic material, including food waste.*

  San Francisco monitors and enforces compliance among businesses and uses outreach and education to encourage compliance among residents. Included in this ordinance, multi-family residences of six units or more are offered a reduced-rate service. However, building owners are fined if they fail to provide tenants with adequate service and information.

- *Portland, OR: Since 2011, the weekly curbside collection of compost for residents has been provided with every-other-week garbage collection to discourage disposable waste. The Bureau of Planning and Sustainability helps to implement this program and provides detailed information online to inform residents about pick-up schedules as well*

as appropriate contents for compost. Between 2011 and 2012, three times more yard debris and food scraps were turned into compost than had previously been recorded.

Portland also requires every garbage and recycling company that offers commercial service to offer composting collection either directly or through subcontracting, with business participation being voluntary. These requirements are part of the Portland Composts! Program.

A.2: PROMOTE WASTE REDUCTION AND MATERIAL RE-USE

Description

The most effective method of reducing the amount of waste sent to landfills is to not generate as much waste in the first place. Some examples include: reusing pallets and lumber in multiple shipping and construction applications; refilling toner cartridges; sending electronic rather than paper newsletters; using ground-up tires in the base of roadways; and making packaging design changes that use less material or use highly recyclable materials. While most waste reduction and reuse efforts are not within direct control of the City, there are policies and activities that can influence businesses and residents to make these efforts. For example:

- *The City plans to implement a residential waste reduction program that will use competitions and rewards to encourage residents to reduce the amount of total waste materials coming into and leaving their homes.*

- *In 2008, the City Council adopted a policy supporting Extended Producer Responsibility (EPR) efforts. EPR requires producers and manufacturers to take some responsibility for the ultimate disposal of the products they make and distribute. This responsibility can encourage innovative product redesign and result in consumer pricing that reflects the true lifecycle cost of a product. Currently, most of these efforts are taking place at the State level, with recent legislation addressing materials that are historically difficult to manage at the end of life, such as paint, mattresses, and carpeting. However, regional efforts may arise that the City could participate in to address other problem materials such as batteries, pharmaceuticals, fluorescent bulbs, and excessive packaging.*

- *Reducing the availability or use of common materials that are not recyclable or that are cost ineffective to recycle. The recent adoption of City ordinances banning the use of single-use plastic bags at retail stores and foam food take-out containers at restaurants are examples of this strategy.*

Barriers

- *Political Resistance: Most EPR efforts must be implemented at the State level, leaving little the City can do except expressing support for such legislation. It can be difficult to implement material or product bans at the local level.*

Precedents

- *Seattle, WA: CleanScapes, Seattle's waste hauler, has developed an education and outreach campaign focused on overall waste reduction. The Neighborhood Waste Reduction Rewards Program rewards the neighborhood that reduces the most overall waste (garbage, recycling, organics) during the competition time period. The rewards are*

usually in the form of a capital improvement project voted on by the winning neighborhood.

A.3: EXPLORE FUTURE PROCESSING TECHNOLOGIES

Description

Since the mid 1990's, all waste collected in Mountain View has been processed at the SMaRT Station in Sunnyvale to remove recyclable materials prior to landfilling. Approximately 19% of the total waste stream is recovered in this way, and the equipment at the facility is currently undergoing improvements to increase recovery to 25% or more. Future improvements to this facility, or the use of other facilities incorporating new technologies, could further help to capture and process materials, and potentially create energy as well.

For example, waste biogas-to-energy technologies come in multiple forms that generally include processing organic material anaerobically and converting it to usable biogas. Once converted, the biogas can be used on-site for electricity generation or sent off-site for use in equipment and vehicles. These processes can also produce by-products that may have a secondary use (e.g., road construction fill) and revenue potential.

There are other conversion technologies (including thermal processes such as pyrolysis and gasification) being developed, and some will eventually become proven in the United States. One or more of these technologies may be appropriate for the post-separation waste stream in Mountain View.

Barriers

- *Scalability, Cost, and Lifecycle Considerations: While waste-to-energy production is appealing, it often falls short of expectations from a "lifecycle" perspective due to scalability and cost.*

- *Public Opposition: Many environmental and community groups oppose thermal technologies. Their opposition is focused on potential toxic pollution, lack of data, and proven success of commercial-scale gasification projects; alleged flaws in the proposed technologies; and public health and air quality impacts.*

Precedents

- *San Jose, CA: In partnership with the Zero Waste Energy Development Company, San Jose is processing commercial organic waste using a commercial-scale, dry-fermentation, anaerobic digester. This is the first of its kind in the U.S.*

- *Monterey Peninsula, CA: The Monterey Regional Waste Management District (MRWMD) teamed with a private corporation, Zero Waste Energy (ZWE), to develop a dry anaerobic digester for food scraps and organic materials. The digester processes organic waste into electricity and high-quality compost. The system is anticipated to process up to 5,000 tons of organic waste per year, generating 100 kW of electricity or up to 3,200 BTU per ton of biogas with 58-60% methane content. This energy will be sold to the neighboring Monterey Regional Water Pollution Control Agency.*

Appendix A

HISTORIC MOUNTAIN VIEW CLIMATE PROTECTION ACTIVITIES

Following are some of the key climate protection activities the City has implemented at a community level in the recent past.

Transportation

- Mountain View's award-winning Downtown Transit Center serves as an intermodal transit hub for pedestrian, bicyclists, Caltrain commuter rail service, VTA light rail and public transit services, and public and private shuttles. The Mountain View Caltrain stop is the third most utilized stop along the peninsula corridor.
- The City completed the 2013 Shoreline Regional Park Community Transportation Study which identified a series of transportation improvement strategies to respond to anticipated increases in employment and development in the North Bayshore Area as envisioned by the 2030 General Plan.

- In 2013, the City adopted commute mode-share targets for the North Bayshore Area:

Travel Mode	Commute Mode-Share Target
Single-Occupancy Vehicle (SOV)	45%
Transit (Public and Private)	35%
Active Transportation	10%
Ride-Sharing (Carpools and Vanpools)	10%

- Adopted the City's first Pedestrian Master Plan in 2013, a City-wide document with pedestrian-oriented policies and guidelines that builds on the City's past and current pedestrian planning efforts and provides tools for future improvements.
- Mountain View is one of five Bay Area cities along the Caltrain corridor (San Jose, Mountain View, Palo Alto, Redwood City and San Francisco) participating the regional Bay Area Bike Share Program that was launched in 2013 with 700 bicycles and 70 stations, including 70 bikes and 7 stations in Mountain View. An additional 3 stations and 300 bicycles in Mountain View have been approved and will be installed in the near future.
- Completed the 2014 Shoreline Boulevard Transportation Corridor Study to determine the feasibility, and develop a conceptual design for, integrated transit, bicycle, and pedestrian facilities in the Shoreline Boulevard Corridor from the Downtown Transit Center to the North Bayshore Area. The facilities/improvements will support the commute mode shift targets endorsed the City Council in March 2013 in response to the anticipated increases in employment and development in the North Bayshore Area as envisioned in the 2030 General Plan and required as part of the North Bayshore Precise Plan adopted in November 2014.
- The City has been awarded a second $500,000 grant to continue its Vehicle Emissions Reductions Based at Schools (VERBS) Program activities through 2016-17. The goal of the VERBS program is to reduce greenhouse gas emissions by promoting walking, bicycling, transit and carpooling to school. During the first three-year VERBS program period, age-appropriate educational programs were provided to Grade K to 12 students at all public and private schools in the City, as well as Los Alto High School. The City's VERBS consultant completed 800 programs and events for students, cyclists and parents, totaling more than 45,300 participants (includes students and/or parents participating in multiple events.
- Currently updating the City's 2008 Bicycle Transportation Plan to provide a vision, strategies and actions for improving and encouraging bicycle travel in and through the City of Mountain View.
- Development, construction and operation of approximately 15 miles of Class I bikeways/multi-use paths (Stevens Creek, Permanente Creek and Hetch-Hetchy Trails), 26 miles of Class II bikeways/on-street bike lanes, and 10.5 miles of Class III bike routes.
- Designation as a "Bicycle-Friendly Community" by the League of American Bicyclists.
- In support of its two-year (Fiscal Years 2013-14 and 2014-15) goal to improve bicycle, pedestrian and other forms of mobility and safety, the City Council committed more than $3.5 million to fund mobility-related capital projects during the two-year period.

- Launched a two-year pilot community shuttle program in January 2015 to provide new transportation options free of charge for Mountain View residents whose mobility needs have not been met in the past by existing transportation services available in the community.
- A collaboration among private employers and landowners, a new free commuter shuttle (MVgo) began operating in January 2015, and runs between the downtown train station and corporate campuses in North Bayshore and the Whisman area.

Land Use

- **2030 General Plan**: In 2012, the new General Plan focused future growth along major transit corridors in key "change areas." It includes key policy directions to implement "complete streets," highly sustainable development, among other sustainability policies.
- **Precise Plan Updates**: In late 2014, the City completed major updates to Precise Plans in the following 3 key areas, which establish development regulations that implement the 2030 General Plan.
    - **North Bayshore**: Includes a Bonus Floor Area Ratio (FAR) system that creates incentives for highly sustainable development. Identifies multi-modal improvements to the area to make biking and walking more attractive. Through Transportation Demand Management (TDM) requirements, sets an aggressive Single Occupancy Vehicle target of 45% for vehicles during the morning commute period.
    - **El Camino Real**: Establishes new development standards, land uses, and public improvements for the El Camino Real corridor to revitalize the corridor with a vibrant mix of uses and pedestrian improvements. Focuses growth near transit stops, and includes strategies for pedestrian and bicycle improvements.
    - **San Antonio**: Establishes new zoning regulations and requirements to implement the 2030 General Plan vision for the area to become a diverse regional and community destination with a wide variety of land uses and bicycle and pedestrian improvements. Identifies improvements to connect to nearby rail, transit, and bus facilities.
- **Transit Oriented Development (TOD)**: The City has created award-winning TOD projects that concentrate housing and jobs near transit and link pedestrian and bicycle pathways to transit stations and on-site services to reduce the need for cars. The City's TOD ordinance allows increased FAR for developments that meet transit-oriented development regulations.

Energy Efficiency and Renewable Energy

- Effective August 2011, the Mountain View Green Building Code (MVGBC) amended the State-mandated California Green Building Code (CalGreen) to include local green building standards and requirements for private development.
- The City developed and implemented a residential energy efficiency program (Energy Upgrade Mountain View) over 3.5 years that served over 2,000 residents and is generating approximately 700 metric tons of GHG savings annually on an on-going basis. (On average, the top quartile of users reduced their energy bills by 21%, their electric use by 22%, and their natural gas use by 19%.)

- Through the City's participation in CaliforniaFIRST, eligible Mountain View residents and businesses have been able to take advantage of low-cost financing to make "green" improvements to their properties.
- The City provides 4 electric vehicle (EV) charging stations in the parking garage under City Hall and the Center for Performing Arts.
- The Mountain View Public Library provides Kill-a-Watt power meters for check-out, enabling residents to see how much electricity various home appliances use when “on” and “off.”

Waste Reduction, Recycling, and Composting

Following are key milestone dates in the City’s almost 30-year history of solid waste activities.

- 1987: A curbside recycling program is implemented, collecting materials first in burlap bags and then switching to small, stackable bins.
- 1992: The City adopts a Source Reduction and Recycling Plan, outlining a plan to divert 25% of the waste stream from disposal by 1995 and 50% by 2000.
- 1993: The SMaRT Station opens; an innovative facility to sort through all disposed trash to recover recyclable materials prior to landfilling. The facility also processes all curbside recycling and serves as a drop-off recycling center.
- 1995: The City begins a multi-family recycling program.
- 1995: The City achieves a 37% diversion rate, exceeding its 25% target.
- 2000: The commercial recycling program is expanded and made free of charge.
- 2000: The City achieves a 52% diversion rate, exceeding its 50% target.
- 2004: The curbside recycling program is updated, replacing stackable bins with rolling split-carts.
- 2005: The City receives an award from the State for achieving an overall 74% diversion rate.
- 2009: A commercial food waste collection pilot is introduced.
- 2009: Installation of new state-of-the-art equipment at the SMaRT Station increases recovery of materials.
- 2009: The City adopts an ordinance requiring construction projects to recycle and salvage debris.
- 2013: A commercial food waste pilot program is implemented city-wide, and multi-family and commercial recycling programs are refreshed.
- 2013: The City implements a ban on single-use plastic carry-out bags.
- 2014: A conversion of the waste collection fleet from diesel to clean-burning compressed natural gas begins.
- 2014: A ban on foam food take-out containers is implemented.

- 2015: The City plans to complete its Zero Waste Plan (with a goal of achieving a 90% diversion rate) and implement a residential food waste collection pilot and waste reduction rewards program.

Water Conservation

- Since 2000, the City has given away 7,600 free water-saving devices (showerheads, faucet aerators, and pre-rinse spray valves for restaurants), provided rebates for or directly installed 4,500 low-flow toilets and urinals, provided rebates for 4,500 clothes washers and 400 sub-meters, conducted 2,300 home audits/irrigation surveys, and rebated 150 pieces of irrigation equipment and lawn conversions.
- Potable water use has decreased 15% from historical levels (FY 2013-2014 compared to the average "baseline" years of 1995-2004) due to the City's water conservation programs and various other factors.
- In 2009 the City completed installation of recycled water pipelines throughout the North Bayshore area, allowing customers to use recycled water for landscape irrigation and offsetting up to 270 million gallons of potable water annually, once conversion of eligible sites is completed.
- In 2010 the City adopted new "Water Conservation in Landscaping Regulations" for development projects, requiring the implementation of water-efficient practices.

Landscaping

Several sustainable landscape practices are utilized by the Parks & Open Space (Parks) and Forestry & Roadway Landscape (Forestry) divisions. The practices help to maintain healthy plants and turf, reduce waste shipped to landfill, and conserve water.

- **Grasscycling**: The Parks Division maintains 135 acres of turf. The turf crew utilizes a 16-foot span gang mower as well as mowers with 72, 48, 36 and 21-inch decks. All of these mowers are mulching mowers that return the cut grass to the turf. This practice has two benefits. The grass clippings returned to the turf break down over time releasing nutrients that are utilized by the turf. The practice helps to reduce the amount of fertilizer needed to keep the turf healthy. Returning grass clippings also reduces the amount of green waste generated and reduces transportation costs for that waste.
- **Compost Materials**: Using compost or mulch in planting beds, shrub beds and bare areas help add nutrients to soils as they decompose. Mulch adds to the aesthetic look of areas and helps suppress weed growth. All the mulch in Mountain View is provided by trimming operations of the tree crew. This practice is beneficial for the landscape and reduces green waste and the associated transportation costs for its disposal.
- **Central Irrigation Control System**: The Parks Division has an Internet-based irrigation control system utilized since 1993 for all park and roadway median operations. The system user downloads local evapotranspiration (ET) information on a weekly basis. Evapotranspiration is the total amount of water loss through evaporation and plant transpiration. The information is uploaded to 175 linked irrigation controllers. The controller program times are then automatically increased or decreased to replace only the water lost through ET. Use of the central irrigation control system has saved millions of gallons of water over the years. Staff also routinely troubleshoots the parks and

roadway median irrigation systems to look for irrigation breaks and adjust sprinkler heads to minimize water waste.

- **Pesticide Use Reduction Strategy**: Since 2003 the City has made a concerted effort to use fewer toxic pesticides and reduce the amount of pesticides used. Pesticides are classified as Category I through III, with Category I being the most toxic. The City has made a commitment to use only safe Category III pesticides. Herbicide use has been reduced by using mulch in planter beds, around tree wells and in large bare areas in medians. Utilizing biological controls for many insect pests has also reduced pesticide use.
- **Landscape Plant Palette**: The Parks Division is aware of the need for water-wise landscaping and has incorporated this into the choice of landscape plants for the last fifteen years. Plants are selected that will thrive in our environment and have reduced water needs once established.
- **Urban Canopy Cover**: In 2015, the City will adopt the Community Tree Master Plan. The plan discusses the environment value provided by trees for the community. Mountain View currently has canopy coverage of 17.7 %. This is similar to other peninsula communities. The plan will set a twenty year goal to increase Mountain View's canopy cover by 5% from 17.7% to 22.7%. Approximately 11,000 additional public and private trees will need to be planted over the next two decades to reach this goal.
- **Green Waste Recycling**: Mountain View separates all green waste from trash. Green waste is transported to the Sunnyvale SMaRT Station and turned into compost. The compost is sold and reused in the landscape. This also reduces the amount of material going to local landfills.

Habitat Restoration

The City has conducted the following activities in the Shoreline regional park.

- **Planting and Landscaping**: For all plantings outside of the golf course and Rengstorff House Gardens, our policy is to use California native plants that are drought tolerant and can tolerate a high salt content, as we only use non-potable water within Shoreline. We place a high emphasis on habitat plants that will provide ecological services and food and shelter resources for wildlife species. Planting islands (small groupings of native plants) are placed in strategic locations to provide prime habitat for wildlife species especially in grassland areas to create different ecological habitats.
- **Removal of Non-Native Invasive Plants**: Our first line of approach is mowing to prevent non-native invasive plants from going to seed to reduce weed infestations for the following year, especially for annual weeds. We also use some limited herbicides and hand removal depending on the plant species and its location within Shoreline with respect to protected animals.
- **Wildlife Habitat**: We actively leave some areas of grassland un-mowed to provide habitat for those species that prefer taller, stratified levels of vegetation. We also place rock and brush piles in strategic areas to provide micro-habitats for wildlife species especially prey species of burrowing owls and other raptors.

Appendix B

STATE AND FEDERAL POLICIES AND ACTIONS WITH EMISSION REDUCTION POTENTIAL USED WITHIN CPR ANALYSIS

Following are the State and Federal policies and actions used within the CPR analysis that will contribute to GHG emission reductions overall, and therefore assist the City of Mountain View's emission reduction efforts.

Renewable Portfolio Standard (RPS)

Renewable Portfolio Standards (RPS) requirements mandate that utilities incorporate renewable energy sources in their electricity generation so that by certain milestone years, a specified minimum percentage of energy generation comes from renewable, non-GHG-emitting sources. RPS-eligible energy sources include wind, solar, geothermal, biomass, and small-scale hydro-power. The following actions have established increasingly stringent RPS requirements for California utilities:

- **State Bill 1078 (SB 1078):** requires investor-owned utilities to provide at least 20 percent of their electricity from renewable resources by 2020.
- **Senate Bill 107 (SB 107):** accelerates the timeframe to take effect in 2010.
- **Executive Order S-14-08 (EO S-14-08):** increases the RPS further to 33% by 2020.
- **Senate Bill X1-2 (SB X1-2):** codifies the 33% requirement in State law in 2011.

Pacific Gas and Electric (PG&E), Mountain View's electricity provider, delivered 23.8% of its electricity from renewable sources in 2013.

Title 24 – Building Energy Efficiency Standards Updates

The 2013 updates to California's Building Energy Efficiency Standards improve upon the 2008 Standards for new construction of, and additions/alterations to, residential and non-residential buildings. The purpose of these standards is to ensure that building construction, and system design and installation achieve energy efficiency and preserve outdoor and indoor environmental quality. The 2013 Building Energy Efficiency Standards focus on several key areas to improve the energy efficiency of newly constructed buildings and additions and alterations to existing buildings, and include requirements that will enable both demand reductions during critical peak periods and future solar electric and thermal system installations. The most significant efficiency improvements to the residential standards are proposed for windows, envelope insulation, and HVAC system testing. The most significant efficiency improvements to the non-residential standards are proposed for lighting controls, windows, unitary HVAC equipment, and building commissioning.

Assembly Bill 1493

Assembly Bill 1493 (AB 1493, also known as the Pavley Standard), enacted in 2002, requires automakers to meet GHG emission reduction standards for new passenger cars, pickup trucks, and sport utility vehicles of model years 2009 to 2016. Manufacturers have flexibility in meeting these standards through a combination of reducing tailpipe emissions of carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4), and receiving credit for systems demonstrated to mitigate fugitive emissions of hydro-fluorocarbons from vehicle air conditioning systems. The second phase of AB 1493 (Pavley II) will require light-duty vehicles with model years 2017 to 2025 to control GHG emissions. Pavley II is now part of the Advanced Clean Cars Program, which aims to address reduction in other criteria pollutants as well.