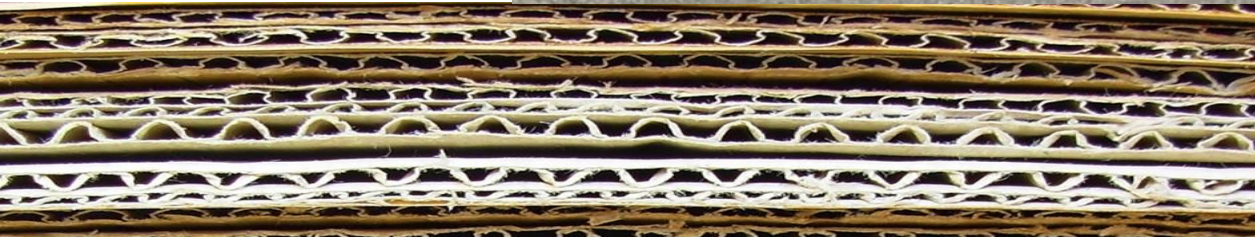




City of Madera

Climate Action Plan



Final
Adopted by City Council
September 2, 2015

CITY OF MADERA

CLIMATE ACTION PLAN

Final

Prepared for:

City of Madera
205 West 4th Street
Madera, California 93637

Submitted by:

Rincon Consultants, Inc.
1530 Monterey Street, Suite D
San Luis Obispo, California 93401



Adopted by City Council
September 2, 2015

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APPENDICES

Appendix A: City of Madera Community-wide Greenhouse Gas Emissions Inventory

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Appendix C: Technical Assumptions

Appendix D: Cost & Savings Analysis

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Acronyms

AB	Assembly Bill
CAFE	Corporate Average Fuel Economy
CAL FIRE	California Department of Forestry and Fire Protection
CALGreen	California Green Building Standards Code
Caltrans	California Department of Transportation
CAP	Climate Action Plan
CARB	California Air Resources Board
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CFL	Compact fluorescent light
CH ₄	Methane
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
CNG	Compressed natural gas
CREB	Clean renewable energy bonds
DOE	U.S. Department of Energy
EPA	Environmental Protection Agency
GHG	Greenhouse gas
HPS	High pressure sodium
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt hours
kW	Kilowatt
LED	Light-emitting diode
LEED	Leadership in Energy and Environmental Design
LEV	Low Emissions Vehicles
MCTC	Madera County Transportation Commission
MPG	Miles per gallon
MPO	Metropolitan planning organization
MT	Metric tons
PEV	Plug-in Electric Vehicle
PV	Photovoltaic
RTP	Regional Transportation Plan
SB	Senate Bill
SJVAPCD	San Joaquin Valley Air Pollution Control District
SCS	Sustainable Communities Strategy
TDA	Transportation Development Act
TDM	Transportation demand management
VMT	Vehicle miles traveled
QECB	Qualified energy conservation bonds
ZEV	Zero Emissions Vehicles



Executive Summary

The City of Madera Climate Action Plan (CAP) is a long-range plan to reduce greenhouse gas (GHG) emissions from City government (municipal) and community-wide activities within the City of Madera and prepare for the anticipated effects of climate change. Implementation of the measures will not only reduce GHG emissions, but also support local economic development and improve public health and quality of life. Specifically this CAP is designed to:

- Benchmark Madera's 2007 GHG emissions and 2020 and 2030 projected emissions.
- Establish GHG emissions targets for the years 2020 and 2030 to support California's larger effort to reduce statewide emissions under AB 32 and Executive Orders S-3-05 and B-30-15.
- Provide a roadmap for achieving the city's GHG emissions reduction targets.
- Fulfill City of Madera General Plan (2009) Action Item CON-36.2, which directs the City to prepare this CAP.
- Support the streamlining of the environmental review process for future projects within Madera in accordance with State California Environmental Quality Act (CEQA) Guidelines Sections 15152 and 15183.5.

Madera's GHG Emissions

The City of Madera Community-wide Greenhouse Gas Emissions Inventory (2014) (Community-wide Inventory) was prepared to identify the major sources and quantities of GHG emissions produced within the City of Madera's jurisdictional boundaries in 2007 and forecast how emissions may change over time. The Community-wide Inventory provides information on the scale of emissions from various sources and where the opportunities to reduce emissions lie. It also provides a baseline against which the city can measure its progress in reducing GHG emissions.

In 2007, the Madera community as a whole emitted approximately 324,690 metric tons of carbon dioxide equivalent GHG emissions (MT CO₂e) from the Residential Energy, Commercial/Industrial Energy,

Transportation & Mobile Sources, Solid Waste, Water, and Wastewater sectors. As shown in **Figure ES-1** and **Table ES-1**, the largest contributors of GHG emissions were the Transportation & Mobile Sources (58 percent), Residential Energy (20 percent), and Commercial/Industrial Energy (17 percent) sectors. The remainder of emissions resulted from the Solid Waste (4 percent), Water (one percent) and Wastewater (less than one percent) sectors.

FIGURE ES-1: COMMUNITY-WIDE GHG EMISSIONS BY SECTOR (2007)

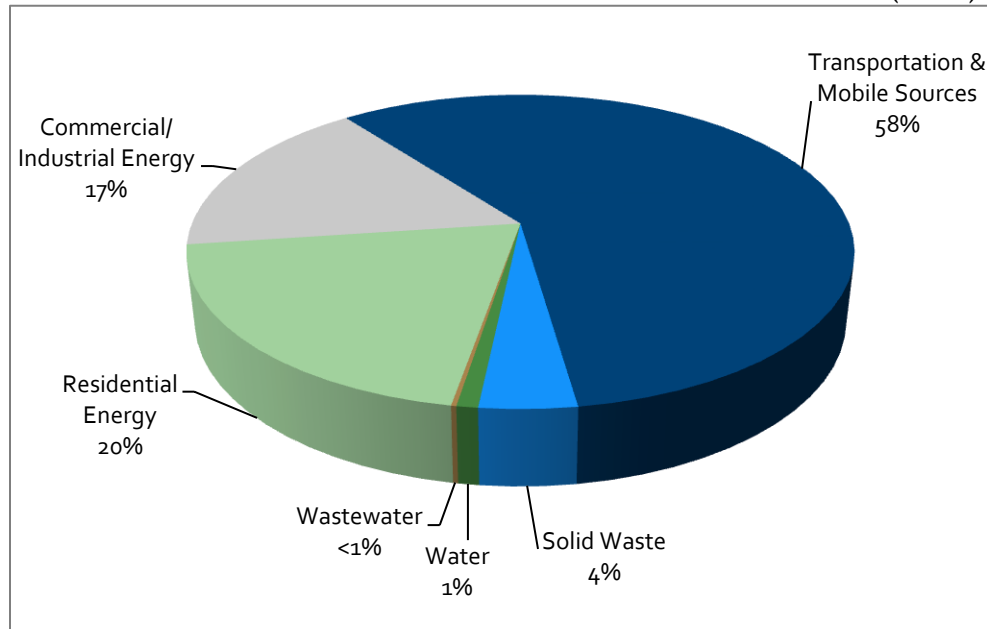


TABLE ES-1: COMMUNITY-WIDE GHG EMISSIONS BY SECTOR (2007)

Sector	Description	GHG Emissions (MT CO ₂ e)	Percent of Total
Residential Energy	Electricity and natural gas consumption in residential buildings	65,210	20%
Commercial/ Industrial Energy	Electricity and natural gas consumption in non-residential buildings	54,387	17%
Transportation & Mobile Sources	Vehicle miles travelled (VMT)* and fuel consumption in on-road vehicles and off-road equipment	188,585	58%
Solid Waste	Solid waste generated and sent to landfills	12,973	4%
Water	Electricity and natural gas used to convey and treat potable water	2,840	1%
Wastewater	Electricity used to convey and treat wastewater and wastewater treatment process emissions	695	<1%
Total		324,690	100%

* Includes VMT from vehicle trips generated by land uses within the city. As such, these trips have an origin and/or destination within the City of Madera, and pass-through trips are not included in this total. Refer to **Appendix A** for details.

The City of Madera also prepared a Government Operations GHG Inventory (2012) (Government Operations Inventory) to identify emissions resulting from facilities that the City owns and/or operates. The Government Operations Inventory is mostly a subset of the Community-wide Inventory, meaning that the majority of GHG emissions from the City's facilities and operations are included in the Community-wide Inventory. For example, electricity and natural gas used in the City's buildings is accounted for in the Commercial Energy sector of the Community-wide Inventory, while government-generated solid waste is accounted for in the community-wide Solid Waste sector. As such, per the U.S. Community Protocol (2012) and Government Operations Protocol (2010), the Government Operations Inventory should not be added to the community analysis; rather, it should be looked at as a portion of the total community-wide emissions.

In 2007, GHG emissions from the City of Madera's government operations totaled 8,464 MT CO₂e. As shown in **Figure ES-2** and **Table ES-2**, the majority of these emissions resulted from Water and Stormwater Services (35 percent), Buildings and Other Facilities (20 percent) and Vehicle Fleet (13 percent). Emissions from Employee Commutes (10 percent) and Wastewater Treatment (10 percent) were also a significant source of emissions. Emissions from Public Lighting (eight percent), Transit Fleet (three percent), Solid Waste (one percent) and Airport Facilities (less than one percent) accounted for the remainder of the City's emissions.

FIGURE ES-2: GOVERNMENT OPERATIONS GHG EMISSIONS BY SECTOR (2007)

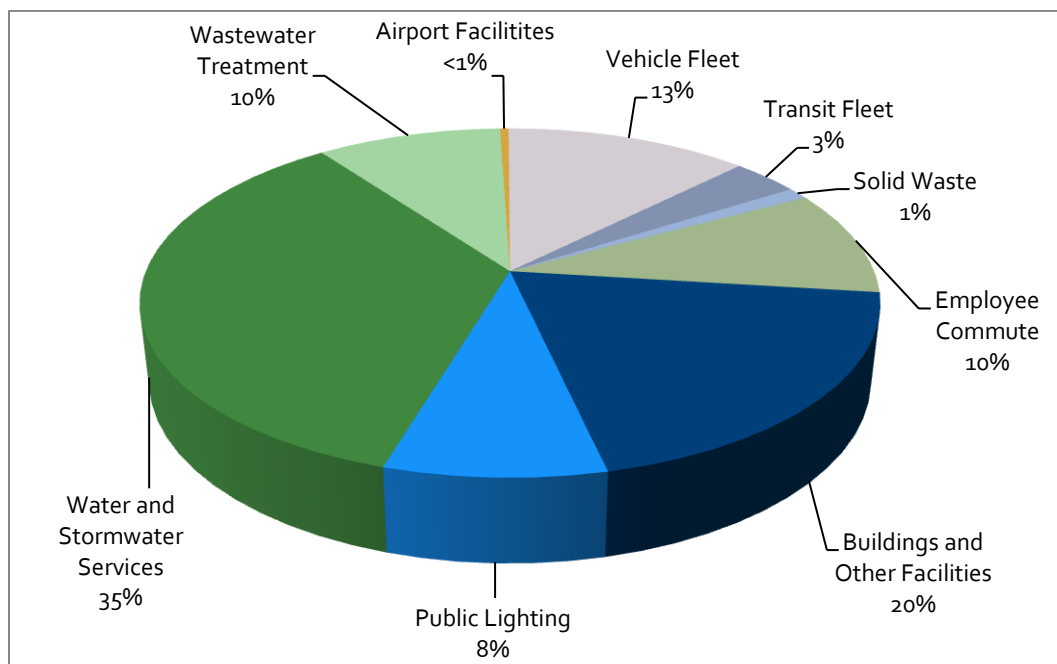


TABLE ES-2: GOVERNMENT OPERATIONS GHG EMISSIONS BY SECTOR (2007)

Sector	Description	GHG Emissions (MT CO ₂ e)	% of Total
Buildings and Other Facilities	Electricity, natural gas, propane, fuel oil, refrigerants, fire suppressants, and carbon dioxide used in City-owned or – operated buildings and facilities	1,651	20%
Public Lighting	Electricity used to power streetlights, traffic signal lights, and other outdoor public lighting	693	8%
Water and Stormwater Services	Electricity, natural gas, and propane used for the distribution or transport of water, including drinking water, sprinkler systems and irrigation	2,983	35%
Wastewater Treatment	Electricity used for wastewater transport; electricity, natural gas, and diesel used in the operation of the wastewater treatment facility; methane and nitrous oxide from wastewater treatment	813	10%
Airport Facilities	Electricity, natural gas, and diesel used in the operation of the City's airport facilities	37	<1%
Vehicle Fleet	Fuel consumption and mobile refrigerants for City fleet vehicles	1,072	13%
Transit Fleet	Fuel consumption and mobile refrigerants for City transit vehicles	294	3%
Solid Waste	Landfilled solid waste generated by City operations	93	1%
Employee Commute	Fuel consumption for City employee commutes	828	10%
Total		8,464	100%

The Community-wide Inventory report also includes a 2007 “business-as-usual” forecast to 2020 and 2030, estimating emissions that would occur if no new emissions reduction policies were implemented. The year 2020 was selected for the forecast in order to maintain consistency with California State AB 32.¹ The year 2030 was selected to maintain consistency with the City of Madera General Plan horizon year. Under a business-as-usual scenario, Madera’s community-wide emissions will grow by approximately 29 percent by 2020 and 58 percent by 2030.

¹ AB 32 establishes a GHG emission target for the State of California to reduce statewide emissions to 1990 levels by the year 2020.

FIGURE ES-3: COMMUNITY-WIDE BUSINESS-AS-USUAL GHG EMISSIONS FORECAST FOR 2020 AND 2030

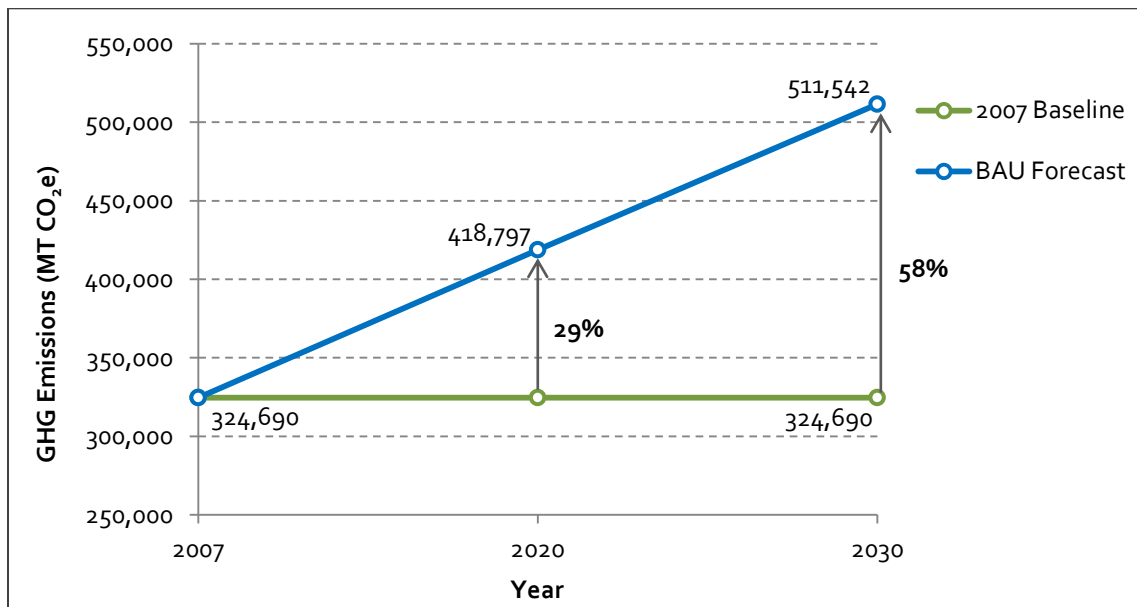


TABLE ES-3: COMMUNITY-WIDE BUSINESS-AS-USUAL GHG EMISSIONS FORECAST

Sector	2007 Emissions (MT CO ₂ e)	2020 Emissions (MT CO ₂ e)	2030 Emissions (MT CO ₂ e)
Residential Energy	65,210	85,042	102,855
Commercial/ Industrial Energy	54,387	79,891	98,230
Transportation & Mobile Sources	188,585	232,336	284,419
Solid Waste	12,973	16,918	20,462
Water	2,840	3,704	4,480
Wastewater	695	906	1,096
Total	324,690	418,797	511,542

Since 2007, a number of federal and state regulations been enacted that would reduce Madera’s GHG emissions in 2020 and 2030. The impact of these regulations was quantified and incorporated into an “adjusted forecast” to provide a more accurate picture of future emissions growth and the responsibility of the City and community once state regulations to reduce GHG emissions have been implemented.

Under the adjusted forecast scenario, GHG emissions are projected to decrease approximately 27 percent below the business-as-usual scenario by the year 2020 (from 418,797 MT CO₂e to 305,741 MT CO₂e), and approximately 32 percent below the business-as-usual scenario by the year 2030 (from 511,542 MT CO₂e to 348,428 MT CO₂e). **Table ES-4** summarizes the reduction in local GHG emissions that would result from State measures and presents the adjusted forecast totals for 2020 and 2030.

TABLE ES-4 SUMMARY OF STATE REDUCTIONS AND ADJUSTED FORECAST

State Measure	2020 Emissions (MT CO ₂ e)	2030 Emissions (MT CO ₂ e)
Business-as-Usual Forecast	418,797	511,542
Total Reduction from State Measures	-113,056	-163,114
Adjusted Forecast	305,741	348,428

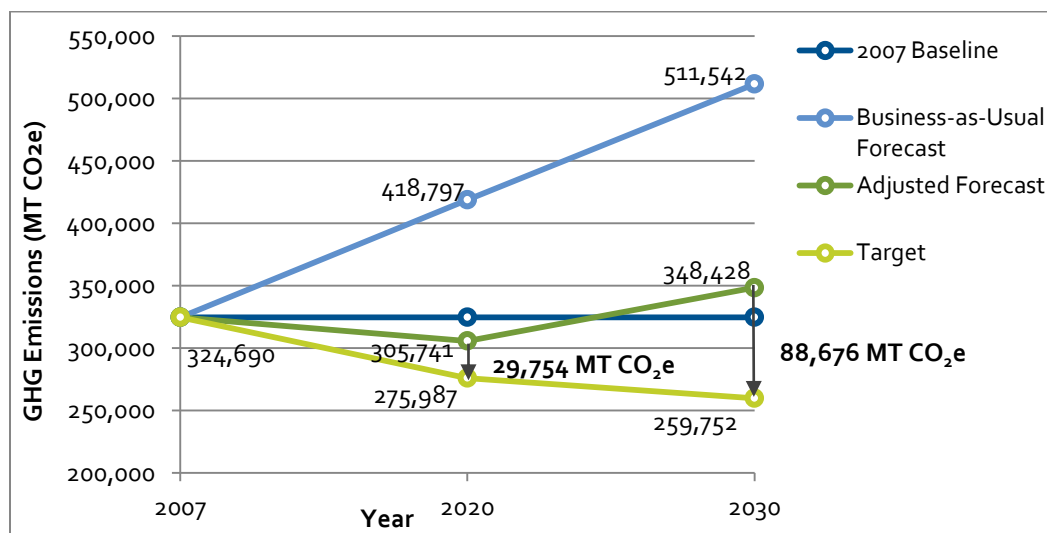
GHG Emissions Reduction Targets

This CAP establishes a reduction goal or target to achieve emissions levels 15 percent below 2007 levels by 2020 consistent with the AB 32 and General Plan Action Item CON-36.2. The CAP also establishes a longer-term target of 20 percent below 2007 levels by 2030 to support California's larger effort to reduce statewide emissions under Executive Orders S-3-05 and B-30-15. As shown in **Table ES-5** and **Figure ES-4**, Madera would need to reduce its GHG emissions by 29,754 MT CO₂e by 2020 and by 88,676 MT CO₂e by 2030 to meet these targets.

TABLE ES-5 MADERA'S GHG EMISSIONS, TARGETS, AND REDUCTION NECESSARY TO MEET TARGETS

	2020 Emissions (MT CO ₂ e)	2030 Emissions (MT CO ₂ e)
2007 Baseline Emissions	324,690	324,690
Adjusted Forecast	305,741	348,428
Targeted Future Emissions Level	275,987	259,752
Necessary Reduction from Adjusted Forecast to Meet Targets	29,754	88,676

FIGURE ES-4: MADERA'S GHG EMISSIONS, TARGETS, AND REDUCTIONS NECESSARY TO MEET TARGETS



GHG Reduction Measures

To achieve the GHG reduction targets of 15 percent below 2007 levels (275,987 MT CO₂e) by 2020 and 20 percent below 2007 levels (259,752 MT CO₂e) by 2030, the CAP identifies a comprehensive set of GHG reduction measures. These measures are organized into the following focus areas: Local Government, Energy, Transportation and Land Use, Solid Waste, Water and Wastewater, Urban Greening, and Adaptation. The measures were selected based on consideration of the emission reductions needed to achieve the targets, the distribution of emissions revealed in the GHG emissions inventory, goals and policies identified in City's 2009 General Plan Update, existing and ongoing efforts and priorities, and the potential costs and benefits of each measure. Collectively, the measures identified in the CAP have the potential to reduce GHG emissions within Madera by 33,601 MT CO₂e by 2020 and 92,341 MT CO₂e by 2030. This would bring 2020 emissions to 272,140 MT CO₂e (equivalent to 16 percent below 2007 levels) and 2030 emissions to 256,087 MT CO₂e (equivalent to 21 percent below 2007 levels), which meets and slightly exceeds the reductions necessary to meet the targets.

Implementation and Monitoring

Implementation and monitoring are essential processes to ensure that Madera reduces its GHG emissions and meets its targets. To facilitate this, each GHG reduction measure is identified along with implementation actions, cost and savings estimates, the GHG reduction potential (as applicable), performance indicators to monitor progress, and an implementation time frame. Measure implementation is separated into three phases: near-term (by 2017), mid-term (2018-2022), and long-term (2023-2030).

In order to ensure that measures are implemented and their progress is monitored, upon adoption of the CAP the City will establish a CAP Coordinator who will provide essential CAP oversight and coordination. This may include, as applicable, organization of a multi-departmental CAP Implementation Team comprised of key staff in selected departments, which will meet at least one time per year to assess the status of CAP efforts. The CAP Coordinator will be responsible for developing an annual progress report to the City Council that identifies the implementation status of each measure, evaluates achievement of or progress toward performance indicators (where applicable), and recommends adjustments to measures or actions, as needed. To evaluate the performance of the CAP as a whole, Madera will update the GHG emissions inventory every five years, using the most up-to-date calculation methods, data, and tools.



Chapter 1.0

Introduction

Although climate change is a global issue, the State of California recognizes that it poses risks to the public health, environment, economic well-being, and natural resources of California, and has adopted legislations and policies to address climate change. In 2005, the governor issued Executive Order S-3-05 to reduce statewide greenhouse gas (GHG) emissions to 1990 levels by 2020 (approximately 15 percent below 2005 to 2008 levels) and to 80 percent below 1990 levels by 2050. Enactment of several related pieces of climate action legislation followed. These include AB 32 (the Global Warming Solutions Act of 2006), which codified the 2020 target, and SB 97 (the California Environmental Quality Act (CEQA) and GHG Emissions bill of 2007), which requires lead agencies to analyze GHG emissions and mitigate climate change impacts under CEQA. In April 2015, the governor issued Executive Order B-30-15 to establish a statewide mid-term GHG reduction target of 40 percent below 1990 levels by 2030. These laws together create a framework for GHG emissions reductions and identify local governments as having a vital role in assisting the State in meeting its targets. The AB 32 Scoping Plan, prepared by the California Air Resources Board (CARB) pursuant to AB 32, notes that local governments have broad influence and, in some cases, exclusive authority over activities that result in GHG emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations. In recognition of the important role that local governments will play in the successful implementation of AB 32 and in reaching the State's long term target, the AB 32 Scoping Plan recommends that local governments adopt a 2020 GHG emission reduction target of 15 percent below 2005 to 2008 levels to match the statewide reduction target.

Recognizing the important role and responsibility that local governments have in reducing GHG emissions and increasing resiliency to anticipated changes in climate, the City of Madera General Plan (2009) directs the City to prepare this climate action plan (CAP). This chapter describes the purpose, scope, and content of the CAP, and discusses its relationship to the General Plan. In addition, this chapter summarizes the scientific and regulatory framework under which this plan has been developed.

1.1 Purpose and Scope

The CAP is a long-range plan that outlines a course of action to reduce GHG emissions from community-wide activities and City government operations in order to support the State's efforts under AB 32 and Executive Orders S-3-05 and B-30-15 and adapt to anticipated changes in climate.

In 2009, the City of Madera completed a comprehensive update to its General Plan, which includes a number of goals, policies, and implementation programs that will reduce GHG emissions from both City operations and the community as a whole. As described further in Section 1.4 below, General Plan Action Item 36.2 directs the City to develop and implement this plan to address GHG emissions and climate change within the City of Madera. This CAP fulfills the requirements of this action item. Specifically, the CAP does the following:

- Summarizes the results of the City of Madera Community-wide Greenhouse Gas Emissions Inventory (2014) (Community-wide Inventor) and City of Madera Government Operations Greenhouse Gas Emissions Inventory (2012) (Government Operations Inventory), which identify the major sources and quantities of GHG emissions produced within the City of Madera and forecasts how these emissions may change over time.
- Establishes GHG emission reduction targets of 15 percent below 2007 levels by the year 2020 and 20 percent below 2007 levels by 2030.
- Sets forth climate action measures, including performance objectives which, if implemented and met, would collectively achieve the City's GHG emission reduction targets.
- Identifies proactive strategies that can be implemented to help the City of Madera prepare for anticipated climate change impacts.
- Identifies steps to implement, monitor, and verify the effectiveness of the climate action measures and adapt efforts moving forward.

In addition to reducing the City of Madera's GHG emissions, implementation of the CAP will result in implementation of many of the General Plan policies and action items. The CAP may also be used to streamline the analysis of GHG emissions from future development projects in the City of Madera pursuant to State CEQA Guidelines sections 15152, 15183, and 15183.5 (refer to Section 1.5, Relationship to CEQA).

1.2 Content

The CAP is organized into the following chapters:

1.0 Introduction – describes the purpose, scope, and content of the CAP. It also discusses the relationship of the CAP to the General Plan and CEQA. In addition, this chapter summarizes the scientific and regulatory framework under which this plan has been developed.

2.0 GHG Emissions and Reduction Targets – identifies the sources of GHG emissions in the City of Madera, quantifies emissions for a baseline year (2007), and forecasts how GHG emission levels would change through 2030. This chapter also identifies and quantifies GHG emissions reduction targets for the years 2020 and 2030.

3.0 Climate Action Measures – identifies the climate action measures, which are organized into the following categories: Local Government, Energy, Transportation and Land Use, Water and Wastewater, Solid Waste, Urban Greening, and Adaptation. Each measure is presented with performance objectives, implementation actions, estimated GHG reductions in 2020 and 2030, and estimated costs and future savings.

4.0 Implementation and Monitoring – identifies steps to implement and monitor the climate action measures, evaluate the CAP’s overall performance, and update the plan over time as needed. It also identifies potential sources of funding to implement the CAP.

1.3 Background and Planning Process

Development of the CAP largely drew on the existing policies and implementation actions listed in the 2009 General Plan. City staff and its consultants worked with stakeholders from various community organizations to develop additional measures and implementation actions identified in the CAP. Nine stakeholders were identified and interviewed for their feedback on the draft climate action measures. City staff and its consultants also held one public workshop to gather public input on the draft climate action measures. In addition, there was a webpage on the City’s website dedicated to the CAP which provided a survey for participants to indicate their level of support for various climate action measures and provided a space for any additional comments and/or suggestions. Feedback received from stakeholder interviews, the public workshop, and the online survey was incorporated into the Draft CAP as appropriate.

1.4 Relationship to the General Plan

The Madera General Plan, adopted in 2009, is a broad framework for planning the future of the City of Madera. It expresses the community’s vision and provides the policy direction to guide private and public development in the city, as well as the City’s own operations and decisions. It contains goals, policies, and action items that provide the City with guidance for long-range planning. The Conservation Element includes Goal CON-12, to meet or exceed all current and future state-mandated targets for reducing emissions of GHGs, and Policy CON-36, which directs the City to support local, regional, and statewide efforts to reduce GHG emissions linked to climate change. To help achieve Goal CON-12, Action Item CON-36.1 directs the City to prepare an inventory of GHG emissions generated from municipal operations and the community-as-a-whole. This inventory was separated into two separate documents—one for municipal GHG emissions and one for community-wide GHG emissions—which are located in **Appendix A** and **B** of this CAP. Action Item CON-36.2 specifically calls for the development of a CAP as follows:

- **Action Item CON-36.2:** *Within six months of the completion of the Greenhouse Gas Inventory if possible (but not later than one year after completion of the Inventory), the City will, in collaboration with stakeholders and the community, prepare a Climate Action Plan (CAP) that incorporates and/or addresses the following criteria:*
 - *The CAP will identify goals for reducing manmade GHG emissions from the community, municipal and business activities.*
 - *The CAP will establish resiliency and adaptation programs to prepare for potential impacts of climate change, and provide a phased implementation plan to achieve these goals.*
 - *The CAP will establish a greenhouse gas emissions reduction target of 15 percent below 2007 levels by 2020, consistent with California Assembly Bill 32, the Global Warming Solutions Act of*

2006 (AB 32) and the guidance provided in the associated California Air Resources Board Climate Change Scoping Plan approved in December 2008.

- *The CAP will also outline a strategy to achieve 1990 GHG levels by 2020 and an 80 percent reduction from 1990 GHG levels by 2050 in accordance with California State Executive Order S-3-05.*

In addition to fulfilling General Plan Action Item CON-36.2, this CAP incorporates and/or builds on the numerous General Plan policies and action items that would reduce Madera's GHG emissions. These policies and action items are listed under each applicable CAP measure in Chapter 3.

1.5 Relationship to CEQA

According to the California Natural Resources Agency (2009) and the State's Office of the Attorney General (2009), GHG emissions may be best analyzed and mitigated at a programmatic level (i.e., GHG reduction plan/CAP). In 2009, the California Natural Resources Agency amended the State CEQA Guidelines to add a new provision, Section 15183.5, which allows jurisdictions to analyze and mitigate the significant effects of GHG emissions at a programmatic level by adopting a plan for the reduction of GHG emissions (i.e., a CAP). Section 15183.5 states a plan for the reduction of GHG emissions should:

- Quantify GHG emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area;
- Establish a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable;
- Identify and analyze the GHGs emissions resulting from sources in the community;
- Identify a suite of specific, enforceable measures that, collectively, will achieve the emissions target;
- Establish a mechanism to monitor the plan's progress and to require amendment if the plan is falling short; and
- Be adopted in a public process following environmental review.

This CAP incorporates these elements consistent with State CEQA Guidelines Section 15183.5, which allows it to be used in the cumulative GHG emissions impacts analysis of later projects. The environmental document for each project must identify those requirements specified in the CAP that apply to the project, and if those requirements are not otherwise binding or enforceable, should be incorporated as mitigation measures applicable to the project (CEQA 15183.5b). To facilitate this process for future projects Appendix E lists CAP measures applicable to new development. If it is determined that the proposed project is not consistent with the CAP, further analysis would be required and the applicant would be required to demonstrate that the proposed project would not substantially interfere with implementation of the CAP.

1.6 Scientific Background

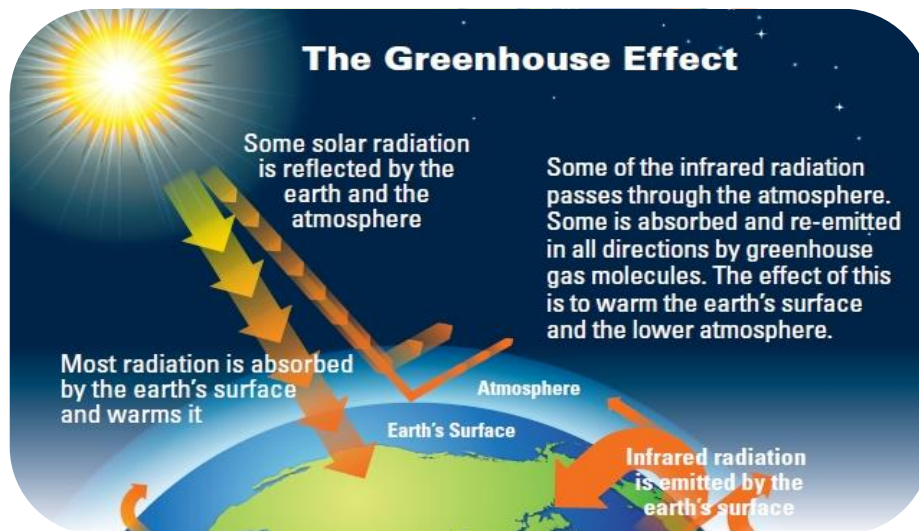
This section provides a brief overview of the scientific background under which this CAP was developed.

1.6.1 GHGs and Climate Change

Climate change refers to changes in the “average weather” or average climatic conditions that an area experiences over an extended period of time (typically decades or longer) and accounts for changes in temperature, wind patterns, precipitation, and storms.¹ Global climate change refers to a change in the climate of the Earth as a whole. Global warming, a related concept, is the observed increase in the average temperature of the Earth’s surface and atmosphere caused by increased GHG emissions, which can contribute to changes in global climate patterns.

Energy from the Sun drives the Earth’s weather and climate. The Earth absorbs energy from the Sun and also radiates energy back into space. A GHG is any gas (e.g., water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons, perfluorocarbons, and ozone) that absorbs this energy in the Earth’s atmosphere. This absorption traps heat within the atmosphere and warms the Earth, which is known as the “greenhouse effect” (refer to **Figure 1-1**).

FIGURE 1-1: THE GREENHOUSE EFFECT

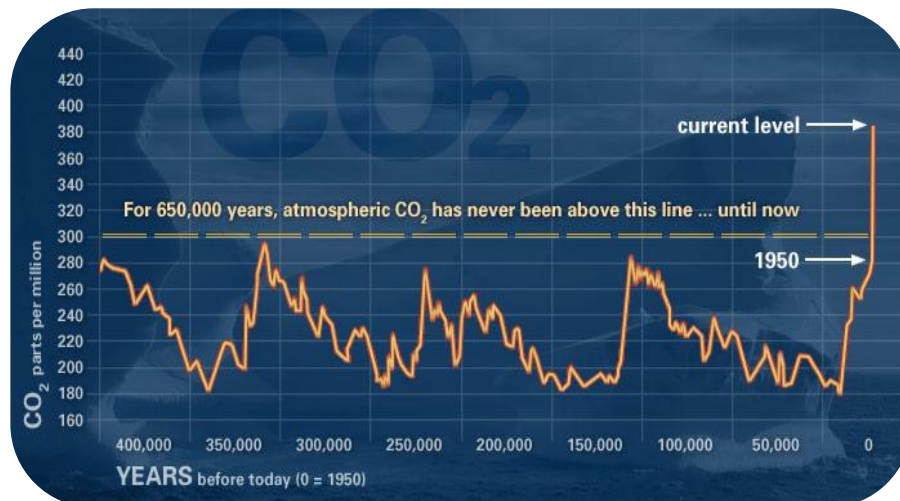


Source: National Oceanic & Atmospheric Administration (NOAA), 2009

GHGs are the result of both natural and anthropogenic activities. The consumption of fossil fuels for power generation and transportation, forest fires, decomposition of organic waste, and industrial processes are the primary sources of GHG emissions from human activities. Naturally, the Earth maintains an approximate long-term balance between the emission of GHGs into the atmosphere and its storage in oceans and terrestrial ecosystems. Following the industrial revolution, however, increased combustion of fossil fuels (e.g., gasoline, diesel, coal, etc.) and other industrial processes have contributed to a rapid increase in atmospheric levels of GHGs (refer to **Figure 1-2**) (NOAA, 2009).

¹ Weather is the short-term changes seen in temperature, clouds, precipitation, humidity, and wind in a region or a city. Climate is the “average weather” of an area measured over an extended period of time (typically decades or longer).

FIGURE 1-2: HISTORIC FLUCTUATIONS AND RECENT INCREASES IN ATMOSPHERIC CO₂



This graph, based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, provides evidence that atmospheric CO₂ has increased since the Industrial Revolution (National Aeronautics and Space Administration (NASA), 2011).

The principal GHGs that enter the atmosphere as a result of human activities are discussed below.

- **Carbon Dioxide (CO₂)** is released into the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., cement production) and deforestation. CO₂ is also removed from the atmosphere (or “sequestered”) when it is absorbed by plants as part of the biological carbon cycle.
- **Methane (CH₄)** is emitted during the production and transport of coal, natural gas, and oil. CH₄ emissions also result from agricultural practices, such as the raising of livestock, and by the decomposition of organic waste in landfills.
- **Nitrous oxide (N₂O)** is emitted during agricultural and industrial activities, as well as during the burning of fossil fuels and solid waste.
- **Fluorinated gases (i.e., hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (SF₆))** are synthetic GHGs that are emitted from a variety of industrial processes (e.g., aluminum production) and used in commercial, industrial, and consumer products (e.g., automobile air conditioners and refrigerants). These gases are typically emitted in smaller quantities, but because they are potent GHGs, they are sometimes referred to as “high intensity” or “high global warming potential” gases.

Each GHG differs in its ability to trap heat in the atmosphere, or in its intensity factor. For example, one pound of CH₄ has 21 times more heat capturing potential than one pound of CO₂. To simplify reporting and analysis of GHGs, GHG emissions are typically reported in terms of metric tons of CO₂ equivalent (MT CO₂e) units. When dealing with an array of emissions, the gases are converted to their CO₂ equivalents for comparison purposes. **Table 1-1** shows the intensity factor for the six most abundant GHGs.

TABLE 1-1: INTENSITY FACTOR OF GHGS

GHG	Global Warming Potential ¹ (compared to CO ₂)
Carbon Dioxide	1
Methane	21
Nitrous Oxide	310
Hydrofluorocarbons	140-11,700
Perfluorocarbons	6,500-9,200
Sulfur Hexafluoride	23,900

¹ Each of the GHGs listed above differs in its ability to absorb heat in the atmosphere, or in its intensity factor/global warming potential over a 100-year period. The values presented above are based on the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report and United Nations Framework Convention on Climate Change reporting guidelines (IPCC, 1996). Although the IPCC Fourth Assessment Report presents different estimates, the current inventory standard relies on the Second Assessment Report's intensity factors to comply with reporting standards and consistency with regional and national inventories (U.S. EPA, 2010).

1.6.2 Climate Change Impacts

Increases in the globally averaged atmospheric concentration of GHGs will cause the lower atmosphere to warm, in turn inducing a myriad of changes to the global climate system. These large-scale changes will have unique and potentially severe impacts in the western United States, California, and Madera County. Current research efforts coordinated through CARB, California Energy Commission, California Environmental Protection Agency (EPA), University of California system, and other entities are examining the specific changes to California's climate that will occur as the Earth's surface warms.

In 2009, California adopted a statewide Climate Adaptation Strategy that summarizes climate change impacts and recommends adaptation strategies across seven sectors: Public Health, Biodiversity and Habitat, Oceans and Coastal Resources, Water, Agriculture, Forestry, and Transportation and Energy. The 2009 Climate Adaptation Strategy was the first of its kind in the use of downscaled climate models to more accurately assess statewide climate impacts as a basis for providing guidance for establishing actions that prepare, prevent, and respond to the anticipated effects of climate change. As discussed throughout the document, rising temperatures affect local and global climate patterns, and these changes are forecasted to manifest themselves in a number of ways, including:

- **Heat Waves** – more frequent, longer, and more-extreme heat waves, thereby increasing energy demand and bringing about public health threats in the process;
- **Air Quality** – increased production of air pollutants, especially ozone, due to higher air temperatures, which can exacerbate respiratory and cardiovascular diseases;
- **Wildfires** – increased wildfire frequency, intensity, and duration, thereby threatening public health and plant and animal species;
- **Water Supply** – decreased water supply, more frequent drought conditions, and increased demand with implications for the community and environment;
- **Infectious Disease** – increase risk of contracting infectious diseases from mosquitoes, ticks, and rodents, such as West Nile Virus and Hantavirus;

- **Biodiversity and Habitats** – loss of plant and animal species, and their habitats ;
- **Agriculture** – decreased production from crops sensitive to temperature increases and decreased water supply, and increase in various pests; and
- **Energy Supply** – more frequent power outages due to increased electricity demand (California Natural Resources Agency, 2009).

1.7 Regulatory Setting

This section summarizes the federal, state, and regional legislation, regulations, policies, and plans that have guided the preparation and development of this CAP.

1.7.1 Federal

Clean Air Act. The U.S. EPA is the federal agency responsible for implementing the Clean Air Act. The U.S. Supreme Court ruled in its decision in *Massachusetts et al. v. U.S. EPA et al.*, issued on April 2, 2007, that CO₂ is an air pollutant as defined under the Clean Air Act and that the U.S. EPA has the authority to regulate emissions of GHGs as pollutants. In 2011, the U.S. EPA began regulating GHG emissions from new power plants and refineries through a set of New Source Performance Standards. These regulations are found in 40 Code of Federal Regulations (CFR) Part 60 and apply to new, modified and reconstructed affected facilities in specific source categories such as manufacturers of glass, cement, rubber tires and wool fiberglass.

Energy Independence and Security Act. The Energy Independence and Security Act of 2007 includes several provisions that will increase energy efficiency and the availability of renewable energy, which in turn will reduce GHG emissions. First, the Act sets a Renewable Fuel Standard that requires fuel producers to use at least 36 billion gallons of biofuel by 2022. Second, it increased Corporate Average Fuel Economy (CAFE) Standards to require a minimum average fuel economy of 35 miles per gallon (mpg) for the combined fleet of cars and light trucks by 2020. Third, it includes a variety of new standards for lighting and for residential and commercial appliance equipment, including residential refrigerators, freezers, refrigerator-freezers, metal halide lamps, and commercial walk-in coolers and freezers.

1.7.2 State of California

The State of California has been proactive in working to reduce emissions and has a long history of addressing energy and climate issues. In 1988, AB 4420 (Sher, Chapter 1506, Statutes of 1988) designated the California Energy Commission as the lead agency for climate change issues in California. Since that time, numerous initiatives in California have addressed climate change and energy efficiency, the majority of legislation passed since 2000. These initiatives have strengthened the ability of entities in California to engage in accurate data collection and have created targets and regulations that will directly lead to reductions in GHG emissions. These initiatives are described below.

Executive Order S-3-05. Executive Order S-3-05, issued in 2005, was the first state action to address climate change. It established ambitious GHG reduction targets for the State: reduce GHG emissions to 2000 levels by 2010, to 1990 levels by 2020 and to 80 percent below 1990 levels by 2050. Executive Order S-3-05 is important for two reasons. First, it obligates State agencies to implement GHG emission reduction strategies. Second, the signing of the Executive Order sent a signal to the Legislature about the framework and content for legislation to reduce GHG emissions as a necessary step toward climate stabilization.

Executive Order B-30-15. On April 29, 2015, Governor Brown issued an executive order to establish a statewide mid-term GHG reduction target of 40 percent below 1990 levels by 2030. According to CARB, reducing GHG emissions by 40 percent below 1990 levels in 2030 ensures that California will continue its efforts to reduce carbon pollution and help to achieve federal health-based air quality standards. Setting clear targets beyond 2020 also provides market certainty to foster investment and growth in a wide array of industries throughout the State, including clean technology and clean energy (CARB, 2015).

Assembly Bill 32 (California Global Warming Solutions Act of 2006). AB 32 codified the State's 2020 GHG emissions target and directed CARB to develop a policy plan to reduce California's statewide emissions to 1990 levels by 2020. The resulting AB 32 Scoping Plan was adopted by CARB in December 2008. Key elements of the plan for achieving the 2020 target include:

- Adopting and implementing measures pursuant to existing state laws and policies, including California's goods movement measures and the Low Carbon Fuel Standard
- Expanding energy efficiency programs and green building practices
- Reducing methane emissions at landfills
- Developing a California cap-and-trade program
- Establishing and seeking to achieve reduction targets for transportation-related GHG emissions
- Increasing waste diversion, composting, and commercial recycling toward zero-waste
- Strengthening water efficiency programs
- Preserving forests that sequester carbon dioxide

Although the AB 32 Scoping Plan does not identify specific reductions for local governments, it identifies overall reductions from local government operations and land use decisions as a strategy to meet the 2020 target. The AB 32 Scoping Plan states that land use planning and urban growth decisions will play an important role in the State's GHG reductions because local governments have primary authority to plan, zone, approve, and permit how land is developed to accommodate population growth and the changing needs of their jurisdictions. It further acknowledges that decisions on how land is used will have large impacts on the GHG emissions that will result from the transportation, housing, industry, forestry, water, agriculture, electricity, and natural gas emission sectors. However, the AB 32 Scoping Plan stopped short of identifying mandatory targets for local government compliance. Instead, it encourages local governments to adopt a target for City government and community-wide emissions that parallels the State's AB 32 target and reduces emissions by approximately 15 percent below "current" levels by 2020.²

In 2014, CARB published The First Update to the Climate Change Scoping Plan (2014). The update defines CARB's climate change priorities, sets the groundwork to reach post-2020 goals set forth in Executive Order S-3-05 and highlights California's progress toward meeting the "near-term" 2020 GHG emission reduction goals defined in the original Scoping Plan (2008). It also evaluates how to align the state's longer-term GHG reduction strategies with other state policy priorities, such as for water, waste, natural resources, clean energy, transportation, and land use. AB 32 requires CARB to convene an Environmental Justice Advisory Committee

² "Current" as it pertains to the AB 32 Scoping Plan is commonly understood as sometime between 2005 and 2008.

to advise it in developing the Scoping Plan and any other pertinent matters in implementing AB 32 (Health and Safety Code section 38591). The Committee's final recommendations for the Update included a call for a 2030 target of, at a minimum, 40 percent reduction from 1990 levels and a 2040 target, of at a minimum, 60 percent reduction from 1990 levels. Despite this recommendation, official statewide mid-term targets were not established as part of the Update. CARB is currently working to update the Scoping Plan to incorporate the recently issued 2030 target established by Executive Order B-30-15. The updated Scoping Plan will provide a framework for achieving the 2030 target and is expected to be completed and adopted by CARB in 2016 (CARB, 2015).

Senate Bill 97. SB 97 (2007) established that GHG emissions and the effects of GHG emissions are appropriate subjects for CEQA analysis and required the Governor's Office of Planning and Research to revise the State CEQA Guidelines to include guidance for the analysis of GHG impacts under CEQA. The guidelines were adopted on December 31, 2009.

Assembly Bill 1493 (Pavley Regulations). AB 1493 (referred to as Pavley I) (2002) directed CARB to develop and adopt standards for vehicle manufacturers to reduce GHG emissions coming from passenger vehicles and light-duty trucks at a "maximum feasible and cost effective reduction" by January 1, 2005. Pavley I took effect for model years starting in 2009 to 2016 and Pavley II will cover 2017 to 2025. Fleet average emission standards would reach a 22 percent reduction by 2012 and 30 percent by 2016.

Executive Order S-1-07 (Low Carbon Fuel Standard). This 2007 order requires fuel providers to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020.

Senate Bill 375. SB 375 (2008) supports implementation of AB 32 by aligning regional transportation planning efforts with land use and housing allocations in order to reduce transportation-related GHG emissions. Specifically, SB 375 directed CARB to set regional GHG emissions targets for passenger vehicles and light trucks for the years 2020 and 2035 for each Metropolitan Planning Organization (MPO) region, which were adopted in February 2011. For Madera County Transportation Commission (MCTC), CARB issued a five percent per capita reduction target from 2005 levels by 2020 and a 10 percent per capita reduction target by 2035 (CARB, 2011). These targets apply to the MCTC region as a whole, and not to individual cities or sub-regions. In 2005, GHG emissions from passenger vehicles in the MCTC region were approximately 19.8 pounds CO₂e per capita. Therefore, MCTC must reduce emissions to at least 18.8 pounds CO₂e per capita by 2020 and to 17.8 pounds CO₂e per capita by 2035 to meet the targets (CARB, 2010). MCTC completed the 2014 Regional Transportation Plan and Sustainable Communities Strategy (RTP-SCS) in July 2014. The 2014 RTP-SCS was unable to demonstrate compliance with MCTC's SB 375 targets. As such, MCTC plans to prepare an alternative planning strategy in consultation with CARB that reflects strategies that would meet the targets.

Senate Bill 1078, Senate Bill 107, and Senate Bill 2X (Renewables Portfolio Standard). Established in 2002 under SB 1078, and accelerated in 2006 under SB 107, California's Renewables Portfolio Standard required investor-owned utilities, electric service providers, and community choice aggregators to increase procurement from eligible renewable energy resources by at least one percent of their retail sales annually, until they achieved 20 percent by 2010. SB 2X raises the target from the current 20 percent, requiring private and public utilities to obtain 33 percent of their electricity from renewable energy sources by 2020.

Assembly Bill 811. AB 811 (2008) authorizes California cities and counties to designate districts within which willing property owners may enter into contractual assessments to finance the installation of renewable energy generation and energy efficiency improvements that are permanently fixed to the property. These financing arrangements would allow property owners to finance renewable energy generation and energy efficiency improvements through low-interest loans that would be repaid as an item on the property owner's property tax bill.

California Green Building Code. The California Green Building Code (2008) (CALGreen) is the statewide green building code, which was developed to provide a consistent approach for green building within California. It lays out minimum requirements for newly constructed buildings in California, which will reduce GHG emissions through improved efficiency and process improvements. It requires builders to install plumbing that cuts indoor water use by as much as 20 percent, divert 50 percent of construction waste from landfills to recycling, and use low-pollutant paints, carpets, and floors.

California Code of Regulations Title 24, Part 6. Although it was not originally intended specifically to reduce GHG emissions, California Code of Regulations Title 24, Part 6: California's Energy Efficiency Standards for Residential and Nonresidential Buildings, was first adopted in 1978 in response to a legislative mandate to reduce California's energy consumption, which in turn reduces fossil fuel consumption and associated GHG emissions. The standards are updated periodically to allow consideration and possible incorporation of new energy-efficient technologies and methods. The California Energy Commission estimates that the 2008 standards reduce consumption by 10 percent for residential buildings and 5 percent for commercial buildings, relative to the previous standards. For projects implemented after January 1, 2014, the California Energy Commission estimates that the 2013 Title 24 energy efficiency standards will reduce consumption by 25 percent for residential buildings and 30 percent for commercial buildings, relative to the 2008 standards. These percentage savings relate to heating, cooling, lighting, and water heating only and do not include other appliances, outdoor lighting that is not attached to buildings, plug loads, or other energy uses.

Assembly Bill 341. AB 341 (2011) establishes a new policy goal of the State of California to divert at least 75 percent of solid waste generated by the year 2020 in an effort to reduce GHG emissions. It also provides for mandatory commercial and multi-family residential recycling, and requires cities and counties to add a commercial and multi-family residential recycling element to their existing resource reduction plans.

1.7.3 Regional

SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DISTRICT (SJVAPCD)

The SJVAPCD has primary responsibility for the development and implementation of rules and regulations designed to attain the National Ambient Air Quality Standards and California



San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

Ambient Air Quality Standards, as well as the permitting of new or modified sources, development of air quality management plans, and adoption and enforcement of air pollution regulations within Madera County, which is located within the San Joaquin Valley Air Basin. The SJVAPCD regulates most air pollutant sources, except for mobile sources, which are regulated by the CARB or the California EPA. State and local government projects, as well as projects proposed by the private sector, are subject to SJVAPCD requirements if the sources are regulated by the SJVAPCD.

The AB 32 Scoping Plan does not provide an explicit role for local air districts in implementing AB 32, but states that the CARB will work actively with air districts in coordinating emissions reporting, encouraging and coordinating GHG reductions, and providing technical assistance in quantifying reductions. The ability of air districts to control emissions (both criteria pollutants and GHGs) is provided primarily through permitting as well as through their role as CEQA lead or commenting agency, the establishment of CEQA thresholds or guidance documents, and the development of analytical requirements for CEQA documents where SJVAPCD serves as lead agency for CEQA purposes. In December 2009, the SJVAPCD adopted a district policy document titled Addressing GHG Emission Impacts for Stationary Source Projects Under CEQA When Serving as the Lead Agency. It applies to projects for which the SJVAPCD has discretionary approval authority over the project and serves as the lead agency. The policy establishes the process used by SJVAPCD staff to evaluate the significance of project specific GHG emissions impacts for CEQA purposes. Based on the SJVAPCD policy, a project's GHG-related impact is considered to be less than significant pursuant to CEQA if it complies with an adopted statewide, regional, or local plan for reduction or mitigation of GHG emissions, complies with SJVAPCD approved Best Performance Standards, or achieves AB 32 targeted GHG emissions reductions (29 percent) compared to the business-as-usual scenario (SJVAPCD, 2009).

MADERA COUNTY TRANSPORTATION COMMISSION (MCTC)

MCTC is the Regional Transportation Planning Agency and the designated MPO. MCTC's efforts address regional issues relating to transportation, land use and urban form, housing, environment, economic development, regional public facilities, and climate change. Plans and programs that MCTC has adopted or participates in that support GHG emissions reductions in Madera County are described below.

2014 Regional Transportation Plan and Sustainable Communities Strategy (RTP-SCS). The RTP is a long-range transportation plan providing a vision for regional transportation investments over at least a 20-year period. Using growth forecasts and socioeconomic trends, the RTP considers the role of transportation including economic factors, quality of life issues, and environmental factors. The RTP provides an opportunity to identify transportation strategies today that address our mobility needs for the future. The RTP is updated every four years to reflect changes in economic trends, state and federal project and funding requirements, progress made toward project implementation, and current socioeconomic trends. Transportation projects must be included in the RTP in order to qualify for federal and state funding.

The SCS is a new element of the RTP that demonstrates the integration of land use, transportation strategies, and transportation investments within the RTP. This new requirement was put in place by the passage of SB 375, with the goal of ensuring that the MCTC region can meet its regional GHG reduction targets set by the CARB. The 2014 RTP-SCS was adopted by MCTC's Policy Board in July 2014. As discussed in Section 1.7.2 above, the 2014 RTP-SCS was unable to demonstrate compliance with MCTC's SB 375 targets. As such, MCTC plans to prepare an alternative planning strategy in consultation with CARB that reflects strategies that would meet the targets.

San Joaquin Valley Blueprint. MCTC works with the seven Regional Transportation Agencies of the additional counties within the San Joaquin Valley to implement the San Joaquin Valley Blueprint planning process. The San Joaquin Valley Blueprint planning process is a unique opportunity to work together to convey a regional vision of land use and transportation that will be used to guide growth in the San Joaquin

Valley over the next 50 years. Through its public outreach and education component and technical data for local decision makers, the Blueprint provides a tangible opportunity to ensure the San Joaquin Valley remains a desirable place to live.

San Joaquin Valley Greenprint. The San Joaquin Valley Greenprint is a voluntary, stakeholder-driven project that provides agricultural, water, and environmental leaders with improved planning data and fosters regional collaboration on strategies that prioritize resource sustainability while enhancing economic prosperity. It focuses on the challenges and opportunities in non-urban land use planning, and how those rural decisions shape the region's economy and environment.

1.7.4 Local Government Rules and Responsibilities

The AB 32 Scoping Plan establishes a framework for achieving statewide GHG reductions required by AB 32. Specifically, it describes a list of measures that the State will undertake, and the anticipated GHG reductions associated with these measures by 2020. Because the State does not have jurisdictional control over all of the activities that produce GHG emissions in California, the AB 32 Scoping Plan articulates a unique role for local governments by identifying them as essential partners in achieving the State's GHG reduction goals. The AB 32 Scoping Plan states that local governments "have broad influence and, in some cases, exclusive authority over activities that contribute to significant direct and indirect GHG emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations". In addition, many of the plan's proposed measures to reduce GHG emissions rely on local government actions. Based on this role, the AB 32 Scoping Plan recommends that local governments reduce GHG emissions from both their municipal operations and community at large by 15 percent from baseline levels by 2020 to parallel the State's target.



Chapter 2.0

GHG Emissions and Reduction Targets

A GHG emissions inventory identifies the major sources and quantities of GHG emissions produced by community-wide and local government activities within a jurisdiction's boundaries for a given year. Estimating GHG emissions enables local governments to establish an emissions baseline, track emissions trends, identify the greatest sources of GHG emissions within their jurisdiction, set targets for future reductions, and create an informed mitigation strategy based on this information. This chapter summarizes the results of the City of Madera Community-wide and Government Operations GHG Emissions Inventories (refer to **Appendix A** and **B** for the complete reports). The documents include inventories of 2007 baseline GHG emissions resulting from local government facilities and operations and community-wide activities within the City of Madera. This chapter also presents the 2020 and 2030 business-as-usual forecast of how emissions in Madera would change if no further actions are implemented to reduce those emissions, and a 2020 and 2030 adjusted forecast to account for the impact of several State regulations that have been established since the 2007 baseline year that will reduce local emissions. In addition, this chapter identifies the City of Madera's GHG emissions reduction targets for the years 2020 and 2030.

2.1 2007 Baseline GHG Emissions

This section describes the methodologies used to complete the 2007 baseline inventory of GHG emissions from government operations and community-wide activities, and summarizes the results.

2.1.1 Methodology

The baseline inventories quantified the GHG emissions resulting from activities and sources within the City of Madera in the 2007 calendar year. The Community-Wide Inventory is divided into six sectors, or sources of emissions: Residential Energy, Commercial/Industrial Energy, Transportation & Mobile Sources, Solid Waste, Water, and Wastewater. The Government Operations Inventory provides a more detailed analysis of emissions resulting from City-owned or –operated buildings, airport facilities, lighting, fleet and transit vehicles; water and stormwater services, wastewater treatment; City-generated solid waste; and employee

commute travel. The Government Operations Inventory is mostly a subset of the Community-wide Inventory, meaning that the majority of GHG emissions from the City's facilities and operations are included in the Community-wide Inventory. For example, electricity and natural gas used in the City's buildings is accounted for in the Commercial Energy Sector of the Community-wide Inventory, while government-generated solid waste is accounted for in the community-wide Solid Waste sector. As such, per the U.S. Community Protocol (2012) and Local Government Operations Protocol (2010), the Government Operations Inventory should not be added to the community analysis; rather, it should be looked at as a portion of the total community-wide emissions.

The Government Operations Inventory followed the Local Government Operations Protocol (version 1.1), which was adopted in 2010 by CARB and serves as the national standard for quantifying and reporting GHG emissions from local government operations. The Community-wide Inventory followed the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (2012). These protocols provide standard accounting principles, boundaries, quantification methods, and procedures for reporting GHG emissions. Like all emissions inventories, the inventory must rely on the best-available data and calculation methodologies, and, therefore, represents a best estimate of GHG emissions following standard protocol. As protocols are updated and better data and calculation methodologies become available, the inventory can be updated and improved. Nevertheless, the findings of this analysis provide a solid basis upon which Madera can begin planning and taking action to reduce its GHG emissions.

2.1.2 Government Operations Emissions

In 2007, GHG emissions from the City of Madera's government operations totaled 8,464 MT CO₂e. As shown in **Figure 2-1** and **Table 2-1**, the majority of these emissions resulted from Water and Stormwater Services (35 percent), Buildings and Other Facilities (20 percent) and Vehicle Fleet (13 percent). Emissions from Employee Commutes (10 percent) and Wastewater Treatment (10 percent) were also a significant source of emissions. Emissions from Public Lighting (eight percent), Transit Fleet (three percent), Solid Waste (one percent) and Airport Facilities (less than one percent) accounted for the remainder of the City's emissions.

FIGURE 2-1: GOVERNMENT OPERATIONS GHG EMISSIONS BY SECTOR (2007)

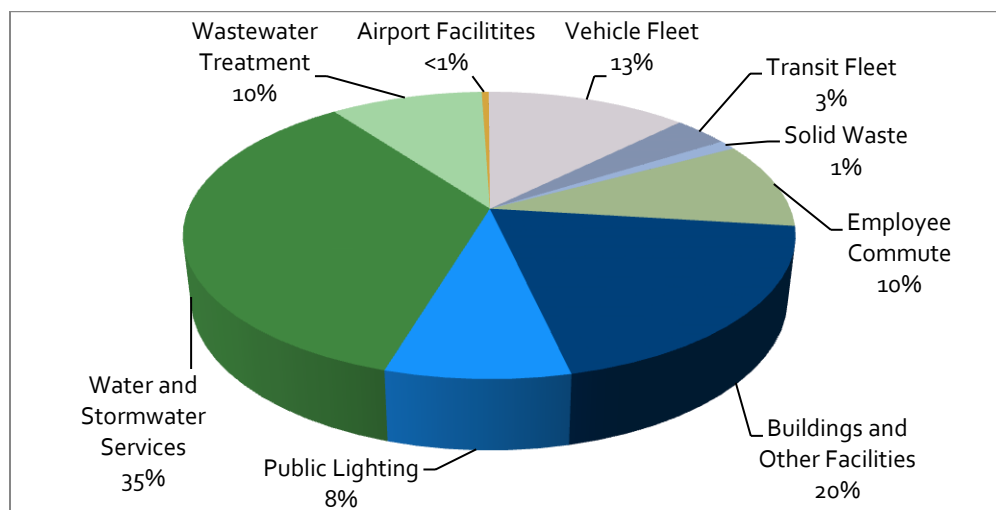


TABLE 2-1: GOVERNMENT OPERATIONS GHG EMISSIONS BY SECTOR (2007)

Sector	Description	GHG Emissions (MT CO ₂ e)	Percent of Total
Buildings and Other Facilities	Electricity, natural gas, propane, fuel oil, refrigerants, fire suppressants, and carbon dioxide used in City-owned or –operated buildings and facilities	1,651	20%
Public Lighting	Electricity used to power streetlights, traffic signal lights, and other outdoor public lighting	693	8%
Water and Stormwater Services	Electricity, natural gas, and propane used for the distribution or transport of water, including drinking water, sprinkler systems and irrigation	2,983	35%
Wastewater Treatment	Electricity used for wastewater transport; electricity, natural gas, and diesel used in the operation of the wastewater treatment facility; methane and nitrous oxide from wastewater treatment	813	10%
Airport Facilities	Electricity, natural gas, and diesel used in the operation of the City's airport facilities	37	<1%
Vehicle Fleet	Fuel consumption and mobile refrigerants for City fleet vehicles	1,072	13%
Transit Fleet	Fuel consumption and mobile refrigerants for City transit vehicles	294	3%
Solid Waste	Landfilled solid waste generated by City operations	93	1%
Employee Commute	Fuel consumption for City employee commutes	828	10%
Total		8,464	100%

2.1.3 Community-wide Emissions

In 2007, the Madera community as a whole emitted approximately 324,690 MT CO₂e from the Residential Energy, Commercial/Industrial Energy, Transportation & Mobile Sources, Solid Waste, Water, and Wastewater sectors. As shown in **Figure 2-2** and **Table 2-2**, the Transportation & Mobile Sources sector was the largest source of emissions, generating approximately 188,585 MT CO₂e, or 58 percent of total emissions in 2007. Transportation & Mobile Sources sector GHG emissions are the result of fuel combustion in on-road vehicles, which accounted for 86 percent (or 162,670 MT CO₂e) of the Transportation & Mobile Sources sector emissions, and off-road equipment, which accounted for 14 percent (or 25,915 MT CO₂e) of the Transportation & Mobile Sources sector emissions. The Residential Energy sector was the second largest source of 2007 emissions, generating 65,210 MT CO₂e, or 20 percent of total community-wide emissions, as a result of electricity and natural gas consumed in residential buildings. Madera's Commercial/Industrial Energy sector produced 54,387 MT CO₂e, or 17 percent of total community-wide emissions, as a result of electricity and natural gas consumption in non-residential buildings. The Solid Waste sector resulted in 12,973 MT CO₂e, or four percent of total GHG emissions, as a result of landfilled solid waste generated by the

community. The remainder of GHG emissions resulted from the Water sector (2,840 MT CO₂e or one percent) and Wastewater sector (695 MT CO₂e or less than one percent).

FIGURE 2-2: COMMUNITY-WIDE GHG EMISSIONS BY SECTOR (2007)

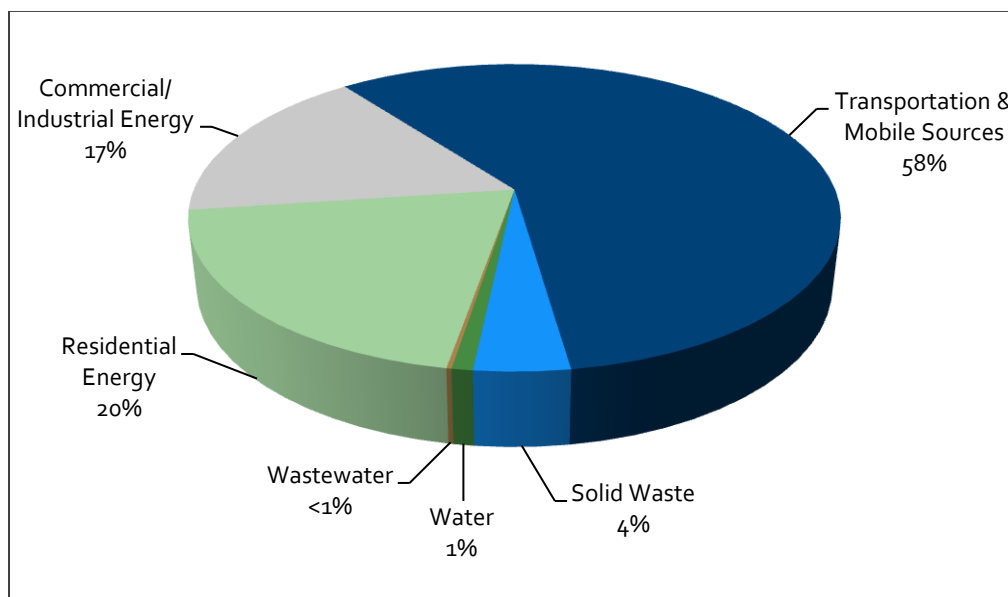


TABLE 2-2 COMMUNITY-WIDE GHG EMISSIONS BY SECTOR (2007)

Sector		GHG Emissions (MT CO ₂ e)	Percent of Total
Residential Energy	Electricity and natural gas consumption in residential buildings	65,210	20%
Commercial/ Industrial Energy	Electricity and natural gas consumption in non-residential buildings	54,387	17%
Transportation & Mobile Sources	Vehicle miles travelled (VMT)* and fuel consumption in on-road vehicles and off-road equipment	188,585	58%
Solid Waste	Solid waste generated and sent to landfills	12,973	4%
Water	Electricity and natural gas used to convey and treat potable water	2,840	1%
Wastewater	Electricity used to convey and treat wastewater and wastewater treatment process emissions	695	<1%
Total		324,690	100.0%

* Includes VMT from vehicle trips generated by land uses within the city. As such, these trips have an origin and/or destination within the City of Madera, and pass-through trips are not included in this total. Refer to **Appendix A** for details.

2.2 2020 and 2030 Emissions Forecast

2.2.1 Methodology

The GHG emissions forecast provides a “business-as-usual estimate,” or scenario, of how emissions will change in the years 2020 and 2030 if consumption trends and efficiency continue as they did in 2007, absent any new regulations or actions that would reduce emissions. The year 2020 was selected for the forecast in order to maintain consistency with AB 32 target year. The year 2030 was selected to maintain consistency with the City of Madera General Plan horizon year and to support California’s larger effort to reduce statewide emissions under Executive Orders S-3-05 and B-30-15.

The forecast is based on projected growth trends in population, jobs, and VMT. The forecast relies on population and job projections provided by the City and VMT projections provided by Fehr & Peers using the MCTC travel model. The forecast is based on the assumption that the number of drivers, electricity and natural gas consumption, solid waste tonnage, water usage, and wastewater generation will increase over time in proportion to the growth in population, jobs, and VMT. As a business-as-usual projection, the forecast does not take into account legislation or regulations implemented after 2007, which are accounted for in the adjusted forecast (refer to Section 2.2.3).

The forecasting approach varies for each sector:

- Residential Energy, Solid Waste, Water, and Wastewater sector emissions are correlated with the City of Madera’s forecasted population growth, which was provided by the City.
- Commercial/Industrial Energy sector emissions are correlated with forecasted with job growth in Madera, which was also provided by the City.
- On-road Transportation subsector emissions are based on projected growth in VMT provided by Fehr & Peers and were calculated using EMFAC2011.
- Off-road Equipment subsector emissions were calculated using OFFROAD2007.

Table 2-3 shows the growth projections used to determine the emissions growth for each emissions sector in 2020 and 2030.

TABLE 2-3: MADERA’S GROWTH PROJECTIONS

Growth Indicator	2007	2020	2030	Sector Applied to
Population	57,181	74,571	90,191	Residential Energy, Solid Waste, Water, Wastewater
Jobs	15,258	22,413	27,558	Commercial/Industrial Energy, Off-road Equipment
Annual VMT	256,504,829	333,100,731	410,301,822	On-road Transportation

Source: City of Madera, 2014; Fehr & Peers, 2014

2.2.2 Business-as-Usual Forecast

As shown in **Figure 2-3**, under the business-as-usual scenario Madera's GHG emissions are projected to grow by approximately 29 percent from 2007 levels by 2020 and 58 percent from 2007 levels by 2030. **Table 2-4** shows the results of the business-as-usual forecast scenario.

FIGURE 2-3: COMMUNITY-WIDE BUSINESS-AS-USUAL GHG EMISSIONS FORECAST FOR 2020 AND 2030

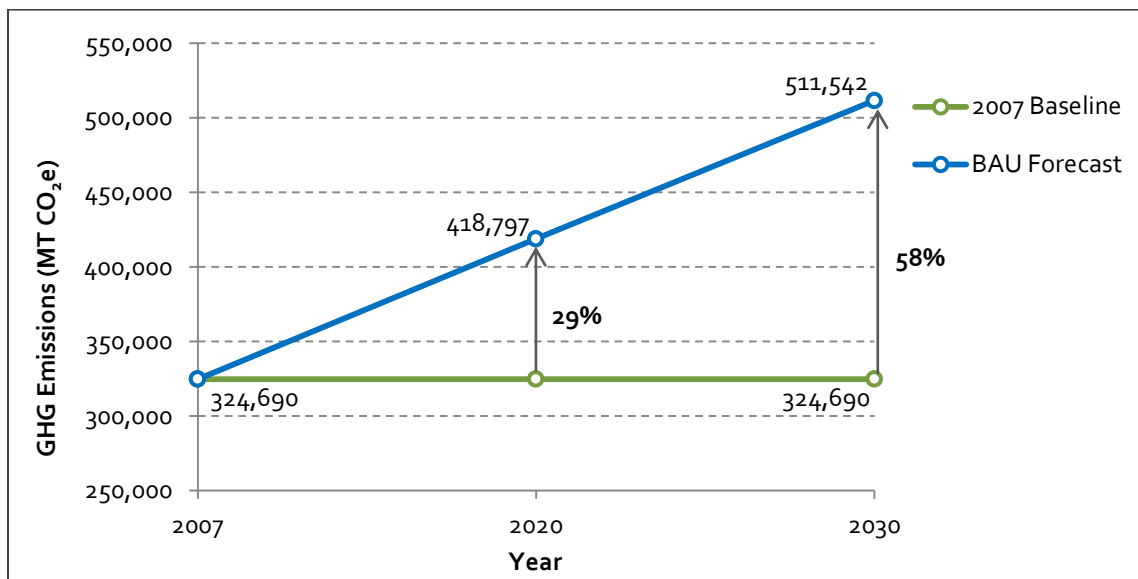


TABLE 2-4: COMMUNITY-WIDE BUSINESS-AS-USUAL GHG EMISSIONS FORECAST

Sector	2007 Emissions (MT CO ₂ e)	2020 Emissions (MT CO ₂ e)	2030 Emissions (MT CO ₂ e)
Residential Energy	65,210	85,042	102,855
Commercial/ Industrial Energy	54,387	79,891	98,230
Transportation & Mobile Sources	188,585	232,336	284,419
Solid Waste	12,973	16,918	20,462
Water	2,840	3,704	4,480
Wastewater	695	906	1,096
Total	324,690	418,797	511,542

2.2.3 Adjusted Forecast

Since 2007, a number of federal and state regulations been enacted that would reduce Madera's GHG emissions in 2020 and 2030. The impact of these regulations was quantified and incorporated into an "adjusted forecast" to provide a more accurate picture of future emissions growth and the responsibility of the City and community once state regulations to reduce GHG emissions have been implemented. A brief description of each of these regulations is provided below. **Table 2-5** summarizes the local reduction that will result from each state regulation. These state regulations will reduce Madera's business-as-usual GHG emissions by approximately 113,056 MT CO₂e in 2020 and 163,114 MT CO₂e in 2030.

Clean Car Standards, AB 1493 (Pavley I)

Signed into law in 2002, AB 1493 requires vehicle manufacturers to reduce GHG emissions from new passenger cars and light trucks from 2009 through 2016. Regulations were adopted by the CARB in 2004 and took effect in 2009 when the USEPA issued a waiver confirming California's right to implement the bill. CARB anticipates that the Pavley I standards will reduce GHG emissions from new California passenger vehicles by about 22 percent in 2012 and about 30 percent in 2016, while simultaneously improving fuel efficiency and reducing motorists' costs.

Advanced Clean Cars Standards

The Advanced Clean Cars program (January 2012) coordinates the goals of the Low Emissions Vehicle (LEV), Zero Emissions Vehicle (ZEV), and Clean Fuels Outlet programs combining the control of smog, soot causing pollutants and GHG emissions into a single coordinated package of requirements for model years 2017 through 2025. By 2020, GHG emissions would be reduced by three percent and by 2025 emissions would be reduced approximately 12 percent from 2008 baseline levels. The reduction increases in 2035 to 27 percent reduction from baseline levels and even further in 2050 to 33 percent reduction.

Low Carbon Fuel Standard

The Low Carbon Fuel Standard is a flexible performance standard designed to accelerate the availability and diversity of low-carbon fuels by taking into consideration the full life-cycle of GHG emissions. As part of the AB 32 Scoping Plan, the Low Carbon Fuel Standard is expected to reduce the carbon intensity of gasoline and diesel fuels by 10 percent.

Renewable Portfolio Standard

Established in 2002 under SB 1078, and accelerated in 2006 under SB 107, California's Renewables Portfolio Standard required investor-owned utilities, electric service providers, and community choice aggregators to increase procurement from eligible renewable energy resources by at least one percent of their retail sales annually, until they achieved 20 percent by 2010. SB 2X raised the target from 20 percent, requiring private and public utilities to obtain 33 percent of their electricity from renewable energy sources by 2020.

California Code of Regulations Title 24, Part 6

Although it was not originally intended specifically to reduce GHG emissions, California Code of Regulations Title 24, Part 6: California's Energy Efficiency Standards for Residential and Nonresidential Buildings, was first adopted in 1978 in response to a legislative mandate to reduce California's energy consumption, which in turn reduces fossil fuel consumption and associated GHG emissions. The California Energy Commission estimates that the 2008 standards reduce consumption by 10 percent for residential buildings and 5 percent for commercial buildings, relative to the previous standards. For projects implemented after January 1, 2014, the California Energy Commission estimates that the 2013 Title 24 energy efficiency standards will reduce consumption by 25 percent for residential buildings and 30 percent for commercial buildings, relative to the 2008 standards.

TABLE 2-5: SUMMARY OF GHG EMISSIONS REDUCTIONS FROM STATE REGULATIONS IN 2020 AND 2030

State Regulations	2020 Reduction (MT CO ₂ e)	2030 Reduction (MT CO ₂ e)
Pavley I Clean Car Standards – AB 1493	-29,460	-44,015
Advanced Clean Cars	-3,408	-20,448
Low Carbon Fuel Standard – On-Road Transportation	-17,325	-19,319
Low Carbon Fuel Standard – Off-Road Vehicles	-2,622	-2,677
Title 24	-4,876	-11,870
Renewable Portfolio Standard	-55,365	-64,785
Total Reduction from State Regulations	-113,056	-163,114

2.3 GHG Emissions Reduction Targets

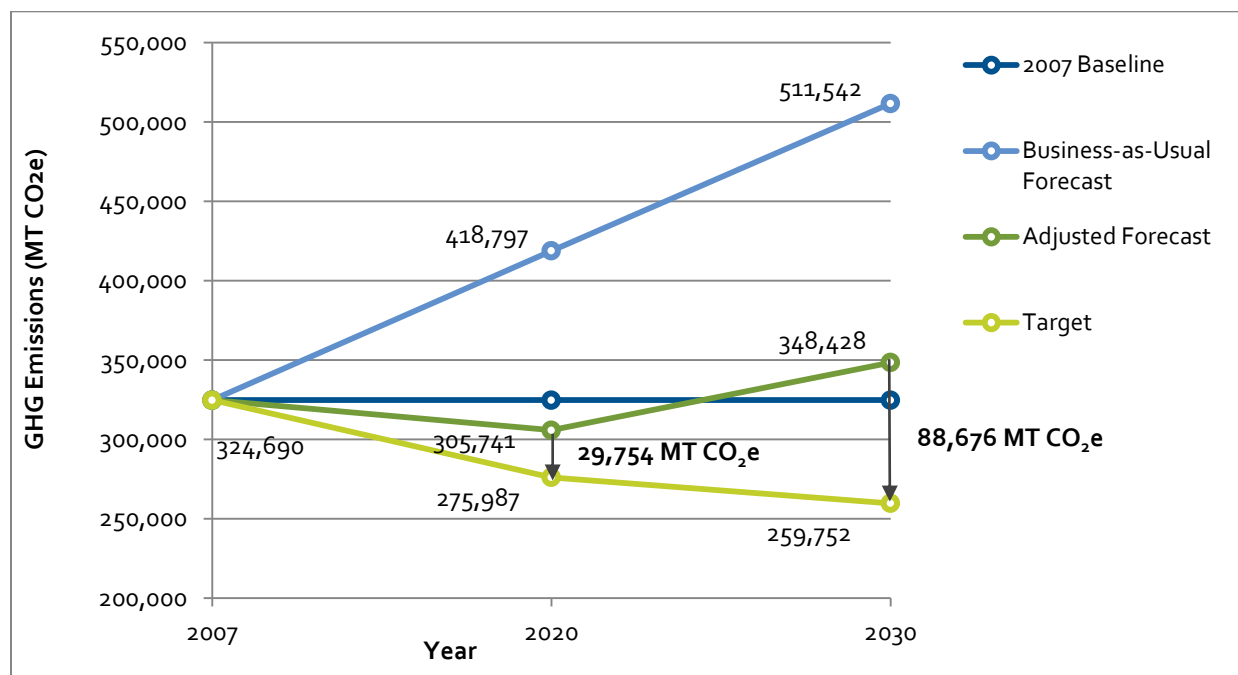
The City is committed to reducing Madera's GHG emissions consistent with AB 32 and working towards the goals of Executive Orders S-3-05 and B-30-15. The AB 32 Scoping Plan encourages local governments to establish a reduction target that parallels the State's commitment to reduce GHG emissions by approximately 15 percent from baseline levels by 2020. Therefore, this CAP establishes a reduction goal or target to achieve emissions levels 15 percent below 2007 levels by 2020 consistent with the AB 32 and General Plan Action Item CON-36.2. This CAP also establishes a longer-term target of 20 percent below 2007 levels by 2030, to support California's larger effort to reduce statewide emissions under Executive Orders S-3-05 and B-30-15.

The 2007 baseline GHG emissions inventory and 2020 and 2030 GHG emissions forecasts under the adjusted scenario provide the necessary background for the City to identify the reduction in emissions needed from local measures to meet these targets. As shown in **Table 2-6** and **Figure 2-4**, Madera would need to reduce its GHG emissions by an additional 29,754 MT CO₂e by 2020 and by 88,676 MT CO₂e by 2030 beyond reductions associated with State regulations to meet these targets.

TABLE 2-6: MADERA'S GHG EMISSIONS, TARGETS, AND REDUCTION NECESSARY TO MEET TARGETS

	2020 GHG Emissions (MT CO ₂ e)	2030 GHG Emissions (MT CO ₂ e)
2007 Baseline Emissions	324,690	324,690
Adjusted Forecast	305,741	348,428
Targeted Future Emissions Level	275,987	259,752
Necessary Reduction from Adjusted Forecast to Meet Targets	29,754	88,676

FIGURE 2-4: MADERA'S GHG EMISSIONS, TARGETS, AND REDUCTION NECESSARY TO MEET TARGETS





Chapter 3.0

Climate Action Measures

This chapter identifies the measures and actions that the City will implement to achieve the GHG emissions reduction targets of 15 percent below 2007 levels by 2020 and 20 percent below 2007 levels by 2030. These measures will also help the City prepare for the anticipated effects of climate change.

The City has identified the climate action measures and actions based on careful consideration of the reductions needed to achieve the targets, the sources and distribution of emissions revealed in the GHG emissions inventory, existing priorities and resources, and the potential costs and benefits of each measure. The climate action measures and actions incorporate and/or build on many of the goals and policies identified in the General Plan and strategies of neighboring jurisdictions and regional agencies. Detailed analyses of each measure's GHG reduction potential and estimated costs and savings are located in **Appendix C** and **D**.

3.1 Chapter Organization

The climate action measures are organized into seven focus areas that represent the primary ways in which Madera will reduce GHG emissions and adapt to the anticipated effects of a changing climate. Each focus area begins with an introduction, followed by a summary table listing the measures within the focus area and the associated GHG reduction potential. Following the introduction to each focus area, the chapter presents each measure with the following information:

The climate action measures, which represent ways to reduce GHG emissions or adapt to climate change, are organized into seven focus areas. These focus areas include:

- Local Government
- Energy
- Transportation and Land Use
- Water and Wastewater
- Solid Waste
- Urban Greening
- Adaptation

- **Measure:** Measures represent the ways to reduce GHG emissions or adapt to a changing climate.

- **Performance Objective:** The outcome necessary to achieve the measure's GHG emissions reduction potential
- **Existing and/or Completed Efforts:** A list of completed, programmed, or in progress efforts (since the 2007 baseline year) to implement the measure.
- **General Plan Policies and Action Items:** A list of General Plan policies and action items to accomplish the measure. Some policies and/or action items have been abbreviated. Where the full text of policies or action items is not included, it is denoted with "...". Please refer to the General Plan document for the complete text.
- **Additional Implementation Actions:** A list of additional actions to accomplish the measure. Additional implementation actions were developed from industry best practices and often build on the General Plan policies and action items.
- **GHG Reduction Potential:** The GHG reduction potential value identifies the estimated annual emission reductions anticipated in 2020 and 2030, measured in MT CO₂e per year. Supporting information pertaining to the reduction calculations is provided in **Appendix C**.
- **Costs and Savings:** For each measure, potential costs and savings to the City or community are categorized as none, very low, low, medium, high, and very high. **Table 3-1** summarizes these category definitions. Costs account for the expense that would occur beyond conducting business-as-usual (i.e., without implementation of the CAP). Supporting information is provided in **Appendix D**.

TABLE 3-1 MEASURE COST AND SAVINGS

Cost/Savings Type	Range	
City Cost/Savings	None:	\$0
	Very Low:	\$1- \$10,000
	Low:	\$10,001 - \$50,000
	Medium:	\$50,001 - \$100,000
	High:	\$100,001 - \$200,000
	Very High:	\$200,001 or greater
Private Cost/Savings	None:	\$0
	Very Low:	\$1 - \$1,000
	Low:	\$1,001 - \$5,000
	Medium:	\$5,001 - \$10,000
	High:	\$10,001 - \$20,000
	Very High:	\$20,001 or greater

Details to help the City implement each measure and monitor its progress are located in Chapter 4, Implementation and Monitoring. Details include responsible departments, implementation time frames, performance indicators to track progress, and potential funding resources.

3.2 Local Government Measures

The City has already taken a number of steps that have resulted in GHG emissions reductions and is committed to building on those efforts by increasing energy efficiency and conservation in municipal buildings, increasing its use of renewable energy, purchasing more efficient fleet vehicles, expanding commute options for City employees, reducing solid waste, and planting trees. This focus area identifies measures and actions that the City can implement to further reduce GHG emissions from City government operations and facilities. Although the GHG emissions that result from local government operations and facilities account for less than one percent of Madera's community-wide emissions, as an employer, property-owner, and regulatory entity, the City can set an example of GHG emissions reduction practices for the community and demonstrate additional benefits of the measures beyond reducing GHG emissions, such as cost savings in buildings and operations and improved operational efficiency. As shown in **Table 3-2**, local government measures have the potential to reduce Madera's GHG emissions by 653 MT CO₂e by 2020 and 991 MT CO₂e by 2030.

Co-Benefits of Local Government Measures

In addition to reducing GHG emissions, the local government measures described in this section have the potential to provide other important benefits to the community. These benefits include:

- Municipal leadership
- Reduced operating costs
- Lower maintenance costs and extended equipment lives
- Improved public health
- Improved air and water quality
- Improved infrastructure
- Resource conservation
- City beautification

TABLE 3-2 LOCAL GOVERNMENT GHG REDUCTIONS BY MEASURE

Measure Number	Measure	2020 GHG Reduction (MT CO ₂ e)	2030 GHG Reduction (MT CO ₂ e)
LG-1	Municipal Energy Efficiency and Conservation	74	148
LG-2	Municipal Renewable Energy	445	611
LG-3	Fuel Efficient and Low-Carbon Vehicle Fleet	58	105
LG-4	Employee Commute Alternatives	41	66
LG-5	Municipal Solid Waste Diversion	19	28
LG-6	Tree Planting on City Property	16	33
Local Government Operations Total		653	991

LG-1: Municipal Energy Efficiency and Conservation

Reduce non-renewable energy consumption in City buildings and facilities.

Objective: Reduce the amount of energy used at City buildings and facilities by five percent below 2007 levels by 2020 and 10 percent below 2007 levels by 2030.

2020 Reduction

Potential:

74 MT CO₂e

2030 Reduction

Potential:

148 MT CO₂e

Existing and/or Completed Efforts:

- **Lighting retrofits:** The City has replaced approximately 650 City-owned high pressure sodium (HPS) street lights, all traffic signal lights, and several “walk/don’t walk” indicators with light-emitting diodes (LED), since 2007. The City has also replaced approximately 1,500 other indoor and outdoor lights with compact fluorescent lights (CFL) or other energy efficient lights.
- **Street light standards:** The City requires that all new street lights use LED technology and has engineering standards and specifications for their installation.
- **Energy audits:** All City buildings and facilities have been audited in regards to their energy consumption.
- **Demand response programs:** The City implements peak load management and demand response programs, which have resulted in an estimated electricity savings of 3,255 kilowatt hours per year (kWh/yr).
- **Energy management systems:** Occupancy sensors, which automatically turn off lights when areas are not in use, have been installed at a number of City facilities.
- **Energy efficient equipment:** As municipal appliances and technologies wear out, the City replaces them with ones that are energy efficient. Since 2007, the City has replaced numerous appliances, the water heater at Fire Station 6, installed low flow toilets, and energy efficient heating, ventilation, and air conditioning (HVAC) units with economizers. All water pumps have been audited for energy usage and as pumps are replaced, new highly efficient motors are utilized. Many of the irrigation controls have been upgraded at a number of City facilities, resulting in greater efficiency.
- **Building retrofits:** In 2008, the airport, Westside Activity Center, Millview Kitchen, Youth Hut, and engineering building, and City Hall finance building were retrofitted, resulting in electricity savings of 39,764 kWh/yr. From 2010-2011, the Wastewater Treatment Plant, Fleet Shop, and Central Supply (Public Works) facilities were retrofitted, resulting in electricity savings of 37,901 kWh/yr.
- **Utility coordination:** The City regularly works with Pacific Gas and Electric Company (PG&E) to identify funding sources and mechanisms for building retrofit projects.

General Plan Policies and Actions:

- **Policy CON-40:** All public and private development—including homes, commercial, and industrial—should be designed to be energy-efficient.
 - **Action Item CON-40.3:** City buildings and facilities will be operated in the most energy-efficient manner without endangering public health and safety and without reducing public safety or service levels.

- Policy CON-45: The City supports the use of green building practices in the planning, design, construction, management, renovation, operations, and demolition of facilities constructed, owned, managed, or financed by the City. All new building projects (projects intended for human occupancy) involving the use of local public funds should incorporate green building practices. Except as dictated by unique circumstances associated with a given project, the typical standard for green building will be the equivalent of the “Leadership in Energy and Environmental Design (LEED) Silver Standard.”
 - Action Item CON-45.1: Evaluate and update the City’s procurement processes to provide incentives to bidders who propose the use of green building practices in the construction of City buildings and facilities.
 - Action Item CON-45.2: Require that any building constructed in whole or in part with local, public funding incorporate passive solar design features, such as daylighting and passive solar heating, where feasible.

Additional Implementation Actions:

- LG-1.1:** Track municipal energy consumption and performance over time using PG&E Portfolio Manager Web Services which automatically feeds key data into ENERGY STAR® Portfolio Manager.
- LG-1.2:** Establish a prioritized list of energy efficiency upgrade projects and implement as funding becomes available.
- LG-1.3:** Convert the remaining HPS street lights to LED.
- LG-1.4:** Identify staff positions or employees that could benefit from energy-related workshops and trainings.
- LG-1.5:** Continue to coordinate with PG&E and the Madera Energy Watch partnership to identify funding sources, tools, and other mechanisms to improve municipal energy efficiency.

City Cost	City Savings	Private Cost	Private Savings
Low – Medium	High – Very High	None	None

LG-2: Municipal Renewable Energy

Increase the amount of municipal energy derived from renewable sources.

Objective: By 2020, install 1,265 kilowatt (kW) of solar photovoltaics (PVs) (please note the City has already met this objective for the year 2020). By 2030, install an additional 162 kW of solar PVs (for a total of 1,427 kW of solar PVs by 2030). By 2020, procure 10 percent of municipal electricity from renewables by 2020 and 20 percent by 2030.

2020 Reduction Potential:
445 MT CO₂e

2030 Reduction Potential:
611 MT CO₂e

Existing and/or Completed Efforts:

- Since 2007, the City has installed a 1.15 megawatt (MW) PV system at the Wastewater Treatment Plant, a 75 kW PV system at the Youth Center, and a 40 kW PV system at the Police Department.

General Plan Policies and Actions:

- Action Item CON-40.4: To the extent practical, integrate appropriate renewable energy and clean generation technologies into existing City facilities, such as solar, wind, biofuel, cogeneration, and fuel cells to power City facilities.
- Policy CON-42: The City will promote and encourage co-generation projects for commercial, industrial, and municipal facilities, provided they meet all applicable air quality standards and provide a net reduction in GHG emissions associated with energy production.
- Policy CON-43: The City will install renewable energy systems at its facilities where feasible, including solar collection systems at municipal properties and waste-to-energy (methane recovery) systems at the waste water treatment plant.

Additional Implementation Actions:

- LG-2.1:** Conduct a feasibility study on the installation of renewable energy projects at select City facilities.
- LG-2.2:** Identify and secure funding (e.g., through grants, on-bill financing, loans, energy performance contracts, lease-purchase agreements, or other mechanisms) to install additional solar PV systems at City facilities.
- LG-2.3:** Consider participation in PG&E's green power option, which would allow the City to purchase up to 100 percent of its electricity from renewable energy sources.

City Cost	City Savings	Private Cost	Private Savings
Very Low	High – Very High	None	None

LG-3: Fuel Efficient and Low-Carbon Vehicle Fleet

Increase overall fuel efficiency and the use of low-carbon fuels in the City's vehicle fleet.

Objective: By 2020, replace 10 light duty vehicles with three hybrid or electric vehicles with combined average fuel economy of 55 mpg and seven compressed natural gas (CNG) fueled vehicles. Also replace 10 heavy-duty vehicles with CNG fueled vehicles by 2020. By 2030, replace an additional 12 light-duty vehicles with five hybrid or electric vehicles with combined average fuel economy of 55 mpg and seven CNG fueled vehicles. Also replace an additional six heavy-duty vehicles with CNG fueled vehicles by 2030. The City has already replaced six light-duty vehicles (with one hybrid and five CNG) and 10 heavy-duty vehicles with CNG since 2007.

2020 Reduction Potential:
58 MT CO₂e

2030 Reduction Potential:
105 MT CO₂e

Existing and/or Completed Efforts:

- City resolution 03-55 declares the City's desire to integrate zero emission and low emission vehicles into the City fleet.
- Since 2007, the City has purchased one hybrid vehicle and several vehicles fueled by CNG. The City has also reduced its fleet size across all equipment classes.
- The City regularly conducts vehicle maintenance, including tune-ups and maintenance checks at 3,000 miles or every four months, whichever comes first.
- Since 2008, the Madera Area Express system had added 10 CNG buses. The City's transit fleet consists entirely of CNG transit vehicles.
- Between 2011 and 2012, combined City/School District CNG fueling facilities were constructed.

General Plan Policies and Actions:

- Policy CON-32: Where feasible, the City's vehicle fleet should include clean fuel, hybrid, electric, or other fuel-efficient vehicles, so long as their utility, durability, and cost meets the City's needs.
 - Action Item CON-32.1: Update the City's procurement policies to include criteria for vehicle purchases that implement this policy.

Additional Implementation Actions:

- LG-3.1:** Update the City's procurement policies to include minimum fuel efficiency criteria in procurement specifications.
- LG-3.2:** Continue to identify and secure funding to help purchase alternative and fuel efficient fleet vehicles and equipment.
- LG-3.3:** Inform staff of fuel-efficient driving techniques (e.g., avoiding excessive, quick starts, speeding, etc.).

City Cost	City Savings	Private Cost	Private Savings
High	Low	None	None

LG-4: Employee Commute Alternatives

Promote alternatives to reduce annual VMT associated with City employee commutes.

Objective: Reduce annual VMT associated with employee commutes by five percent below 2007 levels by 2020 and eight percent below 2007 levels by 2030.

Existing and/or Completed Efforts:

- None at this time.

2020 Reduction Potential:
41 MT CO₂e

2030 Reduction Potential:
66 MT CO₂e

General Plan Policies and Actions:

- Policy CI-37: The City encourages the use of ridesharing and other Transportation Demand Management (TDM) tactics for reducing area traffic congestion and improving air quality.

Additional Implementation Actions:

- LG-4.1:** Provide City employees with incentives to use alternatives to single-occupant auto commuting, such as transit incentives, bicycle facilities, flexible schedules, ridesharing services and subsidies, and telecommuting.
- LG-4.2:** Participate in and promote annual commute trip reduction events.

City Cost	City Savings	Private Cost	Private Savings
Very Low	None	None	Varies

LG-5: Municipal Solid Waste Diversion

Reduce the amount of landfilled solid waste generated at City facilities.

Objective: Reduce City-generated solid waste by 20 percent below 2007 levels by 2020 and by 30 percent below 2007 levels by 2030.

Existing and/or Completed Efforts:

- The City provides recycling receptacles at meetings and has a policy to install recycling receptacles at municipal facilities.
- The City has a recycle and environmentally preferred products policy.
- The City participates in “grasscycling” by leaving clippings on the lawn after mowing.
- The City has established and implements an organic material recovery program for green waste from agency parks and facility landscaping.

2020 Reduction Potential:

19 MT CO₂e

2030 Reduction Potential:

28 MT CO₂e

General Plan Policies and Actions:

- Policy CI-63: The City itself will be a leader in promoting waste reduction and recycling through a variety of means when feasible, including:
 - Adopting requirements for the use of recycled base materials (e.g., recycled raw batch materials, rubberized asphalt from recycled tires, and other appropriate materials), if practicable, in requests for bids for public roadway construction projects.
 - Procurement policies and procedures which facilitate purchase of recycled, recyclable, or reusable products and materials where feasible.
 - Requiring contractors to provide products and services to the City, including printing services, demonstrating that they will comply with the City’s recycled materials policies.

Additional Implementation Actions:

- LG-5.1:** Audit City facilities to identify opportunities to increase material recovery and beneficial use of organic material.

City Cost	City Savings	Private Cost	Private Savings
Very Low	None	None	None

LG-6: Tree Planting on City Property

Increase the quantity of drought-tolerant, low-maintenance native trees and vegetation on City-owned or -operated property.

Objective: Plant 100 trees and three acres of vegetation on City properties by 2020 and an additional 100 trees and three acres by 2030 (for a total of 200 trees and six acres of vegetation planted on City properties between 2007 and 2030). The City has already planted 85 trees and two acres of vegetation.

2020 Reduction Potential:
16 MT CO₂e

2030 Reduction Potential:
33 MT CO₂e

Existing and/or Completed Efforts:

- Since 2007, 10 trees were planted at Rotary Park, 35 trees were planted at the Sunrise Rotary Sports Complex, and 40 trees were planted in the Lake Street median islands (total of 85 trees).
- Since 2007, the City planted two acres of bare dirt with grass at the Sunrise Rotary Sports Complex.

General Plan Policies and Actions:

- Policy CON-9: The City will evaluate existing City-maintained landscaping and will, as feasible, install or replace vegetation with drought-tolerant, low-maintenance native species.
- Policy CON-10: The City will evaluate existing landscaping and options to convert reflective and impervious surfaces to landscaping, and will, as feasible, install or replace vegetation with drought-tolerant, low-maintenance native species that can also provide shade and reduce heat-island effects.

Additional Implementation Actions:

- LG-6.1:** Continue to identify and secure funding to plant additional drought-tolerant, native trees and vegetation on City properties.

City Cost	City Savings	Private Cost	Private Savings
Medium - High	Very Low	None	None

3.3 Energy Measures

Energy use accounted for 37 percent of Madera's total GHG emissions in 2007. These emissions result from the combustion of fossil fuel, primarily coal, oil, and natural gas, which is used to heat, cool, and provide power to residential, commercial, and industrial buildings and other facilities. Factors affecting energy-related emissions in buildings include building design and the efficiency of technology and electronics in buildings. GHG emissions reductions can be achieved by changes to both energy demand (e.g., improving energy efficiency and reducing consumption) and energy supply (e.g., switching from a high-carbon to a low- or zero-carbon technology or fuel). The energy measures listed in **Table 3-3** focus on these strategies and have the potential to reduce Madera's GHG emissions by 13,050 MT CO₂e by 2020 and by 40,847 MT CO₂e by 2030.

Co-Benefits of Energy Measures

In addition to reducing GHG emissions, the energy measures described in this section have the potential to provide other important benefits to the community, including:

- Reduced energy and operating costs
- Lower maintenance costs and extended equipment lives
- Increased building re-sale value
- Strengthened local economy
- Resource conservation
- Increased electricity reliability
- Improved air quality

TABLE 3-3 ENERGY GHG REDUCTIONS BY MEASURE

Measure Number	Measure	2020 GHG Reduction (MT CO ₂ e)	2030 GHG Reduction (MT CO ₂ e)
E-1	Energy Efficiency and Conservation in Existing Buildings	10,707	30,163
E-2	Energy Efficient New Construction	531	7,670
E-3	On-Site Small-Scale Renewable Energy	1,813	3,014
Energy Total		13,051	40,847

E-1: Energy Efficiency and Conservation in Existing Buildings

Increase energy efficiency and conservation within the community.

Objective: Reduce residential and commercial energy by 10 percent by 2020 and 15 percent by 2030.

Existing and/or Completed Efforts:

- The City works with PG&E to promote its home energy efficiency audit and retrofit programs.
- Several low-income units received weatherization in conjunction with grant funding related to owner-occupied rehab and with the Neighborhood Stabilization Program.

General Plan Policies and Actions:

- Action Item CON-40.1: Work with the local energy providers and developers on voluntary incentive based programs to encourage the use of energy efficient designs and equipment.
- Policy H-5.6: The City shall promote the use of energy conservation measures in residential units to conserve energy as well as reduce household utility costs.
 - Action Item H-5.6.1: The City shall encourage the continuation of energy conservation programs offered through PG&E, when available, including low interest financing of energy conservation measures.
 - Action Item H-5.6.2: The City shall continue to incorporate energy conservation measures into housing rehabilitation work, especially insulation and weather stripping.
 - Action Item H-5.6.3: The City shall continue to seek out and utilize available funds for weatherization and energy conservation work in homes.
 - Action Item H-5.6.4: The City shall consider the adoption of a program which requires all publicly funded residential projects involving new construction and major renovation to utilize and/or incorporate energy efficient appliances.
 - Action Item H-5.6.5: The City shall consider the adoption of a Voluntary Energy Independence Program which allows property owners to install solar equipment (or major energy efficient appliances/building systems) with up-front costs financed by public or private funding. Under this program, the costs of the equipment would be paid off by the property owner through a special tax attached to the property tax bill.

Additional Implementation Actions:

- E-1.1:** Continue to coordinate with PG&E to promote use of utility financial incentives to improve energy efficiency, such as by using on-bill financing, rebates and tax credits, building audit and retrofit programs, and demand management programs.
- E-1.2:** Conduct additional outreach and promotional activities, either individually or in collaboration with PG&E and/or local organizations, targeting specific groups within the community (e.g., homeowners, renters, businesses, income-qualified households, etc.).
- E-1.3:** Designate one week per year to conduct an energy efficiency outreach campaign. The campaign week may also be used to recognize and encourage programs and educational outreach conducted by industry organizations, non-government entities, government agencies, and other community groups.
- E-1.4:** Collaborate with PG&E to hold an educational workshop in Madera regarding measures that individuals can take to reduce energy usage.

2020 Reduction Potential:

10,707 MT CO₂e

2030 Reduction Potential:

30,163 MT CO₂e

- E-1.5:** Participate in and promote a residential and commercial energy efficiency financing program (e.g., through Energy Upgrade California, CaliforniaFIRST, a joint powers authority with other local agencies, or other mechanisms) allowing residential and commercial property owners to voluntarily invest in energy efficient upgrades for their buildings.
- E-1.6:** Promote existing income-qualified weatherization programs (e.g., Energy Upgrade California, PG&E's Middle Income Direct Install Program, etc.), either individually, or in collaboration with an existing organization, to income-qualified households using sources of data available to the local agency, (e.g., water bills, housing records, etc.).

City Cost	City Savings	Private Cost	Private Savings
Medium - High	None	None	Varies

E-2: Energy Efficient New Construction

Increase the efficient use of energy and conservation of available resources in the design and construction of new buildings.

Objective: By 2020, 10 percent of new residential and commercial development to exceed Title 24 by 20 percent. By 2030, 25 percent of new residential development to exceed Title 24 by 30 percent; all new commercial development after 2020 is net zero energy.

2020 Reduction Potential:

531 MT CO₂e

2030 Reduction Potential:

7,670 MT CO₂e

Existing and/or Completed Efforts:

- None at this time.

General Plan Policies and Actions:

- Policy CON-40: All public and private development—including homes, commercial, and industrial—should be designed to be energy-efficient.
 - Action Item CON-40.1: Work with the local energy providers and developers on voluntary incentive based programs to encourage the use of energy efficient designs and equipment.
 - Action Item CON-40.2: Promote enhanced energy conservation standards for new construction through informational handouts, outreach to the construction industry, or other methods.
- Policy CON-44: The City supports the use of green building practices in the planning, design, construction, management, renovation, operations, and demolition of all private buildings and projects, including: water conservation indoors and outdoors; selection of materials based on recyclability, durability and the amount of energy used to create the material; waste reduction, reuse and recycling during construction and throughout the life of the project; other new aspects of green design and construction included in LEED or other certification programs; control nighttime lighting to lower energy use...
 - Action Item CON-44.1: Develop a voluntary, market-driven Green Building Program that includes performance standards, guidelines, review criteria, incentives, and implementation schedules for private sector development, with criteria tailored to project types (i.e., residential, commercial, retail), size, and location.

- Action Item CON-44.2: Identify, evaluate, and provide incentives to encourage projects that incorporate green building practices and site design, including the potential for certification through the City's Building Department.
- Action Item CON-44.3: Facilitate the professional development and education of City staff to learn about green building practices and to have the tools to evaluate development proposals.
- Action Item CON-44.4: Offer information, technical assistance, and training to promote green building to property owners, building, design, and planning professionals, school districts, and special districts.
- Policy CON-46: The City will identify and remove regulatory or procedural barriers to implementing green building practices within its jurisdiction, such as updating codes, guidelines, and zoning, and will ensure that all plan review and building inspection staff are trained in green building materials, practices, and techniques.

Additional Implementation Actions:

- E-2.1:** Provide support to and recognition of developers proposing projects that voluntarily exceed Title 24 Energy Efficiency Building Standards, meet the state's Green Building Standards voluntary tier levels, or are LEED Greenpoint, or ENERGY STAR rated.

City Cost	City Savings	Private Cost	Private Savings
Low	None	None	Varies

E-3: On-Site Small-Scale Renewable Energy

Facilitate the installation and use of on-site small-scale renewable energy systems, such as solar PV systems and solar water heaters.

Objective: Achieve installation of 4,000 kW of solar PV systems on existing residential property and 1,500 kW of solar PV systems on existing non-residential property by 2020, and an additional 2,720 kW of solar PV systems on existing residential property and 500 kW of solar PV systems on existing non-residential property by 2030. Achieve installation of 400 residential and 200 non-residential solar water heaters by 2020 and an additional 350 residential and 200 non-residential solar water heaters by 2030.

2020 Reduction Potential:

1,813 MT CO₂e

2030 Reduction Potential:

3,014 MT CO₂e

Existing and/or Completed Efforts:

- Between 2007 and the August 2014, 2,044 kW of solar PV systems were installed on residential buildings and 493 kW of solar PV systems were installed on non-residential buildings in Madera.¹

¹ California Solar Initiative. Geographical Statistics. Available at: http://www.californiasolarstatistics.ca.gov/reports/locale_stats/

- The City provides information on its website about essential resources (e.g., local financing options and available incentives) for residential and commercial property owners that are considering solar PVs, as well as specific requirements and resources for solar installers and other industry professionals.
- The City participates in the Southwest Solar Transformation Initiative, an initiative that aims to make solar power more affordable for communities by improving approval processes and local solar market conditions, and has developed a customized Solar Roadmap for Madera.
- The City simplified its process for obtaining necessary permits to install solar energy systems and posted general permitting information on its website.
- The City provides links to solar information for new home builders on its website.

General Plan Policies and Actions:

- Policy CON-41: The City will allow renewable energy projects in areas zoned for open space, where significant environmental impacts can be avoided or mitigated to the greatest extent feasible, where consistent with all of the elements of this General Plan, and other uses and values.
 - Action Item CON-41.1: Update the City's Building and Zoning codes as needed to establish standards (such as, but not limited to, height and size) for renewable energy projects.
- Policy CON-42: The City will promote and encourage co-generation projects for commercial, industrial, and municipal facilities, provided they meet all applicable air quality standards and provide a net reduction in GHG emissions associated with energy production.

Additional Implementation Actions:

- E-3.1:** Expand education on and promotion of existing incentive, rebate, and financing programs for solar PV systems and solar hot water heaters, such as those offered through the California Solar Initiative and California Public Utilities Commissions, including the Single Family Affordable Solar Homes (SASH) Program and the Multifamily Affordable Solar Homes (MASH) Program. Target specific groups or sectors within the community.

City Cost	City Savings	Private Cost	Private Savings
Low - Medium	None	None	Varies

3.4 Transportation and Land Use Measures

Transportation-related emissions make up the largest portion (58 percent) of Madera's GHG emissions inventory, resulting in 188,585 MT CO₂e annually. Factors affecting GHG emission from transportation include the number of VMT, fuel economy, and the type of fuel used. The number of VMT is directly influenced by the geographic distribution of people and places, especially the density of development and zoning. Therefore, land use measures are included as reduction policies in this section.

The measures in this section focus on reducing GHG emissions from transportation fuel consumption by reducing VMT. This involves reducing automobile dependence by facilitating infill and mixed-use development patterns, promoting walking, bicycling, and public transit as viable travel options, and managing transportation demand. The transportation and land use measures listed in **Table 3-4** focus on these strategies and have the potential to reduce Madera's GHG emissions by 14,913 MT CO₂e by 2020 and by 43,526 MT CO₂e by 2030.

Co-Benefits of Transportation Measures

The transportation and land use measures in this section will not only help reduce GHG emissions, but also provide multiple benefits to the community. These include:

- Reduced transportation costs
- Reduced noise, air, and water pollution
- Reduced traffic congestion
- Improved public health
- Strengthened local economy
- Improved infrastructure
- Increased equity
- Increased community interaction
- Increased housing and travel options
- Resource conservation

TABLE 3-4 TRANSPORTATION AND LAND USE GHG REDUCTIONS BY MEASURE

Measure Number	Measure	2020 GHG Reduction (MT CO ₂ e)	2030 GHG Reduction (MT CO ₂ e)
T-1	Infill and Mixed-Use Development	5,613	21,292
T-2	Bicycle and Pedestrian Environment	1,053	3,454
T-3	Transit Travel	2,404	4,757
T-4	Commute Trip Reduction	1,188	1,977
T-5	Traffic Flow and Vehicle Idling	265	401
T-6	Low Carbon Fuel Vehicles and Infrastructure	4,255	11,061
T-7	Construction and Off-Road Equipment	135	584
Transportation and Land Use Total		14,913	43,526

T-1: Infill and Mixed-Use Development²

Facilitate mixed use, higher density, and infill development near transit stops, in existing community centers/ downtown, and in other designated areas.

Objective: Increase service population density within the city 30 percent by 2020 and 50 percent by 2030; 25 percent of new development located within two miles of shopping/transit/job centers by 2030; and 15 percent of new development with two or more land use types (e.g., residential and commercial) by 2030.

**2020 Reduction
Potential:**

5,613 MT CO₂e

**2030 Reduction
Potential:**

21,292 MT CO₂e

Existing and/or Completed Efforts:

- Since 2007, the City amended the municipal code to provide impact fee waivers for reconstruction of previously existing homes demolished within ten years.

General Plan Policies and Actions:

- Policy LU-10: The Growth Boundary is considered by the City to define the physical limits of development in Madera. The City shall direct all future growth in Madera and in the unincorporated area outside the city limits to occur inside the Growth Boundary shown on the Land Use Map in this General Plan. Within the City's Planning Area, the City encourages the County to assist the City in maintaining an agricultural greenbelt around the Growth Boundary by limiting the use of land designated for Agriculture on the City's General Plan Land Use map to agriculture...
- Policy LU-11: The City specifically envisions the establishment and maintenance of a greenbelt of agricultural and other open space lands around the urbanized portion of the Planning Area, outside the Growth Boundary, as shown on the Land Use Map...
- Policy LU-19: The following are the City's residential land use categories:...
 - Village Mixed Use: This category provides for a mix of uses generally corresponding to the Medium Density Residential, High Density Residential, and Commercial land use categories...
 - High Density Residential: Residential development at a range of 15.1 to 50 units per acre, with a Target Density of 22.5 units per acre...
- Policy LU-24: Mixed Use projects, in which residential and commercial uses are combined within one building or site, are permitted in commercially designated properties, provided that the uses are complementary to each other and integrated in a unified design (architecture, landscape and circulation).
 - Action Item LU-24.1: Incorporate provisions for mixed use projects into the zoning ordinance, providing for flexibility in applying development standards (such as floor area), where appropriate, based on the location, type, and size of the units and the design of the development.
 - Action Item LU-24.2: Seek funding to prepare master plans and/or specific plans and related environmental documents to facilitate mixed use development at selected sites.

² Mixed-use development integrates a mixture of commercial, residential, and office type uses that are often segregated into separate land use areas. Infill development is defined as new development that is sited on vacant or undeveloped land within an existing community, and that is enclosed by other types of development (Sustainable Cities Institute, 2013).

- Policy LU-33: Reflecting the community's desire for a more livable, walkable, and sustainable community, Madera's future growth shall be based on the Building Block concept of Neighborhoods, and Villages.³ In addition, two Districts have been established for specific areas of Madera (the Downtown and the Airport North districts) which don't conform to typical neighborhood and village concepts, but do possess unique features that should make them the subject of future, more detailed planning efforts...
- Policy LU-40: The City will prioritize infill residential development inside the city limits as of December 31, 2008, and will seek to encourage the development community to build on vacant or under-utilized land within those limits.
 - Action Item LU-40.1: The City will develop and implement an infill development program to facilitate infill development...
 - Action Item LU-40.2: In conjunction with the program identified in Action Item LU-40.1 above, the City will consider the adoption of a fee requirement applied to new development that recognizes the additional cost necessary to serve non-infill development...
- Policy LU-43: The City supports jobs/housing balance programs at the local and regional scale intended to reduce the need for workers to commute outside their communities.
- Policy LU-44: The City supports the creation and retention of jobs that provide sustainable wages and benefits for Madera residents.
 - Action Item LU-44.1: Explore the use of financing incentives to encourage employment generating businesses to locate in Madera.
- Policy H-1.2: The City shall promote infill development and reuse of underutilized parcels, consistent with maintaining or enhancing the positive qualities of the surrounding neighborhoods...
 - Action Item H-1.2.1: The City shall identify potential infill sites including smaller (parcels less than one quarter of an acre) vacant and underutilized parcels. The City shall create an inventory of these sites and make the list available at the Planning and Building Department permit counter.
 - Action Item H-1.2.2: In cooperation with the Redevelopment Agency⁴ and Housing Authority and its affiliated non-profit organization, the City shall work with interested for-profit and non-profit developers in consolidating infill parcels designated for multi-family residential development.
 - Action Item H-1.2.3: The City will explore the feasibility of establishing a housing fee program that would provide fiscal incentives for infill and affordable housing projects.
 - Action Item H-1.2.4: The City will ensure compliance with the State Density Bonus by amending its Zoning Ordinance to reflect amendments to State Density Bonus law.
- Policy H-1.3: Where appropriate, the City shall encourage developers/ builders to develop their projects at the maximum density allowed under the General Plan land use designations and zoning provisions.
 - Action Item H-1.3.1: The City shall review and potentially amend its Zoning Ordinance to include minimum densities in the medium and high density zones unless there are issues of site constraints or the affordability of the units would be compromised...
- Policy H-5.1: The City shall examine its processes and policies to ensure facilitation of opportunities for horizontal and vertical mixed-use development in suitable areas, including the Downtown District and Cores as specified in the Land Use Element of the General Plan...

³ A "neighborhood" is defined as a compact, walkable residential area, generally $\frac{1}{3}$ to $\frac{1}{2}$ mile in radius, as this is the distance an average person would comfortably walk or bicycle. A "village" is defined as a collection of three to four neighborhoods.

⁴ Redevelopment Agencies were officially dissolved as of February 1, 2012.

- Action Item H-5.1.1: The City will continue to support innovative ways to incorporate mixed uses in new development. The program will also be supported by the creation of the Village Mixed Use designation in the General Plan update.
- Policy H-5.2: The City shall make the attraction of industrial, office, commercial, and industrial development a high priority in an effort to promote the creation of new jobs in the community, improve the financial resources of residents, and create a balanced community that is more resistant to economic downturns.
 - Action Item H-5.2.1: The City shall improve the jobs/housing balance through the development of housing in proximity to jobs and both in proximity to public transportation.
- Policy CD-10: Madera will seek to transition the density and intensity of uses from an urban to rural character while maintaining a clear City edge and establishing a sense of entry and arrival to the City. To implement this policy, the City will: encourage the County of Madera to preserve undeveloped lands outside of the Sphere of Influence; and apply and implement land use designations and open space preservation techniques to create a clearly identifiable edge to the city.
- Policy CD-37: The City shall encourage the on-going conservation, maintenance and upgrading of existing neighborhoods through enforcement of property maintenance codes, requirements of high quality infill development, programs for the rehabilitation of housing, and replacement of deteriorated infrastructure.
- Policy CD-40: The City shall encourage a combination of retail, office, civic, entertainment uses, (e.g. movie and performing arts theaters) in the downtown that serve the daily and occasional needs of all of Madera's residents.
- Policy CD-41: A vertical mix of uses with residential and office above retail is encouraged in the downtown.
- Policy CD-42: The City will focus its facilities Downtown and encourage other publicly oriented uses, such as post offices, governmental offices, meeting halls, community centers, libraries and medical facilities to remain or relocate Downtown.
- Policy CON-39: The City supports the goals of recently adopted Senate Bill 375 and will review this General Plan for consistency with the Sustainable Community Strategy (SCS) to be adopted by the MCTC. The City will consider amendments to the General Plan as it deems appropriate to implement the SCS.

Additional Implementation Actions:

- T-1.1:** Expand the promotion of incentives for new development and renovation of existing uses in identified infill areas.
- T-1.2:** Continue to work with MCTC in updates to the Madera County Blueprint to direct future growth to existing urbanized areas through implementation of smart growth principles and use of toolkit resources identified in the Blueprint.
- T-1.3:** Showcase infill and mixed-use projects on the City's website, in newsletters, or via other mechanisms.

City Cost	City Savings	Private Cost	Private Savings
Low - Medium	None	None	Varies

T-2: Bicycle and Pedestrian Environment

Continue to expand and improve the City's bicycle and pedestrian network.

Objective: Achieve a one percent reduction in light-duty VMT by 2020 and a three percent reduction in light-duty VMT by 2030 as a result of mode shift to bicycling and walking.

2020 Reduction Potential:

1,053 MT CO₂e

2030 Reduction Potential:

3,454 MT CO₂e

Existing and/or Completed Efforts:

- Since 2007, the City installed new bicycle parking at Town and Country Park, completed a bicycle/pedestrian undercrossing on the south bank of the Fresno River beneath Schnoor Avenue Bridge, and completed a bicycle/pedestrian trail from Westberry Avenue to Road 24 (0.45 miles).
- Since 2008, the City has secured four grants totaling \$1,233,431 for sidewalk improvement projects.
- On March 16, 2011, the City readopted the Madera 2004 Regional Bicycle Transportation Plan by Resolution of the City Council.
- Between April 2007 and September 2027, the Measure "T" Program will allocate approximately \$33,779,566 to the City of Madera for Safe Routes to School & Job Programs and \$1,535,435 to the City of Madera for Environmental Enhancement Programs such as bicycle/pedestrian facilities.⁵
- The Vision Madera 2025 Plan includes a strategy to include provisions for expanded pedestrian access within Master Transportation Plan.

General Plan Policies and Actions:

- Policy CD-1: The City of Madera will require that all new development is well-planned and of the highest possible quality. The City will seek to build an image of Madera as a contemporary small city with vibrant, livable neighborhoods and walkable pedestrian- and bicycle- oriented development.
- Policy CD-2: All new development shall adhere to the basic principles of high-quality urban design, architecture and landscape architecture including, but not limited to, human-scaled design, pedestrian orientation, interconnectivity of street layout, siting buildings to hold corners, entryways, gathering points and landmarks.
 - Action Item CD-2.1: Adopt a set of comprehensive Design Guidelines to establish basic design standards and criteria for public and private development projects.
- Policy CD-4: Site layout and building design shall take into consideration Madera's warm, dry climate, by including trees, landscaping and architectural elements to provide shade.
- Policy CD-5: New development shall be approved only if it meets the design principles set forth in this Community Character Element and to any local, project specific, or citywide design guidelines.
- Policy CD-6: The City of Madera will take a leadership role in promoting design excellence by requiring that all City-sponsored projects reflect the highest standards of design.

⁵ Measure "T" was approved by voters of Madera County on the November 7, 2006 ballot, allowing the Madera Transportation Authority to impose a ½ cent retail transaction and use the tax for the next 20 years (between April 1, 2007 and September 30, 2027) to provide funds for road improvements, public transit, and other transportation programs that improve mobility and air quality within the County and each of the cities. The Madera Transportation Authority is responsible for administering the Measure "T" Program in accordance with plans and programs outlined in the Measure T – ½ Cent Transportation Sales Tax Program 2013 Strategic Plan (June 19, 2013).

- Policy CD-7: All new development projects requiring site plan approval, shall establish landscape and façade maintenance programs for the first three years, ensuring that streetscapes and landscapes areas are installed and maintained as approved.
- Policy CD-8: In order to improve and protect the quality of neighborhoods and commercial districts, the City will enforce established building codes and community standards.
 - Action Item CD-8.1: Review and update building codes and inspection procedures, incorporating community maintenance standards and assistance programs as needed.
- Policy CD-15: Except where site conditions make it infeasible, new commercial development shall be designed to front or have a presence along all street frontages. The intent of this policy is to enhance the pedestrian scale of new development, and minimize the presence of parking, circulation, and loading areas as the primary visual features of development.
- Policy CD-19: Create streetscape designs with themes that are oriented toward and inviting to pedestrians and cyclists and that are unique in character to a district, corridor, or area within the City.
- Policy CD-21: Create safe, inviting, and functional pedestrian and cyclist environments in commercial, office, and mixed-use projects through a variety of techniques, including: planting trees to provide shade on pedestrian paths, sidewalks, and walkways; safe, separated pedestrian walkways; safe, visible bicycle parking; and wide sidewalks.
- Policy CD-22: Commercial developments should have public open space areas such as plazas, courtyards, expanded walkways, or other areas suitable for small gatherings. The facilities should be sized proportionate to the scale of the development.
 - Action Item CD-22.1: Amend the Zoning Code to include standards to implement Policy CD-22.
- Policy CD-24: Wherever possible, the City shall use public rights of way and other features (including the Fresno River, utility easements, and drainage ways) as part of a citywide system of off-street walking and bicycling trails. The City will also encourage other agencies to do the same.
- Policy CD-25: Sidewalks shall be provided on both sides of the street in commercial and residential areas, and where appropriate in industrial areas.
- Policy CD-27: Wherever possible, residential subdivisions shall provide vehicular and pedestrian connections to adjacent subdivisions. New residential subdivisions should not be designed as separated from other neighborhoods by walls or other features.
- Policy CD-28: New development projects should be designed on a traditional or curvilinear grid street system. Cul-de-sacs may only be used within the grid so long as the objective of pedestrian and bicycle connectivity is achieved.
- Policy CD-43: The following policies shall apply to all commercial development, and particularly in the Downtown: include human-scale details in the design of buildings such as windows on the street, awnings, and architectural features that create a visually interesting pedestrian environment; include areas designed to create spaces where people can interact and socialize, such as parks, plazas or open air seating in cafes and restaurants, as well as pedestrian amenities such as awnings, pedestrian-scaled lighting, benches and trash cans; street trees shall be incorporated into all development and street improvement projects...
- Policy CD-47: Commercial projects shall be designed to minimize the intrusion of parked vehicles on the streetscape. Parking areas, driveways, and drive-through lanes should not be located between buildings and the sidewalk.
- Policy CD-48: Buildings and building entrances shall be oriented to the pedestrian environment.
- Policy CD-49: Buildings shall include human-scale details such as windows facing the street, awnings, and architectural features that create a visually interesting pedestrian environment.
- Policy CD-50: Parking lots shall be landscaped, including shade trees, to create an attractive pedestrian environment and reduce the impact of heat islands.

- Policy CD-51: Safe and well-defined pedestrian connections from buildings to parking areas, from buildings to the adjoining street(s), and among buildings on the same site shall be provided. Pedestrian connections between commercial development and surrounding residential neighborhoods shall also be provided. Enhanced paving materials or other techniques shall be used to identify pedestrian connections.
- Policy CD-59: Parking for alternative modes of transportation, such as preferential parking for carpool/vanpool, motorcycles or alternative fuel vehicles and bicycles, should be incorporated into parking plans for all significant commercial development projects...
- Policy CI-24: The City shall seek to use a modified grid system for the roadway network, particularly in new development. The City defines a “modified grid” road system as follows...Residential blocks shall be designed to limit traffic speeds and encourage pedestrian and bicycle safety through the design of the roadways or the use traffic calming measures (such as narrower streets)...
- Policy CI-27: The City shall encourage pedestrian circulation and access around the City and at the neighborhood level through the design of roadways and pedestrian facilities.
 - Action Item CI-27.1: Expand the availability and visibility of bicycle infrastructure such as bike racks and bike storage facilities.
 - Action Item CI-27.2: Consider opportunities for lower-income individuals to have access to bicycles, through community-sponsored programs such as “bicycle sharing” or bicycle giveaways to children.
- Policy CI-28: New development areas shall include pedestrian and bicycle facilities and connections to public transit systems, commercial centers, schools, employment centers, community centers, parks, senior centers, and high-density residential areas.
 - Action Item CI-28.1: Establish a transit and/or multimodal impact fee to be applied to new development to fund public transit infrastructure and other multimodal accommodations.
- Policy CI-29: The City shall create a connected system of on- and off-street trails and paths for pedestrians and bicycles throughout Madera in both existing and new development areas, with a focus on on-street bike trails on collector roads, and off-street trails in parkways and along the Fresno River and other waterways.
- Policy CI-30: Where it deems appropriate, the City may require the dedication of additional right of way to accommodate pedestrian, bicycle, alternative transportation (transit), additional travel lanes, safety or efficiency-related improvements, or other similar uses.
- Policy CI-31: The City’s roadway cross-sections shall incorporate “complete streets” concepts and be designed to safely accommodate vehicles, cyclists, pedestrians, diverse and disabled users, and transit. “Complete streets” are defined as streets that are designed for a variety of users rather than having a focus on the automobile.
 - Action Item CI-31.1: Develop “Complete Street” standards for new arterial, collector, and local street construction. Complete street” standards should include options for narrower travel way widths (on existing streets only, where needed to fit all uses into the existing right of way) and curb return radii, bike lanes, landscape strips, sidewalks that complement adjacent land uses, bus turnouts, and similar features.
- Policy CI-32: To maintain walkability and pedestrian safety, the City shall consider roadway width and roadway design features such as islands, pedestrian refuges, count down timers, and other such mechanisms. This policy applies to new roadway construction and existing roadways where pedestrian hazards may occur due to roadway design or width.
 - Action Item CI-32.1: Update the City’s Standards and Specifications to include the items in Policy CI-32.
- Policy CI-33: The needs of pedestrians and bicyclists shall be routinely considered and, where practical, accommodated in all roadway construction and renovation projects.
- Policy CI-34: Where sufficient right-of-way is available, bicycle lanes should be added to City roadways when repaving or upgrading of the roadway occurs, provided that the bicycle facility

would implement the City's Bicycle Master Plan. The City shall encourage Caltrans to follow these same guidelines on state highways in Madera.

- Action Item CI-34.1: The City shall implement the Bicycle Master Plan through repaving, restriping, providing additional paving for bicycle lanes, or other methods as appropriate.
- Policy CI-35: The City shall encourage grade-separated crossings or enhanced at grade crossings where Class I bicycle facilities intersect arterial roadways at key locations to maximize the safety and attractiveness of bicycling and walking routes. Underpasses are preferable to overpasses in new development areas.
- Policy CI-36: The City shall encourage an increase in bicycle ridership and pedestrian trips over automobile traffic, as a way to improve traffic safety, air quality and the health of Madera residents.
- Policy CI-41: Circulation planning for all modes of travel (vehicle, transit, bicycle, pedestrian, etc.) shall be coordinated with efforts to reduce air pollution and greenhouse gases.
- Policy CI-50: The City shall establish a transit and/or multimodal impact fee to be applied to new development to fund public transportation infrastructure and other multimodal accommodations.
- Policy SUS-2: The City shall work with the Madera Unified School District to coordinate the planning of future land use and school facilities and will encourage the District to identify school site locations and routes that are safe for children to walk or bike to school (also known as "Safe Routes to School").
 - Action Item SUS-2.1: Work with the Madera Unified School District to help the District identify and plan for the construction of all roads, sidewalk, and other infrastructure improvements needed for new schools, and that these improvements are in place at the time the school opens.

Additional Implementation Actions:

- T-2.1:** Continue to pursue public and private funding to expand and link the City's bicycle and pedestrian network in accordance with the General Plan and Bicycle Master Plan.
- T-2.2:** Develop policies and minimum design criteria for bicycle and pedestrian circulation in new residential development and implement through the development review process. Require the installation of adequate and secure bicycle parking at all new multi-family residential, commercial, governmental, and recreational locations throughout the City.
- T-2.3:** Collaborate with law enforcement, school officials, and private organizations to encourage public bicycle safety programs.

City Cost	City Savings	Private Cost	Private Savings
Low – Medium	None	None	Varies

T-3: Transit Travel

Continue to expand and improve the transit network and its accessibility within the City of Madera.

Objective: Achieve a two percent increase in service population transit ridership by 2020 and a four percent increase by 2030. This equates to an approximately two percent reduction in passenger vehicle VMT in 2020 and four percent reduction in 2030.

2020 Reduction Potential:

2,404 MT CO₂e

2030 Reduction Potential:

4,757 MT CO₂e

Existing and/or Completed Efforts in Support of Measure:

- During 2010, the City used grant funding from the CARB to fund the distribution of approximately 800 free monthly bus passes.
- In 2012, the City installed 40 new bus shelters.
- Between April 2007 and September 2027, the Measure “T” Program will allocate approximately \$1,535,435 to the City of Madera for Transit Enhancement Programs including route expansions, night and weekend service, bus shelters and other capital improvements, safer access to public transit, carpools, and American Disabilities Act, senior and paratransit programs.

General Plan Policies and Actions:

- Policy CI-1: The City will implement this Circulation Master Plan through the policies contained in this and other Elements of the Madera General Plan.
 - Action Item CI-1.2: Prepare and adopt a comprehensive transit plan to complement the development of Village Centers and provide transit service throughout Madera. The plan should include: feasibility of BRT [bus rapid transit] facilities and guidelines for system development as appropriate; residential, retail and employment thresholds and service targets for BRT and pedestrian village cores; and Other transit use enhancements such as additional buses, new routes, longer hours, greater headways, real-time boarding information, bus turn out lanes, queue jump lanes, exclusive transit lane improvement alignment, mixed flow/exclusive lane use, and "Express Bus" service for commuters.
- Policy CI-28: New development areas shall include pedestrian and bicycle facilities and connections to public transit systems, commercial centers, schools, employment centers, community centers, parks, senior centers, and high-density residential areas.
 - Action Item CI-28.1: Establish a transit and/or multimodal impact fee to be applied to new development to fund public transit infrastructure and other multimodal accommodations.
- Policy CI-30: Where it deems appropriate, the City may require the dedication of additional right of way to accommodate pedestrian, bicycle, alternative transportation (transit), additional travel lanes, safety or efficiency-related improvements, or other similar uses.
- Policy CI-31: The City’s roadway cross-sections shall incorporate “complete streets” concepts and be designed to safely accommodate vehicles, cyclists, pedestrians, diverse and disabled users, and transit. “Complete streets” are defined as streets that are designed for a variety of users rather than having a focus on the automobile.
 - Action Item CI-31.1: Develop “Complete Street” standards for new arterial, collector, and local street construction. Complete street” standards should include options for narrower travel way widths (on existing streets only, where needed to fit all uses into the existing right of way) and curb return radii, bike lanes, landscape strips, sidewalks that complement adjacent land uses, bus turnouts, and similar features.
- Policy CI-41: Circulation planning for all modes of travel (vehicle, transit, bicycle, pedestrian, etc.) shall be coordinated with efforts to reduce air pollution and greenhouse gases.
- Policy CI-50: The City shall establish a transit and/or multimodal impact fee to be applied to new development to fund public transportation infrastructure and other multimodal accommodations.
- Policy H-5.3: The City shall promote residential development patterns that protect and improve air quality through alternative modes of transportation...
 - Action Item H-5.3.1: The City shall enhance community livability by promoting:
 - Opportunities for transit use including improved bus access and enhanced walking and biking facilities.
 - Increased connectivity between residential and non-residential uses (i.e., commercial, industrial, and institutional uses). Encourage residential project sites to be designed to increase the convenience, safety, and comfort of people using

public transportation, walking, or cycling and coordinate with transit providers to ensure that transit routes are in proximity to high density housing sites.

- Policy CD-59: Parking for alternative modes of transportation, such as preferential parking for carpool/vanpool, motorcycles or alternative fuel vehicles and bicycles, should be incorporated into parking plans for all significant commercial development projects. Transit plazas may be required to be incorporated into significant projects.

Additional Implementation Actions:

- T-3.1:** Through the development review process, require new development to provide safe routes to adjacent transit stops, where applicable, and to finance and/or construct bus turnouts and shelters adjacent to new projects where transit demand warrants such improvements.
- T-3.2:** Promote and encourage businesses to provide public transit vouchers as a benefit of employment.

City Cost	City Savings	Private Cost	Private Savings
Low	None	None	Varies

T-4: Commute Trip Reduction

Facilitate programs that give commuters and employers resources and incentives to reduce their single-occupancy vehicle trips.

Objective: Achieve a five percent decrease in commute trip VMT by 2020 and an eight percent decrease in commute trip VMT by 2030.

Existing and/or Completed Efforts:

- Between April 2007 and September 2027, the Measure "T" Program will allocate approximately \$1,535,435 to the City of Madera for Environmental Enhancement Programs such as car/van pools.

2020 Reduction Potential:

1,188 MT CO₂e

2030 Reduction Potential:

1,977 MT CO₂e

General Plan Policies and Actions:

- Policy CD-59: Parking for alternative modes of transportation, such as preferential parking for carpool/vanpool, motorcycles or alternative fuel vehicles and bicycles, should be incorporated into parking plans for all significant commercial development projects.
- Policy CI-37: The City encourages the use of ridesharing and other TDM tactics for reducing area traffic congestion and improving air quality.
- Policy CI-42: The City will facilitate employment opportunities that minimize the need for private vehicle trips, including:
 - Incorporating provisions for live/work sites and satellite work centers in appropriate locations in the Zoning Ordinance; and
 - Encouraging telecommuting options with new and existing employers through project review and incentives, as appropriate.
- Policy SUS-15: The City shall seek to promote, attract, and retain jobs that pay a living wage and reduce the need for residents to commute to work outside the City.

Additional Implementation Actions:

- T-4.1:** Provide targeted marketing and promotion of commute trip reduction programs to employers such as the SJVAPCD Vanpool Voucher Incentive.
- T-4.2:** Provide information on, and links to, vanpool programs and employer services available to local residents/ on the City's website.
- T-4.3:** Provide information on and promote existing employer based TDM programs as part of the business licensing and renewal process.

City Cost	City Savings	Private Cost	Private Savings
Low - Medium	None	None	Varies

T-5: Traffic Flow and Vehicle Idling

Implement improvements to smooth traffic flow, reduce idling, and eliminate bottlenecks within Madera.

Objective: Achieve a 10 percent reduction in vehicle idling in 2020 and a 13 percent reduction in 2030.

Existing and/or Completed Efforts:

- Since 2007, the City synchronized six traffic signals over a half mile in a high traffic area.

2020 Reduction Potential:

265 MT CO₂e

2030 Reduction Potential:

401 MT CO₂e

General Plan Policies and Actions:

- Policy CI-3: The following are general descriptions of the roadway types shown on the Circulation Master Plan:
 - Madera Loop: This is a system of arterial streets intended to provide for easy intra-city travel by providing links along the perimeter to the city to the Freeway 99 corridor. To help speed the flow of traffic and improve safety, direct access to the Madera Loop is more restricted than on other arterial roadways and interruptions such as signals will be reduced compared to other arterial roadways.
 - Arterials, Collectors, and Local/Branch Collectors: ...To reduce traffic interruptions and improve safety, direct access via driveways is generally not permitted...
- Policy CI-19: The City may consider roundabouts as an alternative to stop-sign control or traffic signals where applicable.
- Policy CI-22: The City shall seek to maintain Level of Service (LOS) C at all times on all roadways and intersections in Madera.
 - Action Item CI-22.1: Consider, during the review of proposed development projects, how to shift travel demand away from the peak period, especially in those situations where peak traffic problems result from a few major generators (e.g. outlying employment locations).
 - Action Item CI-22.2: Perform routine, ongoing evaluation of the efficiency of the urban street traffic control system, with emphasis on traffic signal timing, phasing and coordination to optimize traffic flow along arterial corridors. Use traffic control systems to

- balance arterial street utilization (e.g., timing and phasing for turn movements, peak period and off-peak signal timing plans).
 - Action Item CI-22.3: As funding allows, expand traffic signal timing and synchronization programs where emission reduction benefits can be demonstrated.
- Policy CI-24: The City shall seek to use a modified grid system for the roadway network, particularly in new development...

Additional Implementation Actions:

- T-5.1:** Continue to improve traffic flow and reduce vehicle idling through actions such as synchronized signals and other traffic flow management techniques.

City Cost	City Savings	Private Cost	Private Savings
None	None	None	Varies

T-6: Low Carbon Fuel Vehicles and Infrastructure

Increase the availability of alternative fuel infrastructure to increase the number of alternative fuel vehicles.

Objective: Achieve a two and a half percent reduction in light-duty vehicle emissions in 2020 and a six percent reduction in 2030. Achieve a switch of six percent of heavy-duty vehicles to alternative fuels (e.g., CNG) by 2020 and 15 percent switch to alternative fuels by 2030.

2020 Reduction Potential:

4,255 MT CO₂e

2030 Reduction Potential:

11,061 MT CO₂e

Existing and/or Completed Efforts:

- None at this time.

General Plan Policies and Actions:

- Policy CD-59: Parking for alternative modes of transportation, such as preferential parking for carpool/vanpool, motorcycles or alternative fuel vehicles and bicycles, should be incorporated into parking plans for all significant commercial development projects...
- Policy CON-33: The City shall encourage the development of fueling stations that distribute alternative fuels (such as methanol, ethanol, CNG, biodiesel) to support alternative fuel vehicles.
 - Action Item CON-33.1: Update the City's Building and Zoning Codes as needed to provide for fueling stations for alternative fuels as defined in Policy CON-33.
 - Action Item CON-33.2: Consider the adoption of an incentive program for fueling stations for alternative fuels as defined in Policy CON-33.

Additional Implementation Actions:

- T-6.1:** Implement key recommendations from the San Joaquin Valley Plug-in Electric Vehicle (PEV) Readiness Plan, as they pertain to Madera.
- T-6.2:** Develop an alternative fuel resources page on the City's website that provides information on and links to technical guides, funding opportunities, existing financial incentives, fueling station locations, permitting and siting.

T-6.3: Seek grant funding to install alternative fueling stations for public use.

City Cost	City Savings	Private Cost	Private Savings
Low – Medium	None	None	Varies

T-7: Construction and Off-Road Equipment

Reduce GHG emissions associated with construction equipment and off-road vehicles.

Objective: By 2020, five percent of construction vehicles/equipment utilizes new technologies (i.e., repowered engines, electric drive trains), CARB-approved low carbon fuel, or are electrically-powered. By 2030, 10 percent of construction vehicles/equipment utilizes new technologies, CARB-approved low carbon fuel, or are electrically-powered. Achieve a 15 percent reduction in lawn and garden equipment and associated GHG emissions in 2020 and 30 percent reduction in 2030 as a result of low-maintenance landscaping.

2020 Reduction Potential:

135 MT CO₂e

2030 Reduction Potential:

584 MT CO₂e

Existing and/or Completed Efforts:

- The City specifies that all construction equipment shall be tuned and maintained in accordance with the manufacturer's specifications and that work crews shall shut off construction equipment when not in use.

General Plan Policies and Actions:

- None.

Additional Implementation Actions:

- T-7.1:** Provide information on and promote existing financial incentives, such as those offered by the SJVAPCD, to replace or repower in-use, off-road vehicles and equipment.
- T-7.2:** Promote the installation of low-maintenance native landscaping, xeriscaping, and turf removal (e.g., via the City's website or through education workshops) to reduce landscape maintenance equipment usage.

City Cost	City Savings	Private Cost	Private Savings
Low	None	None	Varies

3.5 Water and Wastewater Measures

The conveyance, treatment, and distribution of water can result in significant GHG emissions depending on the water source, distances and topography traversed in conveyance, and the treatment processes that occur before and after the end-use phase. Water usage in Madera resulted in 2,840 MT CO₂e of emissions in 2007.

Emissions from wastewater are generated from the energy needed to convey and treat wastewater as well as emissions of methane and nitrous oxide generated during the process of wastewater treatment. Emissions from wastewater in Madera totaled 695 MT CO₂e in 2007.

Emissions from water and wastewater use can decrease by reducing overall water consumption and by improving wastewater treatment plant processes to reduce and capture GHG emissions. The water and wastewater measures listed in **Table 3-5** focus on these strategies and have the potential to reduce Madera's GHG emissions by 720 MT CO₂e by 2020 and by 988 MT CO₂e by 2030.

Co-Benefits of Water and Wastewater Measures

The water and wastewater measures in this section will not only help reduce GHG emissions, but also provide multiple benefits to the community. These include:

- Reduced costs
- Improved air quality
- Reduced water consumption
- Reduced energy consumption
- Improved public health

TABLE 3-5 WATER AND WASTEWATER GHG REDUCTIONS BY MEASURE

Measure Number	Measure	2020 GHG Reduction (MT CO ₂ e)	2030 GHG Reduction (MT CO ₂ e)
W-1	Exceed SB x7-7 Water Conservation Target	494	653
W-2	Recycled Water	68	165
W-3	Wastewater Treatment Plant Upgrades	158	170
Water and Wastewater Total		720	988

W-1: Exceed SB X7-7 Water Conservation Target

Adopt a water conservation target that exceeds the SB X7-7 (Water Conservation Act of 2009) target and identify and implement additional water efficiency and conservation measures to meet those targets by 2020 and 2030.

Objective: Exceed SBX7-7 water conservation target by five percent in 2020 and eight percent in 2030.

2020 Reduction Potential:

494 MT CO₂e

2030 Reduction Potential:

653 MT CO₂e

Existing and/or Completed Efforts:

- The City's Urban Water Management Plan (2010) outlines a number of water demand management programs that are currently being implemented, such as free water audits to residential customers to identify sources of water waste, educate customers, and suggest control measures; landscape irrigation programs; residential plumbing retrofits; education programs; and others. Since 2007, 900 water conservation kits were distributed at the City's Finance Department that contained low flow aerator shower heads, a toilet tummy bag (when installed, displaces water in the toilet's tank), and leak detection dye tablets.
- As part of the normal plan check process, the City reviews project plans and specifications to ensure that sound water conservation practices are considered as part of the designs.
- The City enforces water waste restrictions through its Conservation Water Patrols and a series of escalating penalties for violations.
- The City requires the installation of automated water meter reading (AMR) devices for all new service connections and is in the process of retrofitting all existing service connections within the city.
- The City updated its water and sewer rate structure to charge customers based on the actual amount of water used.
- The City Council approved a water conservation program focused on the installation of low flow toilets and low flow washing machines. Each utility customer received a \$100 credit for each water-wasting toilet and washing machine replaced with a low flow toilet or washing machine. The program resulted in the installation of 54 low flow toilets and 24 low flow washing machines.
- The Vision Madera 2025 Plan includes action items to complete the following:
 - Increase water-usage monitoring through meter reading and water-patrol to increase conservation.
 - Encourage water conservation that develops and utilizes landscape and irrigation standards including programs such as: xeriscaping landscaping, mulching, "smart clocks", check valves, and micro-spray systems.

General Plan Policies and Actions:

- Policy CON-2: The City supports the consideration and implementation of a broad range of strategies to ensure the long-term sustainability of its water supply, including strategies related to conservation, reclamation, recharge, and diversification of supply.
- Policy CON-5: To reduce the need for groundwater, the City encourages water conservation and the use of reclaimed water.
 - Action Item CON-5.1: Establish a baseline of per-capita water use and continue to monitor use.
 - Action Item CON-5.2: Develop regulations and programs to encourage water conservation through means such as establishing tiered rate structures for water use, updating the

appropriate City codes to provide performance standards for irrigation equipment and water fixtures, establishing water-friendly landscaping requirements and watering limitations, etc. Continue to monitor the effectiveness of these regulations and programs and refine them as needed.

- Action Item CON-5.3: Develop a program to accelerate the City's water meter installation program to reach the goal of installation of meters for all customers before the current 2025 deadline.
- Policy CON-44: The City supports the use of green building practices in the planning, design, construction, management, renovation, operations, and demolition of all private buildings and projects, including: water conservation indoors and outdoors; selection of materials based on recyclability, durability and the amount of energy used to create the material; waste reduction, reuse and recycling during construction and throughout the life of the project; other new aspects of green design and construction included in LEED or other certification programs; control nighttime lighting to lower energy use...
 - Action Item CON-44.1: Develop a voluntary, market-driven Green Building Program that includes performance standards, guidelines, review criteria, incentives, and implementation schedules for private sector development, with criteria tailored to project types (i.e., residential, commercial, retail), size, and location.
 - Action Item CON-44.2: Identify, evaluate, and provide incentives to encourage projects that incorporate green building practices and site design, including the potential for certification through the City's Building Department.
 - Action Item CON-44.3: Facilitate the professional development and education of City staff to learn about green building practices and to have the tools to evaluate development proposals.
 - Action Item CON-44.4: Offer information, technical assistance, and training to promote green building to property owners, building, design, and planning professionals, school districts, and special districts.

Additional Implementation Actions:

- W-1.1:** Develop, promote, and/or help implement additional water conservation and efficiency programs (e.g., water efficiency audits, point-of-sale replacement/retrofit programs, etc.).
- W-1.2:** Conduct additional outreach and promotional activities targeting specific groups within the community (e.g., homeowners, renters, businesses, income-qualified households, etc.).
- W-1.3:** Offer water efficiency classes or workshops where community members can learn techniques to incorporate water efficient retrofits and landscaping into homes and businesses.
- W-1.4:** Consider implementation of a tiered rate structure to encourage a reduction in community water usage.

City Cost	City Savings	Private Cost	Private Savings
Low - Medium	None	None	Varies

W-2: Recycled Water

Expand opportunities for the use of recycled water within the community.

Objective: Expand recycled water use in the community to five percent of total water usage by 2020 and 10 percent by 2030.

Existing and/or Completed Efforts:

- The Vision Madera 2025 Plan includes action items to complete the following:
 - Examine and implement technologies that recirculate and reuse existing water resources, such as planned reuse of 100 percent of the wastewater treatment plant output.

General Plan Policies and Actions:

- Policy CI-54: The City supports the use of reclaimed water for irrigation wherever feasible.
- Policy CON-2: The City supports the consideration and implementation of a broad range of strategies to ensure the long-term sustainability of its water supply, including strategies related to conservation, reclamation, recharge, and diversification of supply.
- Policy CON-5: To reduce the need for groundwater, the City encourages water conservation and the use of reclaimed water.
 - Action Item Con-5.4: Work with wastewater system operators and other potential partners to identify and implement programs for reuse of treated wastewater, particularly in landscaping, irrigation, parks, and public facilities.
- Policy CON-6: Where feasible, the installation of pipelines in new development to carry existing or future supplies of reclaimed water for irrigation and other uses shall be required.
 - Action Item CON-6.1: Consider adoption of standards and requirements for the installation of plumbing systems for recycled water (e.g., “purple pipe”).
- Policy CON-7: The City encourages the use of gray water systems, and other water re-use methods in new development and renovation projects as consistent with state and local water quality regulations.
 - Action Item CON-7.1: Establish criteria and standards to permit the safe and effective use of gray water (on-site water recycling) that do not compromise public health and safety, and revise existing city codes that may unnecessarily inhibit the use of gray water systems.

Additional Implementation Actions:

- W-2.1:** Promote financial incentives, such as very low interest financing for water recycling projects offered by the State Water Board’s Division of Financial Assistance, to encourage private water recycling.
- W-2.2:** Provide and promote technical assistance and guidelines for water reuse.
- W-2.3:** Educate the community on graywater and rainwater recycling for irrigation.

2020 Reduction

Potential:

68 MT CO₂e

2030 Reduction

Potential:

165 MT CO₂e

City Cost	City Savings	Private Cost	Private Savings
Low - Medium	None	None	Varies

W-3: Wastewater Treatment Plant Upgrades

Increase methane capture and reduce nitrous oxide emissions associated with wastewater treatment.

Objective: Achieve a 50 percent reduction in methane and nitrous oxide emissions and 10 percent reduction in energy use associated with emissions from treatment of the City's wastewater.

2020 Reduction Potential:
158 MT CO₂e

2030 Reduction Potential:
170 MT CO₂e

Existing and/or Completed Efforts:

- In 2007, the Wastewater Treatment Plant was upgraded with the installation of three oxidation ditches and four secondary clarifiers, which replaced the original trickling filters.
- In 2011, the influent mechanical screens at the headworks were replaced.

General Plan Policies and Actions:

- Policy CON-43: The City will install renewable energy systems at its facilities where feasible, including solar collection systems at municipal properties and waste-to-energy (methane recovery) systems at the waste water treatment plant.

Additional Implementation Actions:

- W-3.1:** Continue to install solar systems at the wastewater treatment plant to provide a mean for running blowers and other equipment at maximum effectiveness for reducing nitrous oxide emissions, without generating more carbon emissions.
- W-3.2:** Closely manage flow rates to identify ways to enable the process to function more efficiently, lowering the production of nitrous oxide.

City Cost	City Savings	Private Cost	Private Savings
Very Low	Low	None	None

3.6 Solid Waste Measure

As solid waste decomposes in landfills, it releases methane, a GHG 21 times more potent than carbon dioxide. In 2007, the solid waste sector generated approximately 12,973 MT CO₂e.

Waste management is an important action that the community can take to reduce GHG emissions. Waste management can be achieved by reducing the amount of trash and other waste that is discarded; reusing containers, products, and building materials; and recycling as many materials as possible, including green waste and construction materials. The solid waste measure listed in **Table 3-6** focuses on waste management and has the potential to reduce Madera's GHG emissions by 4,230 MT CO₂e by 2020 and by 5,921 MT CO₂e by 2030.

Co-Benefits of Solid Waste Measure

In addition to reducing GHG emissions, the solid waste measure described in this section has the potential to provide other important benefits to the community. These include:

- Cost savings
- Improved air quality
- Reduced solid waste generation
- Resource conservation

TABLE 3-6 SOLID WASTE GHG REDUCTIONS BY MEASURE

Measure Number	Measure	2020 GHG Reduction (MT CO ₂ e)	2030 GHG Reduction (MT CO ₂ e)
S-1	Solid Waste Reduction and Recycling	4,230	5,921
Solid Waste Total		4,230	5,921

S-1: Solid Waste Reduction and Recycling

Increase recycling, composting, source reduction, and education efforts in Madera to reduce the amount of solid waste sent to landfills.

Objective: Reduce community solid waste by 25 percent in 2020 and 35 percent in 2030. This is equivalent to landfilling no more than 48,115 tons of solid waste in 2020 and 55,139 tons in 2030. Please note, the Madera community generated 49,194 tons of solid waste in 2007; this amount declined to 42,308 tons in 2013.

2020 Reduction Potential:

4,230 MT CO₂e

2030 Reduction Potential:

5,921 MT CO₂e

Existing and/or Completed Efforts:

- In 2008, the City launched a “blue can” curbside recycling system, making it easier for residents to recycle paper, bottles, cans, and other recyclables.
- The City provides blue containers for residential curbside weekly collection of recyclable items at no charge.
- Businesses that generate four cubic yards or more of commercial solid waste per week must institute a recycling program per AB 341.
- The City has a Construction and Demolition Recycling Ordinance that requires construction or demolition projects that will generate eight or more cubic yards of material by volume to recycle a minimum of 50 percent of the debris from the project site. Project applicants must submit a Debris Management Report form to the Solid Waste Department to demonstrate compliance.
- In 2013, the City’s Solid Waste Contractor added food waste composting to the existing green waste composting process.
- The City provides information about solid waste reduction programs, tips, and opportunities on its website.
- The City conducts random audits and tracks additional containers.
- E-waste programs are in place for recycling electronic waste. The City worked with Madera County to develop a receiving facility at the County landfill for electronic waste.
- The Madera Recycling Market Development Zone (RMDZ) program provides attractive loans, tax incentives, fast tract permitting and site review, technical assistance and free product marketing to businesses that use materials from the waste stream for their manufacturing.

General Plan Policies and Actions:

- Policy CI-62: The City will promote solid waste source reduction, reuse, recycling, composting and environmentally-safe transformation of waste. The City will seek to comply with the requirements of AB 939 with regard to meeting state-mandated targets for reductions in the amount of solid waste generated in Madera.
 - Action Item CI-62.1: The City shall provide information to businesses and residents on available options to implement waste reduction targets. Other actions may include: actively promoting a comprehensive, consistent, and effective recycled materials procurement effort among other governmental agencies and local businesses; and encouraging all companies that do business in Madera to recycle and reuse construction scraps, demolition materials, concrete, industrial waste, and green waste.
- Policy CI-64: The City supports efforts to provide solid waste resource recovery facilities and household hazardous waste collection facilities convenient to residences, businesses, and industries.

- Policy CI-65: The City will promote waste diversion and material recycling in private development, business and operations, and will encourage businesses or nonprofit entities to provide source reduction services.
- Policy CON-44: The City supports the use of green building practices in the planning, design, construction, management, renovation, operations, and demolition of all private buildings and projects, including: water conservation indoors and outdoors; selection of materials based on recyclability, durability and the amount of energy used to create the material; waste reduction, reuse and recycling during construction and throughout the life of the project; other new aspects of green design and construction included in LEED or other certification programs; control nighttime lighting to lower energy use...
 - Action Item CON-44.1: Develop a voluntary, market-driven Green Building Program that includes performance standards, guidelines, review criteria, incentives, and implementation schedules for private sector development, with criteria tailored to project types (i.e., residential, commercial, retail), size, and location.
 - Action Item CON-44.2: Identify, evaluate, and provide incentives to encourage projects that incorporate green building practices and site design, including the potential for certification through the City's Building Department.
 - Action Item CON-44.3: Facilitate the professional development and education of City staff to learn about green building practices and to have the tools to evaluate development proposals.
 - Action Item CON-44.4: Offer information, technical assistance, and training to promote green building to property owners, building, design, and planning professionals, school districts, and special districts.

Additional Implementation Actions:

- S-1.1:** Continue to enhance community understanding of resource recovery and waste management programs.

City Cost	City Savings	Private Cost	Private Savings
Very Low – Low	None	None	None

3.7 Urban Greening Measure

Trees and other vegetation absorb and capture the GHG carbon dioxide from the atmosphere in a process called carbon sequestration. By maintaining a healthy urban forest, prolonging the life of trees, and continually increasing the number of trees, Madera can increase its net carbon storage over the long term. Trees and other vegetation also reduce local air and surface temperatures by shading buildings, streets, and sidewalks.

The urban greening measure listed in Table 3-7 has the potential to reduce Madera's GHG emissions by 34 MT CO₂e by 2020 and by 68 MT CO₂e by 2030.

Co-Benefits of Urban Greening Measure

In addition to reducing GHG emissions, the urban greening measure described in this section has the potential to provide other important benefits to the community. These include:

- City beautification
- Increased property values
- Improved air quality
- Improved water quality
- Improved public health
- Reduced surface and air temperatures
- Reduced energy usage and associated costs
- Reduced noise pollution

TABLE 3-7 URBAN GREENING GHG REDUCTIONS BY MEASURE

Measure Number	Measure	2020 GHG Reduction (MT CO ₂ e)	2030 GHG Reduction (MT CO ₂ e)
U-1	Trees and Vegetation	34	68
Urban Greening Total		34	68

U-1: Trees and Vegetation

Facilitate planting of drought-tolerant, low-maintenance native trees and vegetation in Madera.

Objective: Plant 600 new trees and three new acres of vegetated land in the community by 2020 and an additional 600 trees and three acres of vegetated land by 2030 (total of 1,200 trees and six acres vegetated land by 2030).

2020 Reduction

Potential:

34 MT CO₂e

2030 Reduction

Potential:

68 MT CO₂e

Existing and/or Completed Efforts:

- The City has an Approved Tree List which is published on its website.
- The Madera Vision 2025 Plan includes action items to:
 - Develop Master Tree Plan to include City-Approved Tree List. Master Tree Plan to provide inventory of City Forest including tree type, condition and size.
 - Integrate the Tree Master Plan as an element of streetscape maintenance.
 - Consider the establishment of Tree Canopy Standards and shading requirements.
- In addition to perimeter landscape areas, the City requires five percent of all parking areas to be landscaped.
- The City requires all landscape areas in new development to be planted so as to have at least 75 percent vegetative coverage within three years of planting.
- The City has applied for and received a number of grants to plant trees within the community.
- In 2010, a tree planting event was held in conjunction with the national "Make a Difference Day" using trees and materials from the CommuniTrees planting grant project.

General Plan Policies and Actions:

- Policy CD-26: Street trees shall be planted in a parkway strip on all residential streets.
- Policy CD-43: The following policies shall apply to all commercial development, and particularly in the Downtown...street trees shall be incorporated into all development and street improvement projects...
- Policy CD-50: Parking lots shall be landscaped, including shade trees, to create an attractive pedestrian environment and reduce the impact of heat islands.
- Policy CON-10: The City will evaluate existing landscaping and options to convert reflective and impervious surfaces to landscaping, and will, as feasible, install or replace vegetation with drought-tolerant, low-maintenance native species that can also provide shade and reduce heat-island effects.
- Policy CON-31: The City seeks to reduce the urban heat island effect in the City, which causes increased temperatures and increases in ground level ozone formation through methods such as: increasing the amount of tree coverage in the city...
 - Action Item CON-31.1: Develop and adopt a tree ordinance that protects existing trees in the public right of way and promotes the establishment of new tree resources in public areas, including the placement of trees in parkway strips to allow shading of streets. The tree ordinance could establish a City-approved tree-planting list and provide for the creation of a Master Tree Plan that would include an inventory of trees in public areas, including tree type, condition and size.
- Policy CD-4: Site layout and building design shall take into consideration Madera's warm, dry climate, by including trees, landscaping and architectural elements to provide shade.

- Policy CD-7: All new development projects requiring site plan approval, shall establish landscape and façade maintenance programs for the first three years, ensuring that streetscapes and landscapes areas are installed and maintained as approved.
- Policy CI-26: Projects providing significantly more than the required amount of parking shall be allowed only when the City determines that there is a demonstrated need for additional parking.
 - Action Item CI-26.1: Amend parking and other standards in the Zoning Code to reflect a balance between the need for parking and the desire of the City to achieve its goals regarding efficient land utilization, walkability, and increased opportunities to create additional space for landscaping and other amenities.

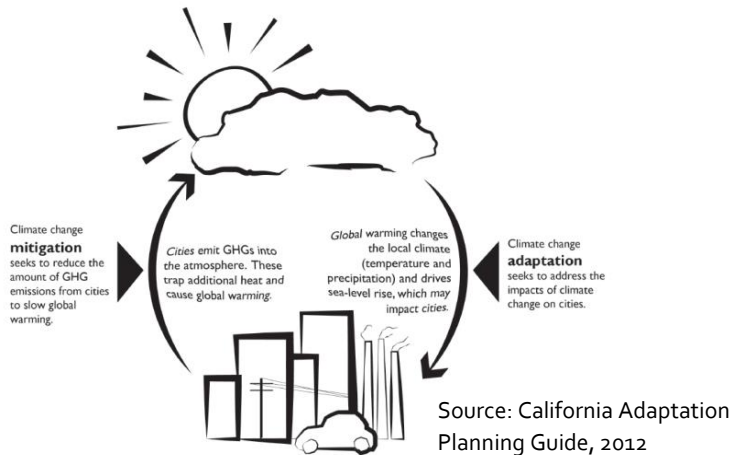
Additional Implementation Actions:

- U-1.1:** Continue to identify and secure funding to enhance the urban forest within Madera.
- U-1.2:** Develop a program to facilitate voluntary tree planting and inventorying within the community, working with non-profit organizations and/or community partners.
- U-1.3:** Amend parking standards to limit over-parking and balance parking needs against other City goals, including creating additional space for landscaping to reduce the impact of heat islands.

City Cost	City Savings	Private Cost	Private Savings
Very Low	None	None	Varies

3.8 Adaptation Measures

Two types of responses to climate change are available: mitigation and adaptation. The previous focus areas have primarily addressed reducing GHG emissions to help limit future climate change. This section addresses adaptation, or preparing for and managing risk associated with climate change effects.



Chapter 1.0, Introduction, describes the potential climate change effects that Madera could expect based on current science and understanding, which include an increase in average annual temperature and heat waves, a decrease in the consistent supply of fresh water, increased risk of wildfires, negative impacts on biodiversity, and an increased risk to public health. The adaptation measures provide a basic framework for integrating climate change risk assessment and management into current planning processes. Where appropriate, the adaptation measures also highlight GHG reductions measures from other sections of the CAP that also contribute to adaptation.

How is climate adaptation related to hazard mitigation planning?

Natural hazard impacts are only one area that may be affected by climate change. Other areas that may be affected include agricultural, forestry, and fisheries productivity; ecosystem structure and function; and public health. Planning in all of these areas should be done in light of potential climate change impacts. For local hazard mitigation plan development, climate change should be incorporated into the assessment of hazards risk. Ideally, measures identified in the hazard mitigation plan would address both current hazards needs and future climate-change affected hazards.

TABLE 3-8 IMPACTS OF CLIMATE CHANGE

Primary Impact	Associated Secondary Impacts
Changed temperature and/or precipitation patterns	Changed seasonal patterns, intense rainstorms
Increased temperature	Heat wave
Wildfire	Landslide
Increased temperature/reduced precipitation	Heat wave, drought, wildfire, reduced snowpack

Source: California Adaption Planning Guide, 2012

A-1: Climate Change Vulnerability

Identify and periodically reassess regional climate change vulnerabilities.

Existing and/or Completed Efforts:

- None at this time.

General Plan Policies and Actions:

- CON-38: The City shall partner with local agencies and organizations to coordinate outreach and education regarding the effects of GHG emissions and climate change.

Additional Implementation Actions:

- A-1.1:** Participate in inter-agency and or inter-jurisdictional meeting and planning activities to periodically reassess projected climate change impacts and vulnerabilities.
- A-1.2:** Incorporate discussions of anticipated climate change impacts, risks, and adaptation strategies into relevant City plans.

City Cost	City Savings	Private Cost	Private Savings
Very Low	None	None	None

A-2: Public Health and Safety

Prepare for the anticipated climate change effects on public health and populations that may bear a disproportionate burden of anticipated climate change effects.

Existing and/or Completed Efforts:

- See existing and/or completed efforts listed under Measure U-1: Trees and Vegetation.
- In 2014, the City received funding from PG&E for cooling centers, which are free-to-use sites that provide residents a safe place indoors where they can cool off when temperatures exceed 100 degrees.

General Plan Policies and Actions:

- Policy CON-10: The City will evaluate existing landscaping and options to convert reflective and impervious surfaces to landscaping, and will, as feasible, install or replace vegetation with drought-tolerant, low-maintenance native species that can also provide shade and reduce heat-island effects.
- Policy CON-31: The City seeks to reduce the urban heat island effect in the City, which causes increased temperatures and increases in ground level ozone formation through methods such as: increasing the amount of tree coverage in the city; green roofs and rooftop gardens; the use of reflective treatments on roofs (such as those which qualify for the EPA/DOE's Energy Star rating); the use of cool pavements such as permeable and light colored and reflective pavements.
 - Action Item CON-31.1: Develop and adopt a tree ordinance that protects existing trees in the public right of way and promotes the establishment of new tree resources in public areas, including the placement of trees in parkway strips to allow shading of streets. The tree ordinance could establish a City-approved tree-planting list and provide for the

- creation of a Master Tree Plan that would include an inventory of trees in public areas, including tree type, condition and size.
 - Action Item CON-31.2: Update or amend the City's zoning and building codes, and provide training to the City's Community Development Department staff, to incorporate features which will have the effect of reducing exterior heat gain, such as: allowances for the construction of green roofs; standards for surface shading of paved areas; standards for the use of paving materials with an enhanced solar reflective index (SRI); standards that provide for pervious pavement options.
- Policy CON-38: The City shall partner with local agencies and organizations to coordinate outreach and education regarding the effects of GHG emissions and climate change.
- Policy HS-4: The City should promote greater public awareness of issues related to health and community well-being through the City's newsletter and other City-sponsored programs.
- Policy HS-5: The City will continually endeavor to improve access in the community for people with disabilities.
 - Action Item HS-5.1: Ensure that all City-owned and City-operated buildings are in compliance with requirements of the Americans with Disabilities Act.
 - Action Item HS-5.2: Continue to implement the City's program to make public sidewalks accessible for persons with disabilities.
- Policy HS-6: The City will work with the Madera County Public Health Department, the Madera County Environmental Health Department, Madera County Behavioral Health Services, and the Community Action Partnership of Madera County in their efforts to promote and facilitate their respective programs and services.
- Policy HS-33: The City shall ensure the safety and protection of Madera and its community members by providing adequate first response capabilities to emergencies and by maintaining sufficient resources to expand protection as the community grows.
- Policy HS-34: The City shall continue to maintain and update emergency service plans, including the Madera City Fire Department Emergency Operations Plan and the Hazardous Material Spills Emergency Response Plan.
 - Action Item HS-34.1: Continue to cooperate with Madera County and other agencies in pre-disaster planning, training and exercise activities.
- Policy HS-35: The City shall ensure the safety and protection of Madera and its community members by providing appropriate first response to emergencies and ensure that sufficient resources are available to expand protection as the community grows.
 - Action Item HS-35.1: Collaborate with existing agencies to review existing interoperable communication and prepare a communications plan as needed.
- Policy HS-36: The City will maintain and enhance community safety through coordinated regional emergency, law-enforcement and protective services systems.
- Policy HS-37: The City will seek to maintain and enhance communications between community residents and the police through regular meetings and a visible community policing program.
- Policy SUS-6: The City shall not approve developments or programs that will create significant inequities in service provision across economic segments of the community.
- Policy SUS-9: The City is committed to providing open, inclusive, and participatory planning processes that include full consideration of the values, opinions, and needs of all segments of the community.
- Policy CD-4: Site layout and building design shall take into consideration Madera's warm, dry climate, by including trees, landscaping and architectural elements to provide shade.
- Policy CD-21: Create safe, inviting, and functional pedestrian and cyclist environments in commercial, office, and mixed-use projects through a variety of techniques, including: planting trees to provide shade on pedestrian paths, sidewalks, and walkways....

- Policy CD-50: Parking lots shall be landscaped, including shade trees, to create an attractive pedestrian environment and reduce the impact of heat islands.

Additional Implementation Actions:

- A-2.1:** Identify and address potential heat health risks posed by climate change in the City's local hazard mitigation plan (e.g., improve heat alerts, cooling centers, etc.).
- A-2.2:** Collaborate with community-based organizations (such as health care providers, public health advocates, etc.) to increase heat wave preparedness and disseminate public preparedness information, particularly targeting vulnerable populations.
- A-2.3:** Work with the Madera County Public Health Department, the Madera County Environmental Health Department, Madera County Behavioral Health Services, and the Community Action Partnership of Madera County to link climate change adaptation strategies with social equity and public health strategies.

City Cost	City Savings	Private Cost	Private Savings
Very Low	None	None	None

A-3: Water Management

Prepare for the anticipated climate change effects on water resources, including altered timing and amount of precipitation and increased temperatures that influence the availability of water supply, and limit community exposure to threats, such as flooding and drought.

Existing and/or Completed Efforts:

- See existing efforts under Measures W-1 and W-2.

General Plan Policies and Actions:

- Policy HS-19: The City shall not permit new development projects to result in new or increased flooding impacts on adjoining parcels in either upstream or downstream areas.
- Policy HS-20: The City's first priority in preventing risks to life and property resulting from flooding shall be to designate appropriate land uses in areas subject to flooding...
- Policy HS-21: The City shall require any development on land subject to a 100-year flood event, based on Federal Emergency Management Agency (FEMA) or on other updated mapping acceptable to the City, to conform to NFIP (National Flood Improvement Program) standards.
- Policy HS-22: Creation of lots whose access will be inundated by flows resulting from a 10-year or greater storm shall not be allowed. Bridges or similar structures may be used to provide flood-free access.
- Policy HS-26: The City shall require all new urban development projects to incorporate runoff control measures to minimize peak flows of runoff and/or assist in financing or otherwise implementing comprehensive drainage plans. All such control measures will consider potential affects to adjacent property owners.
- Policy HS-27: Upon adoption of the Central Valley Flood Protection Plan, and this General Plan, the City shall review the consistencies of City flood-related planning documents for consistency with the current General Plan with the provisions of Central Valley Flood Protection Plan and the policies of the General Plan.

- Action Item HS-27.1: Consider adoption of a local plan of flood protection under Water Code sections 8201 et seq.
- Action Item HS-27.2: Work collaboratively with other appropriate agencies to identify those areas subject to flooding and to prepare flood emergency plans and flood mitigation programs, as provided for by Water Code Sections 9621 through 9623.
- Action Item HS-27.3: Review the flood hazard provisions of the Land Use, Conservation, and Health and Safety Elements of the General Plan for consistency with the Central Valley Flood Protection Plan, upon its adoption.
- Policy HS-28: The City shall continue to cooperate with Madera County and other agencies in pre-disaster planning activities for potential dam breach and similar potential disasters.
- Policy HS-35: The City shall ensure the safety and protection of Madera and its community members by providing appropriate first response to emergencies and ensure that sufficient resources are available to expand protection as the community grows.
- Policy HS-36: The City will maintain and enhance community safety through coordinated regional emergency, law-enforcement and protective services systems.
- Policy CON-1: The City will coordinate with local, regional, and state water suppliers and water resource managers to identify water management strategies and issues that ensure a clean and sustainable water supply.
- Policy CON-2: The City supports the consideration and implementation of a broad range of strategies to ensure the long-term sustainability of its water supply, including strategies related to conservation, reclamation, recharge, and diversification of supply.
 - Action Item CON-2.1: Consider a broad range of strategies to address the City's water supply needs as part of the preparation of the Urban Water Management Plan and other planning documents, including the feasibility of obtaining and treating surface water.
- Policy CON-3: The City supports natural groundwater recharge and new groundwater recharge opportunities through means such as: Developing a comprehensive groundwater recharge program to be applied in conjunction with new development; Increasing the area on developed sites into which rainwater can percolate; Providing areas where rainwater and other water can collect and percolate into the ground; Providing for groundwater recharge in storm drainage facilities; The use of reclaimed water to recharge the groundwater table.
 - Action Item CON-3.1: Prepare a groundwater recharge program which identifies specific recharge strategies and projects, and consider the establishment of a fee-based system for new development to implement these strategies to offset the water demand created by such development.
- Policy CON-4: The City will coordinate water resource management planning with other conservation planning efforts, such as those related to open space, parkland, and agricultural preservation.
- Policy CON-5: To reduce the need for groundwater, the City encourages water conservation and the use of reclaimed water.
 - Action Item CON-5.1: Establish a baseline of per-capita water use and continue to monitor use.
 - Action Item CON-5.2: Develop regulations and programs to encourage water conservation through means such as establishing tiered rate structures for water use, updating the appropriate City codes to provide performance standards for irrigation equipment and water fixtures, establishing water-friendly landscaping requirements and watering limitations, etc. Continue to monitor the effectiveness of these regulations and programs and refine them as needed.
 - Action Item CON-5.3: Develop a program to accelerate the City's water meter installation program to reach the goal of installation of meters for all customers before the current 2025 deadline.

- Action Item Con-5.4: Work with wastewater system operators and other potential partners to identify and implement programs for reuse of treated wastewater, particularly in landscaping, irrigation, parks, and public facilities.
- Policy CON-6: Where feasible, the installation of pipelines in new development to carry existing or future supplies of reclaimed water for irrigation and other uses shall be required.
 - Action Item CON-6.1: Consider adoption of standards and requirements for the installation of plumbing systems for recycled water (e.g., “purple pipe”).
- Policy CON-7: The City encourages the use of gray water systems, and other water re-use methods in new development and renovation projects as consistent with state and local water quality regulations.
 - Action Item CON-7.1: Establish criteria and standards to permit the safe and effective use of gray water (on-site water recycling) that do not compromise public health and safety, and revise existing city codes that may unnecessarily inhibit the use of gray water systems.
- Policy CON-8: The City encourages Low Impact Development practices in all residential, commercial, office, and mixed-use discretionary projects and land division projects to reduce, treat, infiltrate, and manage runoff flows caused by storms, urban runoff, and impervious surfaces...
- Policy CON-9: The City will evaluate existing city maintained landscaping, and will, as feasible, install or replace vegetation with drought-tolerant, low-maintenance native species.
- Policy CON-10: The City will evaluate existing landscaping and options to convert reflective and impervious surfaces to landscaping, and will, as feasible, install or replace vegetation with drought-tolerant, low-maintenance native species that can also provide shade and reduce heat-island effects.
- Policy CON-14: The relocation of natural stream courses is discouraged. Where flood protection is a necessity, the City supports leaving existing natural stream courses and adjoining land in a natural state and creating new storm drainage capacity in parallel above- or below-ground facilities.
- Policy CON-44: The City supports the use of green building practices in the planning, design, construction, management, renovation, operations, and demolition of all private buildings and projects, including...water conservation indoors and outdoors...
- Policy CI-53: Water supply and delivery systems shall be available in time to meet the demand created by new development, or shall be assured through the use of bonds or other sureties to the City’s satisfaction.
 - Action Item CI-53.1: The following shall be required for all development projects, excluding subdivisions:
 - An assured water supply and delivery system shall be available at the time of project approval. If a choice of alternative methods of supply and/or delivery is selected, each shall be capable individually of providing water to the project.
 - All required water infrastructure for the project shall be in place at the time of project approval, or shall be assured through the use of bonds or other sureties to the City’s satisfaction. Water infrastructure may be phased to coincide with the phased development of large-scale projects.
 - Action Item CI-53.2: The following shall be required for all subdivisions to the extent permitted by state law:
 - Proposed water supply and delivery systems shall be identified at the time of tentative map approval to the satisfaction of the City. Alternative methods of supply and/or delivery may be proposed, provided that each is capable individually of providing water to the project.
 - Prior to the approval of a final map by the City, sufficient capacity shall be available to accommodate the subdivision plus existing development, and other approved projects in the same service area, and other projects which have received commitments for water service.

- Offsite and onsite water infrastructure sufficient to provide adequate water to the subdivision shall be in place prior to the approval of a final map or their financing shall be assured to the satisfaction of the City, consistent with the requirements of the Subdivision Map Act.
- Policy CI-54: The City supports the use of reclaimed water for irrigation wherever feasible.
- Policy CI-55: The City shall seek to protect the quality and quantity of groundwater resources, including those which serve households and businesses which rely on private wells.
- Policy CI-56: The City shall require that water flow and pressure be provided at sufficient levels to meet domestic, commercial, industrial, and firefighting needs.

Additional Implementation Actions:

- A-3.1:** Continue to seek grants and other sources of funding to enhance flood control.
- A-3.2:** Implement the CAP measures that facilitate water conservation and use of recycled water.

City Cost	City Savings	Private Cost	Private Savings
None	None	None	None

A-4: Biodiversity and Habitat

Protect biodiversity and habitats by carefully managing open space and creating connections between areas of undeveloped land.

Existing and/or Completed Efforts:

- None at this time.

General Plan Policies and Actions:

- Policy CON-23: The City shall seek to conserve and improve native wildlife and plant habitat in cooperation with governmental agencies, private associations and individuals in Madera.
- Policy CON-24: Residential, commercial, industrial and recreational projects shall avoid impacts to native wildlife and plant habitat to the extent feasible.
- Policy CON-25: The City encourages the preservation of habitat areas needed for the ongoing viability of native species, and habitat connectivity through the use of conservation easements or other methods.
- Policy CON-26: To offset possible additional losses of native wildlife and plant habitat due to development projects, developers shall be responsible for mitigation. Such mitigation measures may include providing and permanently maintaining similar quality and quantity of replacement habitat, enhancing existing habitat areas or paying in-lieu funds to an approved wildlife habitat improvement and acquisition fund. Replacement habitat may occur either on site or at approved offsite locations, but preference shall be given to on-site replacement.

Additional Implementation Actions:

- A-4.1:** Continue to identify and protect locations where native species may shift or lose habitat due to climate change impacts (e.g., warmer temperatures, drought).

- A-4.2:** Collaborate with agencies managing public land to identify or maintain corridors and linkages between undeveloped areas.

City Cost	City Savings	Private Cost	Private Savings
Very Low	None	None	None

A-5: Infrastructure

Work to improve the resilience of transportation, energy, and other infrastructure critical to community function.

Existing and/or Completed Efforts:

- None at this time.

General Plan Policies and Actions:

- Policy H-1.5: The City shall seek implementation of all public service master plans to facilitate construction of infrastructure improvements to serve developing areas.
- Policy LU-13: The City shall support the annexation of property to its boundaries for the purpose of new development only when it determines that the following conditions exist: (1) sufficient public infrastructure, facilities, and services are available or will be provided in conjunction with new development; and (2) demands on public infrastructure, facilities and services created by the new development will not result in reductions in capacity that is necessary to serve the existing city limits (including demand created by potential infill development), reductions in existing service levels within the city limits, or the creation of detrimental fiscal impacts on the City.
 - Action Item LU-13.1: Maintain and periodically update a set of Facility Master Plans for major municipal infrastructure and public facilities, including, at a minimum, wastewater, water, storm drainage, and parks and recreation facilities.
 - Action Item LU-13.3: Monitor levels-of-service for streets, roads, and other features of the circulation system based on the level of criteria included in this general plan as a tool to assess the ability of the City to service growth.
 - Action Item LU-13.4: Conduct an ongoing Development Monitoring Program focused on new development activity and related infrastructure and public facility construction to determine adherence to adopted level of service standards and criteria and compliance with and other City policies and programs.
- Policy CD-37: The City shall encourage the on-going conservation, maintenance and upgrading of existing neighborhoods through enforcement of property maintenance codes, requirements of high quality infill development, programs for the rehabilitation of housing, and replacement of deteriorated infrastructure.
- Policy CI-51: Except when prohibited by state law, the City shall require that sufficient capacity in all public services and facilities will be available on time to maintain desired service levels and avoid capacity shortages, traffic congestion, or other negative effects on safety and quality of life.

Additional Implementation Actions:

- A-5.1:** Incorporate information on projected climate change impacts into the City's utility master plans and service delivery plans, as appropriate.

- A-5.2:** Implement the CAP measures that facilitate energy and water conservation and the use of recycled water and renewable energy.

City Cost	City Savings	Private Cost	Private Savings
Very Low	None	None	None

A-6: Agriculture

Provide information to and assist farmers in adapting to climate change.

Existing and/or Completed Efforts:

- None at this time.

General Plan Policies and Actions:

- Policy CON-4: The City will coordinate water resource management planning with other conservation planning efforts, such as those related to open space, parkland, and agricultural preservation.
- Policy CON-16: The City will facilitate and support agricultural conservation easements, farmland security zone contracts, and land conservation programs when used to preserve agricultural lands and resources.
 - Action Item CON-16.1: Pursue partnerships with private non-profit conservation organizations to preserve Madera's agricultural lands.
- Policy CON-20: The City supports the marketing of local agricultural products to local residents, vendors and restaurants through year-round public farmers' markets and other direct farm-to-table sales.
- Policy CON-21: The City encourages organic and sustainable agricultural practices and crop diversification.

Additional Implementation Actions:

- A-6.1:** Work with entities such as resource conservation districts, cooperative extensions, and other agricultural organizations to introduce adaptation techniques and shorten the time it takes for new scientific findings and adaptive approaches to reach farmers.

City Cost	City Savings	Private Cost	Private Savings
Very Low	None	None	None

3.9 GHG Reduction Summary

As discussed in Section 2.3 of Chapter 2, GHG Emissions and Reduction Targets, Madera will need to reduce its emissions by 29,754 MT CO₂e by 2020 and by 88,676 MT CO₂e by 2030 to meet its targets. The GHG reduction measures in this CAP are estimated to reduce Madera's GHG emissions by 33,601 MT CO₂e by 2020 and by 92,341 MT CO₂e by 2030, as summarized in **Table 3-9**. Therefore, implementation of the measures identified in this chapter would enable Madera to meet its reduction targets by 2020 and 2030.

TABLE 3-9 SUMMARY OF GHG REDUCTIONS BY MEASURE

Measure Number	Measure	2020 GHG Reduction (MT CO ₂ e)	2030 GHG Reduction (MT CO ₂ e)
Local Government			
LG-1	Municipal Energy Efficiency and Conservation	74	148
LG-2	Municipal Renewable Energy	445	611
LG-3	Fuel Efficient and Low-Carbon Vehicle Fleet	58	105
LG-4	Employee Commute Alternatives	41	66
LG-5	Municipal Solid Waste Diversion	19	28
LG-6	Tree Planting on City Property	16	33
Local Government Total		653	991
Energy			
E-1	Energy Efficiency and Conservation in Existing Buildings	10,707	30,163
E-2	Energy Efficient New Construction	531	7,670
E-3	On-Site Small-Scale Renewable Energy	1,813	3,014
Energy Total		13,051	40,847
Transportation and Land Use			
T-1	Infill and Mixed-Use Development	5,613	21,292
T-2	Bicycle and Pedestrian Environment	1,053	3,454
T-3	Transit Travel	2,404	4,757
T-4	Commute Trip Reduction	1,188	1,977
T-5	Traffic Flow and Vehicle Idling	265	401
T-6	Low Carbon Fuel Vehicles and Infrastructure	4,255	11,061
T-7	Construction and Off-Road Equipment	135	584
Transportation and Land Use Total		14,913	43,526
Water and Wastewater			
W-1	Exceed SB X7-7 Water Conservation Target	494	653
W-2	Recycled Water	68	165
W-3	Wastewater Treatment Plant Upgrades	158	170
Water and Wastewater Total		720	988
Solid Waste			
S-1	Solid Waste Reduction and Recycling	4,230	5,921
Solid Waste Total		4,230	5,921
Urban Greening			
U-1	Trees and Vegetation	34	68
Urban Greening Total		34	68
Total		33,601	92,341



Chapter 4.0

Implementation & Monitoring

Implementation and monitoring are essential elements of the CAP to ensure that Madera reduces its GHG emissions and achieves its emissions reduction targets. To achieve the GHG reductions described in the CAP, the measures and implementation actions must translate from policy language into on-the-ground results that can be measured. This chapter describes how the City will implement the CAP measures, monitor the CAP's performance, and if necessary, alter or amend the plan to ensure that the plan remains effective and on track toward meeting its targets.

4.1 Implementation

Ensuring that the CAP measures translate into measurable reductions in GHG emissions is critical to the success of the CAP. To facilitate this, each measure and its corresponding implementation actions identified in Chapter 3, Climate Action Measures, is listed in the implementation matrix in **Table 4-1** along with the following items:

- **Responsible Parties(s):** the City department or division that will be primarily responsible for implementing, monitoring, and reporting on the progress of the measure and corresponding actions.
- **Implementation Timeframe:** the phase in which measure implementation should begin. Timeframes include:
 - Near-Term – By 2017
 - Mid-Term – 2018-2022
 - Long-Term – 2023-2030
- **City Cost and Savings Estimates:** for each measure, potential costs and savings to the City are identified. Additional information on costs and savings is provided in **Appendix D**.

- **GHG Reduction Potential:** the GHG reduction potential value identifies the estimated annual GHG emissions reductions anticipated by 2020 and 2030, measured in MT CO₂e per year. Supporting information pertaining to the reduction potential calculations is provided in **Appendix C**.
- **Performance Indicators:** performance indicators enable the City to generally monitor measure progress.

Upon adoption of the CAP, the City will establish a CAP Coordinator who will provide essential CAP oversight and a multi-departmental CAP Implementation Team comprised of key staff in each department. These individuals will facilitate and oversee the implementation and monitoring of measures for which their department is responsible. The CAP Implementation Team will meet at least one time per year to assess the status of City efforts. Some actions will require interdepartmental or inter-agency cooperation and appropriate partnerships will need to be established accordingly.

TABLE 4-1 IMPLEMENTATION MATRIX

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
Local Government Operations Measures							
LG-1 Municipal Energy Efficiency and Conservation: Reduce non-renewable energy consumption in City buildings and facilities.	LG-1.1: Track municipal energy consumption and performance over time using PG&E Portfolio Manager Web Services which automatically feeds key data into ENERGY STAR® Portfolio Manager. LG-1.2: Establish a prioritized list of energy efficiency upgrade projects and implement as funding becomes available. LG-1.3: Convert the remaining HPS street lights to LED. LG-1.4: Identify staff positions or employees that could benefit from energy-related workshops and trainings. LG-1.5: Continue to coordinate with PG&E and the Madera Energy Watch partnership to identify funding sources, tools, and other mechanisms to improve municipal energy efficiency.	Administrative Services, Community Development – Public Works & Planning	\$36,000 – \$72,000	\$237,252	2020: 74 MT CO ₂ e 2030: 148 MT CO ₂ e	Reduce the amount of energy used at City buildings and facilities by 5% below 2007 levels by 2020 and 10% below 2007 levels by 2030.	Near-Term
LG-2 Municipal Renewable Energy: Increase the amount of municipal energy derived from	LG-2.1: Conduct a feasibility study on the installation of renewable energy projects at select City facilities. LG-2.2: Identify and secure funding (e.g., through grants, on-bill financing, loans, energy performance contracts, lease-	Administrative Services, Community Development – Public Works & Planning	\$5,000 - \$10,000	\$459,673	2020: 445 MT CO ₂ e 2030: 611 MT CO ₂ e	By 2020, install 1,265 kW of solar PVs (the City has already met this objective for the year 2020). By	Near-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
renewable sources.	<p>purchase agreements, or other mechanisms) to install additional solar PV systems at City facilities.</p> <p>LG-2.3: Consider participation in PG&E's green power option, which would allow the City to purchase up to 100 percent of its electricity from renewable energy sources.</p>					<p>2030, install an additional 162 kW of solar PVs (for a total of 1,427 kW of solar PVs by 2030).</p> <p>By 2020, procure 10% of municipal electricity from renewables by 2020 and 20% by 2030.</p>	
<p>LG-3 Fuel Efficient and Low Carbon Vehicle Fleet:</p> <p>Increase overall fuel efficiency and the use of low-carbon fuels in the City's vehicle fleet.</p>	<p>LG-3.1: Update the City's procurement policies to include minimum fuel efficiency criteria in procurement specifications.</p> <p>LG-3.2: Continue to identify and secure funding to help purchase alternative and fuel efficient fleet vehicles and equipment.</p> <p>LG-3.3: Inform staff of fuel-efficient driving techniques (e.g., avoiding excessive, quick starts, speeding, etc.).</p>	Administrative Services, Community Development – Planning	\$147,965 - \$151,965	\$22,232	<p>2020: 58 MT CO₂e</p> <p>2030: 105 MT CO₂e</p>	<p>By 2020, replace 10 light duty vehicles with 3 hybrid or electric vehicles with combined average fuel economy of 55 mpg and 7 CNG fueled vehicles. Also replace 10 heavy-duty vehicles with CNG fueled vehicles by 2020. By 2030, replace an additional 12 light-duty</p>	Mid-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
						vehicles with 5 hybrid or electric vehicles with combined average fuel economy of 55 mpg and 7 CNG fueled vehicles. Also replace an additional 6 heavy-duty vehicles with CNG fueled vehicles by 2030. The City has already replaced 6 light-duty vehicles (with 1 hybrid and 5 CNG) and 10 heavy-duty vehicles with CNG since 2007.	
LG-4 Employee Commute Alternatives: Promote alternatives to reduce annual VMT associated with City	LG-4.1: Provide City employees with incentives to use alternatives to single-occupant auto commuting, such as transit incentives, bicycle facilities, flexible schedules, ridesharing services and subsidies, and telecommuting. LG-4.2: Participate in and promote	Administrative Services, Community Development – Planning	\$4,000 - \$8,000	None	2020: 41 MT CO ₂ e 2030: 66 MT CO ₂ e	Reduce annual VMT associated with employee commutes by 5% below 2007 levels by 2020 and 8% below	Mid-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
employee commutes.	annual commute trip reduction events.					2007 levels by 2030.	
LG-5 Municipal Solid Waste Diversion: Reduce the amount of landfilled solid waste generated at City facilities.	LG-5.1: Audit City facilities to identify opportunities to increase material recovery and beneficial use of organic material.	Administrative Services, Community Development – Public Works & Planning	\$2,000-\$4,000	None	2020: 19 MT CO ₂ e 2030: 28 MT CO ₂ e	Reduce City-generated solid waste by 20% below 2007 levels by 2020 and by 30% below 2007 levels by 2030.	Mid-Term
LG-6 Tree Planting on City Property: Increase the quantity of drought-tolerant, low-maintenance native trees and vegetation on City-owned or -operated property.	LG-6.1: Continue to identify and secure funding to plant additional drought-tolerant, native trees and vegetation on City properties.	Administrative Services, Community Development – Public Works & Planning, Parks & Community Services	\$64,625-\$160,875	\$840 - \$2,520	2020: 16 MT CO ₂ e 2030: 33 MT CO ₂ e	Plant 100 trees and 3 acres of vegetation on City properties by 2020 and an additional 100 trees and 3 acres by 2030 (for a total of 200 trees and 6 acres of vegetation planted on City properties between 2007 and 2030). The City has already planted 85 trees and 2 acres of vegetation.	Mid-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
Energy							
E-1 Energy Efficiency and Conservation in Existing Buildings: Increase energy efficiency and conservation within the community.	E-1.1: Continue to coordinate with PG&E to promote use of utility financial incentives to improve energy efficiency, such as rebates and tax credits, building audit and retrofit programs, and demand management programs. E-1.2: Conduct additional outreach and promotional activities, either individually or in collaboration with PG&E and/or local organizations, targeting specific groups within the community (e.g., homeowners, renters, businesses, income-qualified households, etc.). E-1.3: Designate one week per year to conduct an energy efficiency outreach campaign. The campaign week may also be used to recognize and encourage programs and educational outreach conducted by industry organizations, non-government entities, government agencies, and other community groups. E-1.4: Collaborate with PG&E to hold an educational workshop in Madera regarding measures that individuals can take to reduce energy usage. E-1.5: Participate in and promote a residential and commercial energy efficiency financing program (e.g.,	Administrative Services, Community Development – Planning	\$60,000 - \$120,000	None	2020: 10,707 MT CO ₂ e 2030: 30,163 MT CO ₂ e	Reduce residential and commercial energy by 10% by 2020 and 15% by 2030.	Near-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
	through Energy Upgrade California, CaliforniaFIRST, a joint powers authority with other local agencies, or other mechanisms) allowing residential and commercial property owners to voluntarily invest in efficient upgrades for their buildings. E-1.6: Promote existing income-qualified weatherization programs (e.g., Energy Upgrade California, PG&E's Middle Income Direct Install Program, etc.), either individually, or in collaboration with an existing organization, to income-qualified households using sources of data available to the local agency, (e.g., water bills, housing records, etc.).						
E-2 Energy Efficient New Construction: Increase the efficient use of energy and conservation of available resources in the design and construction of new buildings.	E-2.1: Provide support to and recognition of developers proposing projects that voluntarily exceed Title 24 Energy Efficiency Building Standards, meet the state's Green Building Standards voluntary tier levels, or are LEED Greenpoint, or ENERGY STAR rated.	Administrative Services, Community Development – Planning & Building	\$15,000-\$30,000	None	2020: 531 MT CO ₂ e 2030: 7,670 MT CO ₂ e	By 2020, 10% of new residential and commercial development to exceed Title 24 by 20%. By 2030, 25% of new residential development to exceed Title 24 by 30%; all new commercial development	Near-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
						after 2020 is net zero energy.	
E-3 On-Site Small-Scale Renewable Energy: Facilitate the installation and use of on-site small-scale renewable energy systems, such as solar PV systems and solar water heaters.	E-3.1: Expand education on and promotion of existing incentive, rebate, and financing programs for solar PV systems and solar hot water heaters, such as those offered through the California Solar Initiative and California Public Utilities Commissions, including the Single Family Affordable Solar Homes (SASH) Program and the Multifamily Affordable Solar Homes (MASH) Program. Target specific groups or sectors within the community.	Administrative Services, Community Development – Planning & Building	\$45,000 - \$90,000	None	2020: 1,813 MT CO ₂ e 2030: 3,014 MT CO ₂ e	Achieve installation of 4,000 kW of solar PV systems on existing residential property and 1,500 kW of solar PV systems on existing non-residential property by 2020, and an additional 2,720 kW of solar PV systems on existing residential property and 500 kW of solar PV systems on existing non-residential property by 2030. Achieve installation of 400 residential and 200 non-	Mid-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
						residential solar water heaters by 2020 and an additional 350 residential and 200 non-residential solar water heaters by 2030.	
Transportation and Land Use							
T-1 Infill and Mixed-Use Development: Facilitate mixed use, higher density, and infill development near transit stops, in existing community centers/ downtown, and in other designated areas.	T-1.1: Expand the promotion of incentives for new development and renovation of existing uses in identified infill areas. T-1.2: Continue to work with MCTC in updates to the Madera County Blueprint to direct future growth to existing urbanized areas through implementation of smart growth principles and use of toolkit resources identified in the Blueprint. T-1.3: Showcase infill and mixed-use projects on the City's website, in newsletters, or via other mechanisms.	Administrative Services, Community Development – Planning & Building	\$45,000 - \$90,000	None	2020: 5,613 MT CO ₂ e 2030: 21,292 MT CO ₂ e	Increase service population density within the city 30% by 2020 and 50% by 2030; 25% of new development located within 2 miles of shopping/transit/ job centers by 2030; and 15% of new development with 2 or more land use types (e.g., residential and commercial) by 2030.	Mid-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
T-2 Bicycle and Pedestrian Environment: Continue to expand and improve the City's bicycle and pedestrian network.	T-2.1: Continue to pursue public and private funding to expand and link the City's bicycle and pedestrian network in accordance with the General Plan and Bicycle Master Plan. T-2.2: Develop policies and minimum design criteria for bicycle and pedestrian circulation in new residential development and implement through the development review process. Require the installation of adequate and secure bicycle parking at all new multi-family residential, commercial, governmental, and recreational locations throughout the City. T-2.3: Collaborate with law enforcement, school officials, and private organizations to encourage public bicycle safety programs.	Administrative Services, Community Development – Planning & Public Works, Parks & Community Services	\$30,000-\$60,000	None	2020: 1,053 MT CO ₂ e 2030: 3,454 MT CO ₂ e	Achieve a 1% reduction in light-duty VMT by 2020 and a 3% reduction in light-duty VMT by 2030 as a result of mode shift to bicycling and walking.	Near-Term
T-3 Transit Travel: Continue to expand and improve the transit network and its accessibility within the City of Madera.	T-3.1: Through the development review process, require new development to provide safe routes to adjacent transit stops, where applicable, and to finance and/or construct bus turnouts and shelters adjacent to new projects where transit demand warrants such improvements. T-3.2: Promote and encourage businesses to provide public transit vouchers as a benefit of employment.	Administrative Services, Community Development – Planning	\$22,500 - \$45,000	None	2020: 2,404 MT CO ₂ e 2030: 4,757 MT CO ₂ e	Achieve a 2% increase in service population transit ridership by 2020 and a 4% increase by 2030. This equates to an approximately 2% reduction in	Near-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
						passenger vehicle VMT in 2020 and 4% reduction in 2030.	
T-4 Commute Trip Reduction: Facilitate programs that give commuters and employers resources and incentives to reduce their single-occupancy vehicle trips.	T-4.1: Provide targeted marketing and promotion of commute trip reduction programs to employers such as the SJVAPCD Vanpool Voucher Incentive. T-4.2: Provide information on, and links to, vanpool programs and employer services available to local residents/ on the City's website. T-4.3: Provide information on and promote existing employer based TDM programs as part of the business licensing and renewal process.	Administrative Services, Community Development – Planning	\$45,000 - \$90,000	None	2020: 1,188 MT CO ₂ e 2030: 1,977 MT CO ₂ e	Achieve a 5% decrease in commute trip VMT by 2020 and an 8% decrease in commute trip VMT by 2030.	Mid-Term
T-5 Traffic Flow and Light-Duty Passenger Vehicle Idling: Implement improvements to smooth traffic flow, reduce idling, and eliminate bottlenecks within Madera.	T-5.1: Continue to improve traffic flow and reduce vehicle idling through actions such as synchronized signals and other traffic flow management techniques.	Administrative Services, Community Development – Planning & Public Works	None	None	2020: 265 MT CO ₂ e 2030: 401 MT CO ₂ e	Achieve a 10% reduction in vehicle idling in 2020 and a 13% reduction in 2030.	Mid-Term
T-6 Low Carbon Fuel Vehicles and Infrastructure:	T-6.1: Implement key recommendations from the San Joaquin Valley PEV Readiness Plan, as they pertain to	Administrative Services, Community	\$25,500 - \$51,000	None	2020: 4,255 MT CO ₂ e	Achieve a 2.5% reduction in light-duty	Long-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
Increase the availability of alternative fuel infrastructure to increase the number of alternative fuel vehicles.	Madera. T-6.2: Develop an alternative fuel resources page on the City's website that provides information on and links to technical guides, funding opportunities, existing financial incentives, fueling station locations, permitting and siting. T-6.3: Seek grant funding to install alternative fueling stations for public use.	Development – Planning			2030: 11,061 MT CO ₂ e	vehicle emissions in 2020 and a 6% reduction in 2030. Achieve a switch of 6% of heavy-duty vehicles to alternative fuels (e.g., compressed natural gas) by 2020 and 15% switch to alternative fuels by 2030.	
T-7 Construction and Off-Road Equipment: Reduce GHG emissions associated with construction equipment and off-road vehicles.	T-7.1: Provide information on and promote existing financial incentives, such as those offered by the SJVAPCD, to replace or repower in-use, off-road vehicles and equipment. T-7.2: Promote the installation of low-maintenance native landscaping, xeriscaping, and turf removal (e.g., via the City's website or through education workshops) to reduce landscape maintenance equipment usage.	Administrative Services, Community Development – Planning, Building & Engineering, Public Works, Parks & Community Services	\$22,500 - \$45,000	None	2020: 135 MT CO ₂ e 2030: 584 MT CO ₂ e	By 2020, 5% of construction vehicles/equipment utilizes new technologies (i.e., repowered engines, electric drive trains), CARB-approved low carbon fuel, or are electrically-powered. By 2030, 10% of	Mid-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
						construction vehicles/equipment utilizes new technologies (i.e., repowered engines, electric drive trains), CARB-approved low carbon fuel, or are electrically-powered. Achieve a 15% reduction in lawn and garden equipment and associated GHG emissions in 2020 and 30% reduction in 2030 as a result of low-maintenance landscaping.	

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
Water and Wastewater							
W-1 Exceed SB X7-7 Water Conservation Target: Adopt a water conservation target that exceeds the SB X7-7 (Water Conservation Act of 2009) target and identify and implement additional water efficiency and conservation measures to meet those targets by 2020 and 2030.	W-1.1: Develop, promote, and/or help implement additional water conservation and efficiency programs (e.g., water efficiency audits, point-of-sale replacement/retrofit programs, etc.). W-1.2: Conduct additional outreach and promotional activities targeting specific groups within the community (e.g., homeowners, renters, businesses, income-qualified households, etc.). W-1.3: Offer water efficiency classes or workshops where community members can learn techniques to incorporate water efficient retrofits and landscaping into homes and businesses. W-1.4: Consider implementation of a tiered rate structure to encourage a reduction in community water usage.	Administrative Services, Community Development – Planning & Public Works, Parks & Community Services	\$45,000 - \$90,000	None	2020: 494 MT CO ₂ e 2030: 653 MT CO ₂ e	Exceed SBX7-7 water conservation target by 5% in 2020 and 8% in 2030.	Near-Term
W-2 Recycled Water: Expand opportunities for the use of recycled water within the community.	W-2.1: Promote financial incentives, such as very low interest financing for water recycling projects offered by the State Water Board's Division of Financial Assistance, to encourage private water recycling. W-2.2: Provide and promote technical assistance and guidelines for water reuse.	Administrative Services, Community Development – Planning & Public Works	\$30,000 - \$60,000	None	2020: 68 MT CO ₂ e 2030: 165 MT CO ₂ e	Expand recycled water use in the community to 5% of total water usage by 2020 and 10% by 2030.	Mid-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
	W-2.3: Educate the community on graywater and rainwater recycling for irrigation.						
W-3 Wastewater Treatment Plant Upgrades: Increase methane capture and reduce nitrous oxide emissions associated with wastewater treatment.	<p>W-3.1: Continue to install solar systems at the wastewater treatment plant to provide a mean for running blowers and other equipment at maximum effectiveness for reducing nitrous oxide emissions, without generating more carbon emissions.</p> <p>W-3.2: Closely manage flow rates to identify ways to enable the process to function more efficiently, lowering the production of nitrous oxide.</p>	Administrative Services, Community Development – Planning & Public Works	\$4,000 - \$8,000	\$22,4211	<p>2020: 158 MT CO₂e</p> <p>2030: 170 MT CO₂e</p>	Achieve a 50% reduction in methane and nitrous oxide emissions and 10% reduction in energy use associated with emissions from treatment of the City's wastewater.	Long-Term
Solid Waste							
S-1 Solid Waste Reduction and Recycling: Increase recycling, composting, source reduction, and education efforts in Madera to reduce the amount of solid waste sent to landfills.	S-1.1: Continue to enhance community understanding of resource recovery and waste management programs.	Administrative Services, Community Development – Planning & Public Works	\$7,500 - \$15,000	None	<p>2020: 4,230 MT CO₂e</p> <p>2030: 5,921 MT CO₂e</p>	Reduce community solid waste by 25% in 2020 and 35% in 2030. This is equivalent to landfilling no more than 48,115 tons of solid waste in 2020 and 55,139 tons in 2030. The Madera	Mid-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
						community generated 49,194 tons of solid waste in 2007; this amount declined to 42,308 tons in 2013.	
Urban Greening							
U-1 Trees and Vegetation: Facilitate planting of drought-tolerant, low-maintenance native trees and vegetation in Madera.	U-1.1: Continue to identify and secure funding to enhance the urban forest within Madera. U-1.2: Develop a program to facilitate voluntary tree planting and inventorying within the community, working with non-profit organizations and/or community partners. U-1.3: Amend parking standards to limit over-parking and balance parking needs against other City goals, including creating additional space for landscaping to reduce the impact of heat islands.	Administrative Services, Community Development – Planning & Public Works, Parks & Community Services	\$4,000 - \$8,000	None	2020: 34 MT CO ₂ e 2030: 68 MT CO ₂ e	600 new trees and 3 new acres of vegetated land planted in the community by 2020 and an additional 600 trees and 3 acres of vegetated land planted by 2030 (total of 1,200 trees and 6 acres vegetated land by 2030).	Mid-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
Adaptation							
A-1 Climate Change Vulnerability: Identify and periodically reassess regional climate change vulnerabilities.	A-1.1: Participate in inter-agency and or inter-jurisdictional meeting and planning activities to periodically reassess projected climate change impacts and vulnerabilities. A-1.2: Incorporate discussions of anticipated climate change impacts, risks, and adaptation strategies into relevant City plans.	Administrative Services, Community Development – Planning	\$2,000 - \$4,000	None	2020: N/A 2030: N/A	N/A	Mid-Term
A-2 Public Health and Safety: Prepare for the anticipated climate change effects on public health and populations that may bear a disproportionate burden of anticipated climate change effects.	A-2.1: Identify and address potential heat health risks posed by climate change in the City's local hazard mitigation plan (e.g., improve heat alerts, cooling centers, etc.). A-2.2: Collaborate with community-based organizations (such as health care providers, public health advocates, etc.) to increase heat wave preparedness and disseminate public preparedness information, particularly targeting vulnerable populations. A-2.3: Work with the Madera County Public Health Department, the Madera County Environmental Health Department, Madera County Behavioral Health Services, and the Community Action Partnership of Madera County to link climate change adaptation	Administrative Services, Public Safety (Fire Department and Police Department), Community Development – Planning	\$1,000 - \$2,000	None	2020: N/A 2030: N/A	N/A	Mid-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
	strategies with social equity and public health strategies.						
A-3 Water Management: Prepare for the anticipated climate change effects on water resources, including altered timing and amount of precipitation and increased temperatures that influence the availability of water supply, and limit community exposure to threats, such as flooding and drought.	A-3.1: Continue to seek grants and other sources of funding to enhance flood control. A-3.2: Implement the CAP measures that facilitate water conservation and use of recycled water.	Administrative Services, Community Development – Planning & Public Works	None	None	2020: N/A 2030: N/A	N/A	Mid-Term
A-4 Biodiversity and Habitat: Protect biodiversity and habitats by carefully managing open space and creating connections between areas of undeveloped land.	A-4.1: Continue to identify and protect locations where native species may shift or lose habitat due to climate change impacts (e.g., warmer temperatures, drought). A-4.2: Collaborate with agencies managing public land to identify or maintain corridors and linkages between undeveloped areas.	Administrative Services, Community Development – Planning	\$1,000 - \$2,000	None	2020: N/A 2030: N/A	N/A	Long-Term

Measure	Actions	Responsible Parties(s)	Potential Cost (Aggregated)	Potential Savings (Annual)	GHG Reduction Potential (MT CO ₂ e)	Performance Indicator	Implementation Timeframe
A-5 Infrastructure: Work to improve the resilience of transportation, energy, and other infrastructure critical to community function.	A-5.1: Incorporate information on projected climate change impacts into the City's utility master plans and service delivery plans, as appropriate. A-5.2: Implement the CAP measures that facilitate energy and water conservation and the use of recycled water and renewable energy.	Administrative Services, Community Development – Planning & Public Works	\$2,000 - \$4,000	None	2020: N/A 2030: N/A	N/A	Long-Term
A-6 Agriculture: Provide information to and assist farmers in adapting to climate change.	A-6.1: Work with entities such as resource conservation districts, cooperative extensions, and other agricultural organizations to introduce adaptation techniques and shorten the time it takes for new scientific findings and adaptive approaches to reach farmers.	Administrative Services, Community Development – Planning	\$2,000 - \$4,000	None	2020: N/A 2030: N/A	N/A	Long-Term

4.2 Monitoring

The primary goal for implementing climate action measures is to reduce GHG emissions. However, it may be difficult to determine whether the actions being implemented are actually reducing emissions. The key to long-term success in climate action planning is to periodically measure and track reductions associated with Madera's climate action measures. By doing so, the City can ensure that it is getting results. If the City is not getting the anticipated results, then it can reevaluate strategies and decide whether alternative measures would get better results. This section describes the two ways to monitor and track progress: evaluation of the individual measures and evaluation of the plan as a whole.

4.2.1 Measure Evaluation

The City CAP Coordinator, in coordination with the CAP Implementation Team, will be responsible for developing an annual progress report to the City Council regarding measure implementation. This evaluation may be submitted to the City Council in conjunction with the General Plan status report for that year as required by State Government Code Section 65400. The progress report will:

- Identify the implementation status of each measure (including how new development projects have been implementing CAP measures)
- Evaluate achievement of, or progress toward performance criteria
- Assess the effectiveness of measures included in the CAP
- Report on the State's implementation of state-level measures included in the CAP
- Recommend adjustments to actions or tactics, as needed.

The performance indicators, provided for each quantified measure, identify the level of participation or performance required to achieve the estimated level of GHG emissions reductions by 2020 and 2030. The City should track performance indicators for each measure annually. While a full GHG emissions inventory is necessary to assess community-wide and local government progress toward the 2020 goal, tracking performance indicators can provide an indication of progress between inventories and provide insight on the effectiveness of specific actions. By evaluating whether the implementation of a measure is on track to achieve its performance criteria, the City can identify successful measures, and re-evaluate or replace under-performing measures.

4.2.2 Plan Evaluation

Careful tracking of progress of the CAP as a whole is important to ensure that the plan is implemented effectively and to determine the success of GHG mitigation efforts. To evaluate the performance of the CAP as a whole, the City will update the community and municipal GHG inventories every five years using the most up-to-date calculation methods, data, and tools. Inventory updates provide the best indication of CAP effectiveness as they will allow for comparison to the 2007 baseline. If an update reveals that the plan is not making progress toward meeting the GHG reduction target, the City will adjust the measures as necessary.

The City CAP Coordinator, in coordination with the CAP Implementation Team, will be responsible for initiating the inventory updates as well as reporting on the results and progress toward the targets in the annual report to the City Council for that year. In addition, the report will include an assessment of the

State's implementation of state-level measures included in the CAP to determine whether adjustments to the CAP should be made to account for any shortfalls in their implementation.

At this time, the State has not created a mandate for further reductions beyond the 2020 target. It has identified a long-term goal of reducing emissions to 80 percent below 1990 emissions levels by 2050 (in Executive Order S-3-05), and a mid-term target of reducing emissions to 40 percent below 1990 emissions levels by 2030 (in Executive Order B-30-15), but has not adopted the target and does not plan for meeting this goal. According to the Association of Environmental Professionals (2012), "With statewide emissions reductions making up perhaps two-thirds to three-quarters of the reductions that most local climate action plans currently rely upon to meet 2020 goals, after 2020, it will be highly difficult and likely infeasible for a local jurisdiction to achieve substantial reductions on its own..." (p. 9-12). As such, not all climate action plans have targets for years beyond 2020, and of those that do (typically in the context of a general plan update), many include targets lower than Executive Order S-3-05 goals for later years to reflect the lack of state or federal measures beyond AB 32. Furthermore, having a feasible and legally defensible reduction target is important to the success of the plan. Executive Order B-30-15 was issued on April 29, 2015 and CARB is currently working to update the Scoping Plan. The updated Scoping Plan will provide a framework for achieving the 2030 target and is expected to be completed and adopted by CARB in 2016 (CARB 2015). As the year 2020 approaches, and the Scoping Plan is updated with the 2030 target established under Executive Order B-30-15, Madera will re-evaluate its 2030 target for consistency with the Scoping Plan update.

4.3 Funding Resources and Financing/Incentive Programs

One of the main barriers to an implementation and monitoring plan is lack of available funds. There are multiple grant and loan programs through state, federal, and regional sources to reduce GHG emissions. This section identifies potential funding sources that Madera could pursue to offset the financial cost of implementing the CAP measures.

The spectrum of public and private funding options for the measures outlined in this CAP is ever evolving. The programs listed below represent the current (2015) status of those options that are most relevant to the CAP. These funding sources could quickly become out-of-date; therefore, it is important to evaluate the status of a given program before seeking funding, as availability and application processes are updated periodically.

To reduce costs and improve the CAP's effectiveness, actions should be pursued concurrently whenever possible. Which funding sources the City decides to pursue will be addressed as implementation occurs.

The City can, in part, provide funding for various measures outlined in this CAP. This can be accomplished through the City's annual budgeting and Capital Improvement Program process, which provides an opportunity for citizen input and guides decision-makers while helping them set priorities. The City can also partner with SJVAPCD, MCTC, PG&E, Madera County, community-based organizations, and private companies for joint programs.

ENERGY-RELATED FUNDING SOURCES AND FINANCING/INCENTIVE PROGRAMS

Clean Renewable Energy Bonds (CREBs)

U.S. Internal Revenue Service (IRS)

Clean renewable energy bonds (CREB) may be used by certain entities -- primarily in the public sector -- to finance renewable energy projects. The list of qualifying technologies is generally the same as that used for the federal renewable energy production tax credit. CREBs may be issued by electric cooperatives, government entities (states, cities, counties, territories, Indian tribal governments or any political subdivision thereof), and by certain lenders. The bondholder receives federal tax credits in lieu of a portion of the traditional bond interest, resulting in a lower effective interest rate for the borrower. The issuer remains responsible for repaying the principal on the bond.

The Energy Improvement and Extension Act of 2008 (Div. A, Sec. 107) allocated \$800 million for new CREBs. In February 2009, the American Recovery and Reinvestment Act of 2009 (Div. B, Sec. 1111) allocated an additional \$1.6 billion for New CREBs, for a total New CREB allocation of \$2.4 billion. The IRS recently announced the availability of close to \$1.4 billion in remaining volume cap for New CREBs. On March 5, 2015, the IRS opened the rolling volume-cap application window for governmental bodies and cooperative utilities, as well as a closed-end application period for public power providers.

Qualified Energy Conservation Bonds (QECBs)

U.S. Internal Revenue Service

The Energy Improvement and Extension Act of 2008, enacted in October 2008, authorized the issuance of Qualified energy conservation bonds (QECB) that may be used by state, local and tribal governments to finance certain types of energy projects. QECBs are qualified tax credit bonds, and in this respect are similar to new CREBs. In contrast to CREBs, QECBs are not subject to a U.S. Department of Treasury application and approval process. Bond volume is instead allocated to each state based on the state's percentage of the U.S. population as of July 1, 2008. Implementing allocations and reallocations most often, but not always, takes place through State Energy Offices.

The definition of "qualified energy conservation projects" is fairly broad and contains elements relating to energy efficiency capital expenditures in public buildings that reduce energy consumption by at least 20%; green community programs (including loans and grants to implement such programs); renewable energy production; various research and development applications; mass commuting facilities that reduce energy consumption; several types of energy related demonstration projects; and public energy efficiency education campaigns. In July 2012 the IRS issued Notice 2012-44 clarifying the meaning of "capital expenditures" and "green community program", and providing guidance on meeting the 20% energy consumption reduction requirement for energy -efficiency related capital expenditures in publicly-owned buildings (see 26 USC § 54D and IRS Notice 2012-44 for additional details). Renewable energy facilities that are eligible for CREBs are also eligible for QECBs.

Business Energy Investment Tax Credit

U.S. Internal Revenue Service

The federal business energy investment tax credit is available to Commercial, Industrial, Investor-Owned Utility, Municipal Utilities, Cooperative Utilities, and Agricultural sectors for solar, fuel cells, small wind turbines, geothermal systems, microturbines, combined heat and power. In general, the original use of the equipment must begin with the taxpayer, or the system must be constructed by the taxpayer. The equipment must also meet any performance and quality standards in effect at the time the equipment is acquired. The energy property must be operational in the year in which the credit is first taken.

Residential Renewable Energy Tax Credit

U.S. Internal Revenue Service

The federal tax credit for residential energy property applies to solar-electric systems, solar water heating systems, fuel cells, small wind-energy systems and geothermal heat pumps. A taxpayer may claim a credit of 30 percent of qualified expenditures for a system that serves a dwelling unit located in the United States that is owned and used as a residence by the taxpayer. Expenditures with respect to the equipment are treated as made when the installation is completed. If the installation is at a new home, the "placed in service" date is the date of occupancy by the homeowner. Expenditures include labor costs for on-site preparation, assembly or original system installation, and for piping or wiring to interconnect a system to the home. If the federal tax credit exceeds tax liability, the excess amount may be carried forward to the succeeding taxable year. The excess credit may be carried forward until 2016, but it is unclear whether the unused tax credit can be carried forward after then.

Residential Energy Conservation Subsidy Exclusion

U.S. Internal Revenue Service

This is a personal tax exemption for energy conservation measures implemented in private residences. The term "energy conservation measure" includes installations or modifications primarily designed to reduce consumption of electricity or natural gas, or to improve the management of energy demand. Eligible dwelling units include houses, apartments, condominiums, mobile homes, boats and similar properties. If a building or structure contains both dwelling units and other units, any subsidy must be properly allocated.

Rural Energy for America Program (REAP) Energy Audit and Renewable Energy Development Assistance (EA/REDA) Program

U.S. Department of Agriculture

The Renewable Energy for America Program (REAP) Energy Audit and Renewable Energy Development Assistance Program (EA/REDA) provides assistance to agricultural producers and rural small businesses for energy audits and renewable energy technical assistance including renewable energy site assessments. Applicants must submit separate applications for assistance, limited to one energy audit and one REDA per fiscal year. The maximum aggregate amount of an energy audit and REDA grant in a Federal fiscal year is \$100,000. In 2015, \$2 Million in EA/REDA grant funding is available.

Eligible project costs for eligible applicants includes salaries directly related to the project, travel expenses directly related to conducting energy audits or renewable energy development assistance, office supplies (e.g., paper, pens, file folders), administrative expenses, up to a maximum of 5 percent of the grant, which include but are not limited to utilities, office space, operation expenses of office and other project related equipment.

Loan Guarantee Program

U.S. Department of Energy

Under Section 1703, DOE is authorized to issue loan guarantees for projects with high technology risks that "avoid, reduce or sequester air pollutants or anthropogenic emissions of GHGs; and employ new or significantly improved technologies as compared to commercial technologies in service in the United States at the time the guarantee is issued." Loan guarantees are intended to encourage early commercial use of

new or significantly improved technologies in energy projects. The loan guarantee program generally does not support research and development projects.

Loan guarantees are provided in response to open solicitations. A solicitation for Renewable Energy Projects and Energy Efficiency Projects was issued in July 2014, with a final Part I application due date of December 2, 2015. Up to \$2.5 billion is available for projects in renewable energy, efficient end-use, and efficient generation, transmission, and distribution technologies.

Weatherization Assistance Program

U.S. Department of Energy

Through the Weatherization Assistance Program (WAP), the U.S. Department of Energy (DOE) issues grants to states, territories, and some Indian tribes to improve the energy efficiency of low-income homes in their jurisdictions. The DOE and state governments do not directly issue grants to low-income families or perform the retrofits. Instead, states, territories and Indian governments contract with local governments and nonprofit agencies who provide the weatherization services. Low-income homes that qualify for the program will receive free weatherization services based on the needs of the home, and the rules established by the state. Interested low-income families will need to apply for assistance through their state weatherization agency. Each state establishes its own income requirements based on DOE guidelines.

Weatherization as defined by the WAP includes a wide variety of energy efficiency measures that encompass the building envelope, its heating and cooling systems, its electrical system, and electricity consuming appliances. WAP serves low-income homes free of charge and limits the amount of money that can be spent on any single residence as determined by federal rules. The adjusted average expenditure limit for program year 2015 is \$7,105.

Low Income Home Energy Assistance Program (LIHEAP)

U.S. Department of Health and Human Services

The Low Income Home Energy Assistance Program (LIHEAP) provides resources to assist families with energy costs. This federally funded assistance helps in managing costs associated with home energy bills, energy crises, and weatherization and energy-related minor home repairs. The LIHEAP program may require households to meet additional eligibility criteria to receive LIHEAP assistance.

PowerSaver Loan Program

Federal Housing Administration

Federal Housing Administration PowerSaver loans provide three financing options for homeowners to make home energy efficiency and renewable energy upgrades or improvements. Eligible home energy upgrades include, but are not necessarily limited to, the following:

- A whole home upgrade through Home Performance with ENERGY STAR
- Insulation and air sealing
- Replacing doors and windows
- Upgrading heating, ventilation, and air-conditioning systems and hot water systems
- Home automations systems and controls (e.g., smart thermostats)

- Installing solar photovoltaic (PV) systems, solar thermal hot water systems, small wind power, or geothermal heat pumps

Sustainable Energy Bond Program

California Statewide Communities Development Authority & Foundation for Renewable Energy and Environment

California Statewide Communities Development Authority and the Foundation for Renewable Energy and Environment are teaming together to provide public agencies and nonprofit organizations throughout California with access to tax exempt financing for critical sustainable energy investments. Under the Sustainable Energy Bond Program, participating entities and organizations will contract with an energy service company to complete energy and water conservation measures. Improvements could include street lighting, building lighting, pumps, HVAC, system controls, boilers, chillers, ducting, windows, partial roofing, toilets and others. The program participants will receive substantial utility cost savings, including a contractual guarantee sufficient to cover the full cost of all retrofit work. All projects are financed through tax exempt bonds.

Multi-Family Residential Energy Efficiency Rebate Program

PG&E

PG&E offers prescriptive rebates for owners and managers of multi-family properties of two or more units. Appliances, boilers, water heating, HVAC, and lighting improvements are among the eligible products for rebates. All equipment must meet program requirements listed on the PG&E program website or application forms. Owners or managers can receive rebates for singular improvements or a range of upgrades implemented. Maximum total incentive amounts may apply:

- Clothes Washers (inside tenant dwelling): \$50
- Clothes Washers (in common area laundry room): \$175
- Refrigerator: \$75/unit
- Water Heaters: \$200 - \$500
- Boilers: \$1,500/system
- Replacement Multiple-Speed or Variable-Speed Motors (VSM): \$50
- Furnaces: \$150 - \$300
- Lighting: Varies by type
- Variable-Speed Pool Pumps: \$100/Unit
- Commercial Pool Heater: \$2/MBtu/h

California Inventor Owned Utilities (IOUs) Programs

PG&E

California IOU's, such as PG&E, are required by the California Public Utilities Commission to offer energy efficiency programs to their customers. Each IOU program is unique; generally the programs offer rebates, financing assistance, design and building benchmarking assistance, educational seminars, and other forms of assistance. Rebates are typically a set amount of financial assistance for a specific energy efficiency technology, although PG&E also offers custom rebate programs that are more flexible.

In conjunction with its rebates and incentives programs, PG&E offers On-Bill Financing. On-Bill Financing provides interest-free, unsecured financing to qualified commercial and government-funded customers for the installation of energy-efficient upgrades. Financed equipment must qualify for a rebate or incentive from PG&E's rebate/incentive program(s). The program for local governments, such as the City of Madera, includes: zero-percent financing on qualifying measures for up to ten years; offsets to energy-efficient upgrade costs after rebates and incentives through PG&E; loan amounts that range from a minimum of \$5,000 up to \$250,000 per meter; and loan installments that are added to monthly PG&E bills. Website: www.pge.com/en/mybusiness/save/rebates/bybusiness/govt_local.page

Local Government Renewable Energy Self-Generation Bill Credit Transfer Program (RES-BCT)

PG&E

The RES-BCT program (formerly AB 2466) was established by the Legislature effective January 1, 2009 and is codified in Section 2830 of the Public Utilities Code. It allows a local government with one or more eligible renewable generating facilities to export energy to the grid and receive generation credits to benefitting accounts of the same Local Government (AB 1031 expanded applicability to universities). AB 512, signed into law in 2011 and effective on January 1, 2012, further modified this program to increase the generator size limit to 5 MW per generation account. Website: www.pge.com/en/mybusiness/services/nonpge/generateownpower/transferpgm.page

California Solar Initiative – Solar Thermal Program

PG&E

Originally restricted to just solar water heaters, the program was expanded by California Public Utilities Commission Decision 13-02-018 in February 2013 to include other solar thermal technologies, including solar process heating, solar cooling, and non-residential solar pool heating. There are different incentive levels depending on whether the solar water heating system displaces electricity, natural gas, or propane. Incentives for systems with a capacity of 250 kW-thermal or less will be paid upfront based on the OG-300 estimated first year energy savings. Larger systems will receive 70 percent of the incentive upfront, with the remaining 30 percent paid after 12 consecutive months, based on actual metered energy savings. Similar to the PV incentives offered through the California Solar Initiative, the incentives offered through this program will step down four times as installation milestones are met. Steps will decline separately in each service territory and for the four general customer classes.

Self-Generation Incentive Program

California Public Utilities Commission

The Self-Generation Incentive Program (SGIP) offers incentives to customers who produce electricity with wind turbines, fuel cells, various forms of combined heat and power (CHP) and advanced energy storage. Beginning in May 2012, all technologies previously eligible for the expired Emerging Renewables Program are now eligible for the SGIP program. Systems less than 30 kW will receive their full incentive upfront. Systems with a capacity of 30 kW or greater will receive half the incentive upfront, and the other half will be paid over the following five years based on the actual performance. PG&E administers the SGIP program in its service territories. Incentive amounts are as follows:

- Wind: \$1.07/W

- Waste Heat to Power: \$1.07/W
- Pressure Reduction Turbine: \$1.07/W
- Internal Combustion Engine (CHP): \$0.44/W
- Microturbine (CHP): \$0.44/W
- Gas Turbine (CHP): \$0.44/W
- Advanced Energy Storage: \$1.46/W
- Biogas: \$1.46/W
- Fuel Cell (CHP or Electric Only): \$1.65/W

Energy Efficiency Financing Program

California Energy Commission

The California Energy Commission offers low-interest loans (one percent) to help local jurisdictions finance energy efficiency and renewable energy projects in their buildings and facilities. Projects with proven energy and/or capacity savings are eligible, provided that they meet the eligibility requirements. Examples of projects include: lighting system upgrades, pumps and motors, streetlights and LED traffic signals, energy management systems and equipment controls, building insulation, renewable energy generation and combined heat and power projects, load shifting projects such as thermal energy storage, HVAC equipment, and waste water treatment equipment. There is no minimum loan amount, but the maximum loan amount per application is \$3 million. Website: <http://www.energy.ca.gov/efficiency/financing/index.html>

TRANSPORTATION-RELATED FUNDING SOURCES AND FINANCING/INCENTIVE PROGRAMS

Many federal, state, and regional grant programs are available to fund transportation and infrastructure improvements. The programs listed below represent the current status of the most relevant of these programs.

Livability Grant Program

U.S. Department of Transportation, Federal Transit Administration

The Federal Transportation Authority provides resources on sustainable communities and transit oriented development. This includes access to transit oriented development resources and training free of charge to local government employees. The Federal Transportation Authority's Livable and Sustainable Communities program supports initiatives that demonstrate ways to improve the link between public transit and communities. The Federal Transportation Authority offers a broad selection of Livability Grant Programs that fund projects for accessible, livable, and sustainable communities. In particular, the Bus and Bus Facilities Discretionary Program provides capital assistance for new buses and intermodal transit centers. The Bus Livability Discretionary Grants program provides unallocated Section 5309 Bus and Bus Facilities money to projects that increase transportation options, provide access to jobs and affordable housing, encourage economic development, and improve accessibility to transportation for the public. The program funds capital expenses for projects ranging from intermodal facilities, to sustainability oriented buses, to bicycle infrastructure and more. The Intercity Bus Program supports transit access to residents in non-urbanized areas. Additionally, the Rural Transit Assistance Program provides a source of funding to assist in the design and implementation of training and technical assistance projects and other support services tailored to meet the needs of transit operators in non-urbanized areas. While there are no current notices of

funding availability posted on the Department's website, additional funding may become available in the future.

Alternative and Renewable Fuel and Vehicle Technology Program

California Energy Commission

Assembly Bill 118 created the Alternative and Renewable Fuel and Vehicle Technology Program, within the California Energy Commission. The statute authorizes the Energy Commission to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's GHG reduction goals and reduce our dependence on foreign oil. The statute allows the Energy Commission to use grants, loans, loan guarantees, revolving loans, and other appropriate measures. Eligible recipients include: public agencies, private businesses, public-private partnerships, vehicle and technology consortia, workforce training partnerships and collaboratives, fleet owners, consumers, recreational boaters, and academic institutions. The Energy Commission must prepare and adopt an Investment Plan and convene an Advisory Committee to assist in preparing the Investment Plan. The Energy Commission has an annual program budget of approximately \$100 million.

Sustainable Transportation Planning Grant Program

Caltrans

The Sustainable Transportation Planning Grant Program was created to support Caltrans' current Mission: *Provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability.* The Grant Program's current goals emphasize transportation planning efforts that promote sustainability and support the following overarching objectives: sustainability, preservation, mobility, safety, innovation, economy, health, and equity. Caltrans recently awarded \$9.8 million in funding for the Fiscal Year 2015-2016 awards. Additional funding may be available for Fiscal Year 2016-2017.

Infrastructure State Revolving Fund Program

California Infrastructure and Economic Development Bank

The Infrastructure State Revolving Fund Program provides low-cost financing to public agencies for a wide variety of infrastructure projects. Program funding is available in amounts ranging from \$250,000 to \$10 million, with loan terms of up to 30 years. Eligible project categories include city streets, county highways, state highways, drainage, water supply and flood control, educational facilities, environmental mitigation measures, parks and recreational facilities, port facilities, public transit, sewage collection and treatment, solid waste collection and disposal, water treatment and distribution, defense conversion, public safety facilities, and power and communications facilities.

SJVAPCD Grants & Incentives

San Joaquin Valley Air Pollution Control District

The SJVAPCD Grants & Incentive team develops, implements and administers the District's numerous grants and incentive programs. These highly successful programs are voluntary and reduce emissions, favorably impacting air quality in the San Joaquin Valley.

The SJVAPCD currently offers funding for the following programs for public agencies:

- **Bike Paths** – Provides funds to establish bicycle infrastructure such as Class I or Class II bicycle paths.
- **E-Mobility Commerce** – Provides funds to develop or expand electronic telecommunications services.
- **School Bus Programs** – Provides funds to retrofit existing school buses with ARB verified Level-3 diesel emission control systems, or replace existing high-polluting buses with new, low-emission buses.
- **Public Transportation Subsidy and Park & Ride Lots*** – Provides funds to subsidize transportation passes for bus, shuttle and commuter rail services. Funds are also available for the construction of park and ride lots.
- **Alternate Fuel Mechanic Training*** – Provides funds for mechanic education or training in alternative-fuel vehicles and infrastructure.
- **Public Benefit** – Provides funds to purchase new, alternative-fuel vehicles and infrastructure and develop advanced transit and transportation systems.
- **Heavy Duty Waste Haulers*** – Provides incentives for cleaner heavy-duty waste haulers to solid waste transportation companies and owner/operators hauling from waste transfer stations to landfills and waste facilities within the District boundaries.

The District currently offers funding for the following programs for local residents:

- **Polluting Automobile Scrap & Salvage** – Provides free auto emission evaluation and repair vouchers to residents.
- **Burn Cleaner** – Provides incentives to change out open hearth and older, polluting wood-burning devices for cleaner, wood- and gas-burning devices.
- **Vanpool Voucher** – Provides incentives to encourage vanpooling to reduce single occupant vehicle commutes.
- **Drive Clean*** – Provides rebates towards the purchase of eligible new, clean-air vehicles.
- **Clean Green Yard Machines** – Provides incentives to replace gas-fueled lawn and garden equipment for new zero-emission electric equipment.

The District currently offers funding for the following programs for local businesses:

- **Hybrid Voucher Program** – Provides incentives to vehicle owners to purchase new hybrid and electric trucks and buses.
- **Forklift Program** – Provides incentives for new electric forklifts.
- **Tractor Replacement Program** – Provides incentive to replace in-use, off-road tractors and mobile equipment used in agricultural operations.
- **Off-Road Mobile Equipment Repowers** – Provides incentives to repower in-use, heavy-duty, off-road equipment.
- **Off-Road Replacement** – Provides incentives to replace mobile in-use, off-road, heavy-duty equipment used in construction and other non-agricultural operations.

- **Ag Pump Replacement** – Provides incentives to repower or replace irrigation pump engines/motors used in agricultural operations.
- **Truck Voucher Program** – Provides incentives to small business truck owners, located in the San Joaquin Valley, to replace or retrofit heavy-duty, on-road diesel trucks through a streamlined process.
- **Trucks: Prop 1B** – Provides incentives to truck owners for truck replacement for heavy-duty on-road trucks involved in goods movement.
- **Locomotive Program** – Provides incentives to railroads to purchase new, lower-emission locomotives.

*Programs indicated with an asterisk above are also available to local businesses.

OTHER FUNDING SOURCES AND FINANCING/INCENTIVE PROGRAMS

Beverage Container Recycling Grant and Payment Programs

California Department of Resources Recycling and Recovery (CalRecycle)

CalRecycle administers funding programs to assist organizations with establishing convenient beverage container recycling and litter abatement projects, and to encourage market development and expansion activities for beverage container materials. The Beverage Container Recycling Grant provides funding to local governments, businesses, individuals, and non-profit organizations for projects that implement new programs or enhance existing programs to provide convenient beverage container recycling opportunities in various locations statewide. Eligible projects include, but are not limited to, the following locations: parks and recreational areas, sporting complexes, community events, office buildings, multifamily dwellings, restaurants, and schools and colleges. CalRecycle issues up to \$1.5 million annually for this program. The City/County Payment Program provides a total of \$10.5 million in grant funds annually to eligible cities and counties for beverage container recycling and litter abatement activities. Each city is eligible to receive a minimum of \$5,000 or an amount calculated by the Department based on per capita, whichever is greater.

Water-Energy Grant Program

Department of Water Resources

The Water-Energy Grant Program provides funds to implement water efficiency programs or projects that reduce GHG emissions, and reduce water and energy use. The funding for this program was approved by the Governor on March 1, 2014 through Senate Bill 103, Section 11, which appropriated funds from the GHG Reduction Fund to the California Department of Water Resources to establish a grant program. A total of \$19,000,000 of funding is available to local agencies, joint powers authorities, and nonprofit organizations to fund residential water efficiency, commercial water efficiency, institutional water efficiency programs, or projects that reduce GHG, reduce water and reduce energy use. On March 30, 2015, DWR released the draft funding recommendations and evaluation forms for public comment, which are available on the Department's website: www.water.ca.gov/waterenergygrant/index.cfm

Urban and Community Greenhouse Gas Reduction Fund Grants

California Department of Forestry and Fire Protection (CAL FIRE)

The mission of the California Department of Forestry and Fire Protection's Urban Forestry Program is to lead the effort to advance the development of sustainable urban and community forests in California. Through

the Urban and Community Forestry Program CAL FIRE offers grants to eligible applicants on an annual basis as funding permits. Funding for the grant programs varies from year to year and is based on the availability of state and federal funding sources and approval of budgets for each fiscal year. These grants are designed to assist environmental justice communities to create or implement multi-benefit projects with a focus on reducing GHG emissions. Application deadlines have closed for the 2014/2015 grant period which included grants for the following project types: “Green Trees for The Golden State”, Urban Forest Management for GHG Reduction, Urban Wood and Biomass Utilization, “Woods in the Neighborhood”, and “Green Innovations” Projects. CAL FIRE has been identified to receive funding in the FY 2015/16 Governor’s Budget. There will be no certainty on receiving this funding until the budget is signed. All information on future funding opportunities will be on CAL FIRE’s Grant website: www.fire.ca.gov/grants/grants.php.

Environmental Enhancement and Mitigation (EEM) Program

California Natural Resources Agency

The EEM Program was established by the Legislature in 1989 and amended on September 26, 2013. It offers \$7 million each fiscal year for grants to state, local, federal and nonprofit organizations. Applications for the 2014-2015 grant cycle must be postmarked by July 13, 2015. Eligible projects must be directly or indirectly related to the environmental impact of the modification of an existing transportation facility or construction of a new transportation facility (CA Constitution, Art.XIX, Sec.1). The EEM Program encourages projects that produce multiple benefits which reduce GHG emissions, increase water use efficiency, reduce risks from climate change impacts, and demonstrate collaboration with local, state and community entities. Grants are awarded in the following categories:

- **Urban Forestry Projects** are designed to offset vehicular emissions of carbon dioxide through the planting of trees and other suitable plants.
- **Resource Lands Projects** are for the acquisition, restoration, or enhancement of resource lands (watersheds, wildlife habitat, wetlands, forests, or other significant natural areas) to mitigate the loss of or detriment to such lands within or near the right of way for transportation improvements.
- **Mitigation Projects Beyond the Scope of the Lead Agency** responsible for assessing the environmental impact of the proposed transportation improvement.

Partnerships with Other Jurisdictions and Community Organizations

Partnering with neighboring jurisdictions and community organizations is a key implementation strategy supporting the CAP. Various jurisdictions and organizations within the County could serve as potential partners in implementing the CAP strategies. The City should seek to partner with appropriate local and regional agencies or organizations, as identified within CAP measures.



Chapter 5.0

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5.2 List of Preparers

This CAP was prepared by Rincon Consultants, Inc. under contract to the City of Madera. Persons involved in research, analysis, report preparation, project management, and quality control include:

Joe Power, Principal-in-Charge
Shauna Callery, Senior Project Manager
Christina McAdams, Environmental Scientist

City of Madera staff who contributed to the preparation of this document includes:

Dave Merchen, Community Development Director

Appendix A

City of Madera Community-wide Greenhouse Gas Emissions Inventory

City of Madera Community-wide Greenhouse Gas Emissions Inventory

August 2014

Prepared for:

City of Madera
205 W. 4th Street
Madera, CA 93637

Prepared by:



Rincon Consultants, Inc.

Environmental Scientists Planners Engineers

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EXECUTIVE SUMMARY

The City of Madera Community-wide Greenhouse Gas (GHG) Emissions Inventory identifies the sources and quantities of GHG emissions from community-wide activities within the City of Madera's jurisdictional boundaries. It includes a baseline inventory for the 2007 calendar year and a business-as-usual forecast (i.e., under existing conditions without new GHG emissions reduction measures) for the years 2020 and 2030.

The information presented in this document provides critical insights into the categories of activities, or sectors, that emit GHGs, establishes a baseline from which the City can set reduction targets and monitor changes in future emissions, and indicates where the greatest opportunities to reduce emissions lie. In addition, the forecasts provide understanding as to how future emissions may change based on projected growth in the community.

The inventory was developed following State-recommended methodologies detailed in the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (U.S. Community Protocol) (October 2012) and using the Statewide Energy Efficiency Collaborative ClearPath tool. It quantifies community-wide GHG emissions for six categories of activities, or sectors, within the City of Madera's jurisdictional boundary, which are described in **Table ES.1**.

What are Greenhouse Gas Emissions (GHGs)?

Gases that trap heat in the Earth's atmosphere are called greenhouse gases, or GHGs. GHGs include carbon dioxide, methane, nitrous oxide, and fluorinated gases. While many of these gases occur naturally in the atmosphere, modern human activity has led to a steep increase in the amount of GHGs released into the atmosphere over the last 100 years. Collectively, these gases intensify the natural greenhouse effect, thus causing global average surface temperatures to rise, which in turn affects global climate patterns. GHGs are often quantified in terms of carbon dioxide (CO₂) equivalent, or CO₂e, a unit of measurement that equalizes the potency of GHGs (Intergovernmental Panel on Climate Change [IPCC], 2007).

Table ES.1 GHG Emissions Sectors Included in Community-wide GHG Inventory

Sector	Source/Activity
Residential Energy	Fuel (electricity and natural gas) consumption in residential buildings
Commercial/Industrial Energy	Fuel (electricity and natural gas) consumption in commercial, industrial, and public facilities
Transportation & Mobile Sources	On-road vehicle miles travelled (VMT)*
	Fuel consumption (gasoline, diesel, and compressed natural gas [CNG]) in off-road equipment
Solid Waste	Decomposition of waste generated by the community and sent to landfills
Water	Fuel (electricity and natural gas) used to distribute and transport potable water
Wastewater	Electricity consumption from the operation of wastewater treatment facilities
	Process emissions from wastewater treatment facility

*Includes VMT from vehicle trips generated by land uses within the city. As such, these trips have an origin and/or destination within the City of Madera, and pass-through trips are not included in this total. See Section 3.3.1.

2007 Baseline Inventory

In 2007, the Madera community as a whole emitted approximately 324,690 metric tons of carbon dioxide equivalent GHG emissions (MT CO₂e) from the Residential Energy, Commercial/Industrial Energy, Transportation & Mobile Sources, Solid Waste, Water, and Wastewater sectors. As shown in **Figure ES.1** and **Table ES.2**, the Transportation & Mobile Sources sector was the largest source of emissions, generating approximately 188,585 MT CO₂e, or 58.1% of total emissions in 2007. Transportation & Mobile Sources sector GHG emissions are the result of fuel combustion in on-road vehicles and off-road equipment in Madera. The Residential Energy sector was the second largest source of 2007 emissions, generating 65,210 MT CO₂e, or 20.1% of total community-wide emissions, as a result of electricity and natural gas consumed in residential buildings. Madera's Commercial/Industrial Energy sector produced 54,387 MT CO₂e, or 16.7% of total community-wide emissions, as a result of electricity and natural gas consumption in non-residential buildings. The Solid Waste sector resulted in 12,973 MT CO₂e, or 4.0% of total GHG emissions, as a result of landfilled solid waste generated by the community. The remainder of GHG emissions resulted from the Water sector (2,840 MT CO₂e or 0.9%) and Wastewater sector (695 MT CO₂e or 0.2%).

Figure ES.1 Community-wide GHG Emissions by Sector (2007)

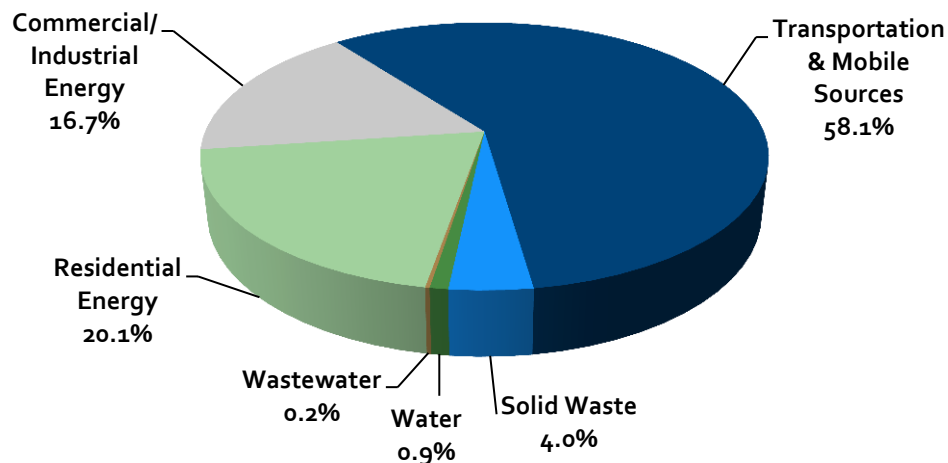


Table ES.2 Community-wide GHG Emissions by Sector (2007)

Sector	GHG Emissions (MT CO ₂ e)	% of Total
Residential Energy	65,210	20.1%
Commercial/ Industrial Energy	54,387	16.7%
Transportation & Mobile Sources	188,585	58.1%
Solid Waste	12,973	4.0%
Water	2,840	0.9%
Wastewater	695	0.2%
Total	324,690	100.0%

2020 and 2030 Emissions Forecast

The GHG emissions forecast provides a 2007 “business-as-usual” estimate of how community-wide GHG emissions would change in the years 2020 and 2030 if consumption trends continue as they did in 2007, absent any new federal, state, regional, or local policies or actions that would reduce GHG emissions. The year 2020 was selected for the forecast in order to maintain consistency with California State Assembly Bill (AB) 32.¹ The year 2030 was selected to maintain consistency with the City of Madera General Plan horizon year.

As shown in **Figure ES.2** and **Table ES.3**, if consumption trends continue the pattern observed in 2007 and accounting for projected growth in population, jobs, and VMT, community-wide emissions will reach 418,797 MT CO₂e in 2020 and 511,542 MT CO₂e in 2030. This represents a 29% increase in emissions over 2007 baseline levels by 2020 and 58% increase in emissions over 2007 baseline levels by 2030.

Figure ES.2 2020 and 2030 Community-wide GHG Emissions Forecast

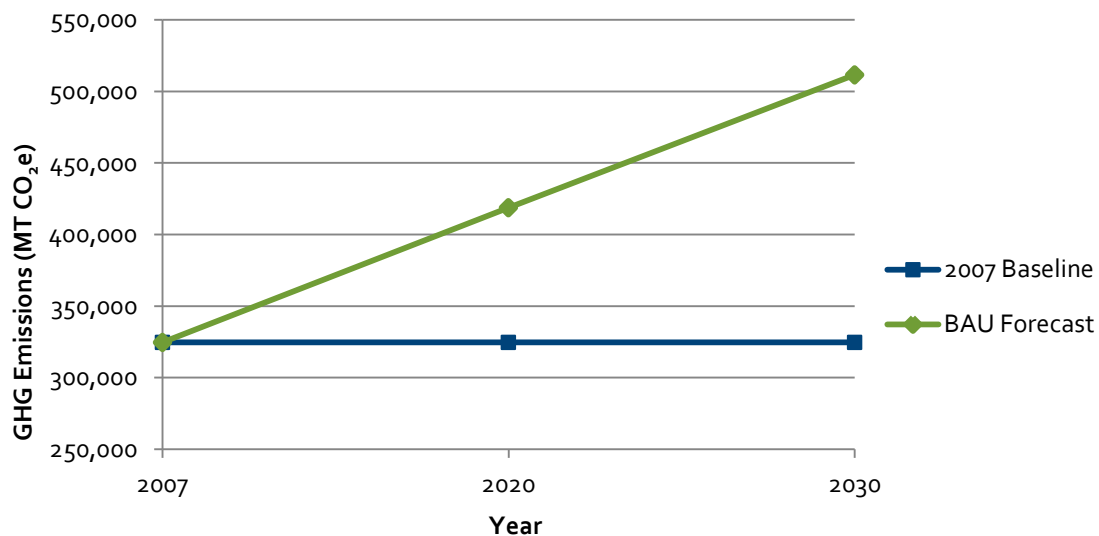


Table ES.3 2020 and 2030 Community-wide GHG Emissions Forecast Summary

Sector	2007 Emissions (MT CO ₂ e)	2020 Emissions (MT CO ₂ e)	2030 Emissions (MT CO ₂ e)	% Change from 2007 to 2020	% Change from 2007 to 2030
Residential Energy	65,210	85,042	102,855	30%	58%
Commercial/ Industrial Energy	54,387	79,891	98,230	47%	81%
Transportation & Mobile Sources	188,585	232,336	284,419	23%	51%
Solid Waste	12,973	16,918	20,462	30%	58%
Water	2,840	3,704	4,480	30%	58%
Wastewater	695	906	1,096	30%	58%
Total	324,690	418,797	511,542	29%	58%

¹ AB 32 establishes a GHG emission target for the State of California to reduce statewide emissions to 1990 levels by the year 2020.

1.0 INTRODUCTION

A community-wide GHG emissions inventory estimates the quantity of GHG emissions associated with community sources and activities taking place during a specific analysis year. It provides information on the activities that cause emissions and background on the methods used to make the calculations. Policy makers use GHG emissions inventories to track emission trends, develop strategies to reduce GHG emissions, and assess progress toward meeting reduction goals or targets.

The purpose of the City of Madera Community-Wide GHG Emissions Inventory is to identify the sources and quantities of GHG emissions from community-wide activities within the City's jurisdictional boundaries. The document includes a baseline inventory of GHG emissions for the 2007 calendar year and a business-as-usual forecast for the years 2020 and 2030.

2.0 METHODOLOGY

This section describes the methodology used to conduct the baseline inventory and forecast of GHG emissions within the City of Madera. The community-wide inventory was developed following methodologies detailed in the U.S. Community Protocol and using the Statewide Energy Efficiency Collaborative ClearPath tool, which are supported by the State of California.

2.1 Community-wide vs. Local Government Operations Inventory

In September 2012, the City of Madera completed a Local Government Operations GHG Emissions Inventory (Local Government Operations Inventory) with a 2007 baseline year. The Local Government Operations Inventory is provided in a separate report and includes emissions resulting from facilities that the City owns and/or operates. In 2007, GHG emissions from the City of Madera's local government operations totaled 8,464 MT CO₂e.

The community-wide inventory is the focus of this report and accounts for all GHG emissions associated with activities occurring within the City's jurisdictional boundary (i.e., the area over which the local government has jurisdictional authority or influence). The Local Government Operations Inventory is mostly a subset of the community-wide inventory, meaning that the majority of GHG emissions from the City's facilities and operations are included in this community-wide inventory. For example, electricity and natural gas used in City's buildings is accounted for in the Commercial Energy sector of this community-wide inventory, while government-generated solid waste is accounted for in the community-wide Solid Waste sector. As such, per the U.S. Community Protocol and Local Government Operations Protocol (2010), the government operations inventory should not be added to the community analysis; rather, it should be looked at as a portion of the total community-wide emissions.

2.2 Inventory Scope

This community-wide inventory accounts for GHG emissions resulting from activities and sources within the City of Madera in the 2007 calendar year.² GHG emissions forecasts were prepared for the 2020 and 2030 calendar years for consistency with the AB 32 target year³ and the General Plan horizon year respectively.

Table 2.1 lists the sectors that were included in the GHG emissions inventory, as well as the emission sources and activities, or subsectors, within each sector. These sectors include the sources of GHG emissions significant at the local level for which quantifiable data and reasonable methodologies were available.

Table 2.1 GHG Emissions Sectors and Subsectors

Sector	Subsector
Residential Energy	Electricity consumption in residential buildings
	Natural gas consumption in residential buildings
Commercial/Industrial Energy	Electricity consumption in commercial, industrial, and public facilities
	Natural gas consumption in commercial, industrial, and public facilities
Transportation & Mobile Sources	On-road VMT*
	Fuel consumption (gasoline, diesel, and CNG) in off-road equipment
Solid Waste	Decomposition of waste generated by the community and sent to landfills
Water	Electricity used to distribute and transport potable water
	Natural gas used to distribute and transport potable water
Wastewater	Electricity consumption from the operation of wastewater treatment facilities
	Process emissions from wastewater treatment

*Includes VMT from vehicle trips generated by land uses within the city. As such, these trips have an origin and/or destination within the City of Madera, and pass-through trips are not included in this total. See Section 3.3.1.

2.3 Data Parameters

This inventory was developed with the best-available tools, data, and methodology; however, as with any GHG inventory, there are limitations to representing all sources of emissions in a local jurisdiction. The main factors that limit GHG inventories include: (1) data availability, (2) privacy laws, (3) deficient methodology, and (4) lack of jurisdictional control. It is estimated that sources not included in the inventory comprise less

² Action item CON-36.1 of the City of Madera General Plan (2009) states that the City shall establish a baseline inventory of emissions for community-wide sources for the year 2007.

³ AB 32 establishes a statewide GHG emission reduction target for reaching 1990 GHG emissions levels by the year 2020.

than 5% of total emissions in the community and are therefore anticipated to have a minimal impact. These sources are described below.

- **Propane Use:** Propane is essentially an unregulated fuel in California (except for storage and safety issues, which are regulated). Because it is an unregulated commodity, no data is collected by the State on propane sales or usage. Madera is an urbanized community with a readily available natural gas system. As such, propane is not anticipated to be widely used and is likely to contribute minimally to community-wide emissions.
- **Ozone Depleting Substances (e.g., Leaked Refrigerants and Fire Suppressants):** Similar to propane, above, the amount of fugitive refrigerants and fire suppressants cannot be calculated because sales are not tracked.
- **Industrial Processes:** According to the U.S. Community Protocol, industrial process emissions are likely to be outside the influence of the local government or community at large.
- **Agriculture (Enteric Fermentation, Manure Management and Fertilizer Application):** No major livestock activities occur within the City of Madera. As such, agriculture sector emissions from enteric fermentation and manure management are considered “de minimis”⁴ or insignificant. In addition, the U.S. Community Protocol does not include a method for calculating GHG emissions from fertilizer application, as there is currently no reliable method to calculate those emissions at the local level.
- **Air Travel:** Aircraft emissions, including the usage of Avgas and jet fuel, are regulated by the Federal Aircraft Administration and are not under the control of the local government. In addition, the Madera Municipal Airport is a general aviation airport which does not provide commercial passenger air travel services.

2.4 Calculating Emissions

2.4.1 Greenhouse Gases

According to the U.S. Community Protocol, local governments should assess emissions of the six internationally recognized GHGs, which are listed in **Table 2.2** below.⁵ Each of the GHGs listed differs in its ability to absorb heat in the atmosphere, or in its intensity factor. GHGs are compared in terms of their respective intensity factor per molecule given an atmospheric lifetime of 100 years. The IPCC defines the intensity factor of various GHG emissions on a normalized scale that recasts all GHG emissions in terms of CO₂e, which compares the gas in question to that of the same mass of carbon dioxide (carbon dioxide has an intensity factor of one by definition). **Table 2.2** shows the intensity factor for the six most abundant GHGs.

⁴ De minimis is defined as emissions from one or more sources, for one or more gases which, when summed, equal less than 5% of an organization’s total emissions (U.S. Community Protocol, p. 53).

⁵ Carbon dioxide, methane, and nitrous oxide were the only gases emitted from the community-wide GHG emission sectors identified in Section 2.2 above.

Table 2.2 Intensity Factor of GHGs for a 100-Year Period

GHG	Activity	Intensity Factor (CO ₂ e) ¹
Carbon Dioxide (CO ₂)	Combustion	1
Methane (CH ₄)	Anaerobic Decomposition of Organic Waste (Landfills, Wastewater), Fuel Handling	21
Nitrous Oxide (N ₂ O)	Combustion, Wastewater Treatment	310
Hydrofluorocarbons	Leaking Refrigerants, Fire Suppressants	12-11,700
Perfluorocarbons	Aluminum Production, Semiconductor Manufacturing, HVAC Equipment Manufacturing	6,500-9,200
Sulfur Hexafluoride (SF ₆)	Transmission and Distribution of Power	23,900

¹ Values are based on the IPCC Second Assessment Report and United Nations Framework Convention on Climate Change reporting guidelines (IPCC, 1996). Although the IPCC Fourth Assessment Report presents different estimates, the current inventory standard relies on the Second Assessment Report's intensity factors to comply with reporting standards and consistency with regional and national inventories (USEPA, 2011).

2.4.2 Activity Data and Emission Factors

GHG emissions are generally calculated by multiplying activity data by a specific emissions factor, as shown in the basic equation below:

$$\text{Activity Data} \times \text{Emission Factor} = \text{Emissions}$$

Activity data refer to the relevant measurement of GHG-generating processes such as electricity consumption (kWh), fuel consumed (gallons of diesel, gasoline, or other fuel), etc. An emissions factor is a fraction that conveys the quantity of emissions resulting from a specific use and a given amount of activity data. Two examples of emissions factors are carbon dioxide emissions/kWh generated by an electric utility and carbon dioxide emissions/gallon of fuel used in a particular vehicle. After emissions are calculated, all emissions are then converted to MT CO₂e per the international convention of using intensity factors (refer to Section 2.4.1 above). Specific methods, assumptions, and data sources used to calculate emissions for each sector are detailed in the following sections. The activity data and emission factors used in the inventory are listed by sector in **Table 2.3** and **Table 2.4** below.

Table 2.3 Community-wide Activity Data (2007)

Sector	Subsector	2007 Activity Data	Data Source
Residential Energy	Electricity Consumption	114,603,809 kWh	Pacific Gas and Electric (PG&E)
	Natural Gas Consumption	6,014,954 therms	PG&E
Commercial/ Industrial Energy	Electricity Consumption	135,883,414 kWh	PG&E
	Direct Access Electricity Consumption	99,999 kWh	PG&E
	Natural Gas Consumption	2,809,906 therms	PG&E
Transportation & Mobile Sources	On-Road Transportation	256,504,829 VMT	Madera County Transportation Commission Travel Demand Model, Fehr & Peers
	Off-Road Equipment	923,633 gallons gasoline 10,151,400 gallons diesel 232,700 gallons CNG	California Air Resources Board OFFROAD2007
Solid Waste	Waste Generation	49,194 wet short tons	City, CalRecycle, U.S. Community Protocol
Water	Electricity Use	9,689,542 kWh	Local Government Operations Inventory
	Natural Gas Use	566 therms	Local Government Operations Inventory
Wastewater	Wastewater Treatment Process	Population served: 57,181 0.0000013 kg nitrogen/day 40,000 cubic ft./day digester gas Digester Gas Composition: 70% CH ₄	City, Local Government Operations Inventory
	Wastewater - Energy Use	1,714,043 kWh	Local Government Operations Inventory

Table 2.4 GHG Emission Factors

Sector	Subsector	2007 Emission Factors	Data Source
Residential Energy	Electricity Consumption	CO ₂ : 635.67 lbs./MWh CH ₄ : 29 lbs./GWh N ₂ O: 10 lbs./GWh	U.S. Community Protocol (Tables B.8 [PG&E] and B.9)
	Natural Gas Consumption	CO ₂ : 53.06 kg/MMBtu CH ₄ : 5 g/MMBtu N ₂ O: 0.1 g/MMBtu	U.S. Community Protocol (Tables B.1 and B.3)
Commercial/ Industrial Energy	Electricity Consumption	CO ₂ : 635.67 lbs./MWh CH ₄ : 29 lbs./GWh N ₂ O: 10 lbs./GWh	U.S. Community Protocol (Tables B.8 [PG&E] and B.9)
	Direct Access Electricity Consumption	CO ₂ : 919.64 lbs./MWh CH ₄ : 29 lbs./GWh N ₂ O: 10 lbs./GWh	U.S. Community Protocol (Table B.9)
	Natural Gas Consumption	CO ₂ : 53.06 kg/MMBtu CH ₄ : 5 g/MMBtu N ₂ O: 0.1 g/MMBtu	U.S. Community Protocol (Tables B.1 and B.3)
Transportation & Mobile Sources	On-Road Transportation	EMFAC ₂₀₁₁ for Madera County	California Air Resources Board EMFAC ₂₀₁₁
	Off-Road Equipment	Emissions were obtained directly from the OFFROAD ₂₀₀₇ model which has built-in region-specific coefficient sets	California Air Resources Board OFFROAD ₂₀₀₇
Solid Waste	Waste Generation	Newspaper: 0.043 MT CH ₄ /wet short ton Paper: 0.203 0.043 MT CH ₄ /wet short ton Cardboard: 0.120 0.043 MT CH ₄ /wet short ton Magazines: 0.049 0.043 MT CH ₄ /wet short ton Food Scraps: 0.078 0.043 MT CH ₄ /wet short ton Grass: 0.038 0.043 MT CH ₄ /wet short ton Leaves: 0.013 0.043 MT CH ₄ /wet short ton Lumber: 0.062 0.043 MT CH ₄ /wet short ton	U.S. Community Protocol (Table SW.5)
Water	Electricity Use	CO ₂ : 635.67 lbs./MWh CH ₄ : 29 lbs./GWh N ₂ O: 10 lbs./GWh	U.S. Community Protocol (Tables B.8 [PG&E] and B.9)
	Natural Gas Use	CO ₂ : 53.06 kg/MMBtu CH ₄ : 5 g/MMBtu N ₂ O: 0.1 g/MMBtu	Local Government Operations Protocol (Tables G1 and G3)
Wastewater	Wastewater Treatment Process	N/A	N/A
	Wastewater - Energy Use	CO ₂ : 635.67 lbs./MWh CH ₄ : 29 lbs./GWh N ₂ O: 10 lbs./GWh	U.S. Community Protocol (Tables B.8 [PG&E] and B.9)

3.0 COMMUNITY-WIDE INVENTORY

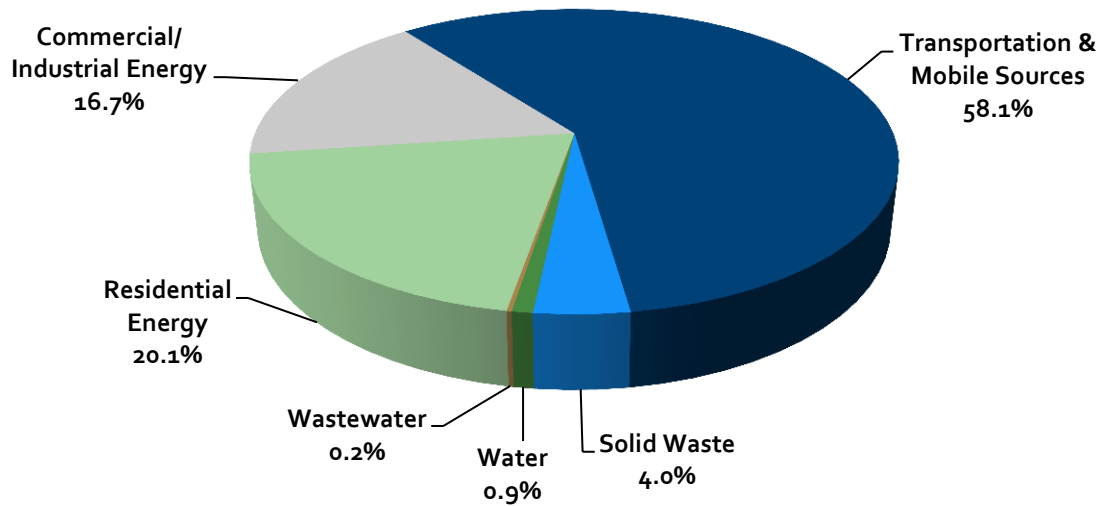
RESULTS

In 2007, the Madera community as a whole emitted approximately 324,690 MT CO₂e from the Residential Energy, Commercial/Industrial Energy, Transportation & Mobile Sources, Solid Waste, Water, and Wastewater sectors. **Figure 3.1** and **Table 3.1** show the breakdown of GHG emissions by sector and subsector.

Table 3.1 Community-wide GHG Emissions by Sector and Subsector (2007)

Sector	Subsector	GHG Emissions (MT CO ₂ e)	% of Total
Residential Energy	Electricity Consumption	33,237	51.0%
	Natural Gas Consumption	31,973	49.0%
	Residential Energy Subtotal	65,210	20.1%
Commercial/ Industrial Energy	Electricity Consumption	39,409	72.5%
	Direct Access Electricity Consumption	42	0.1%
	Natural Gas Consumption	14,936	27.4%
	Commercial/Industrial Energy Subtotal	54,387	16.7%
Transportation & Mobile Sources	On-Road Transportation	162,670	86.3%
	Off-Road Equipment	25,915	13.7%
	Transportation & Mobile Sources Subtotal	188,585	58.1%
Solid Waste	Landfilled waste	12,973	100.0%
	Solid Waste Subtotal	12,973	4.0%
Water	Water - Energy Use	2,840	100.0%
	Water Subtotal	2,840	0.9%
Wastewater	Wastewater Treatment Process	198	28.5%
	Wastewater - Energy Use	497	71.5%
	Wastewater Subtotal	695	0.2%
Total		324,690	100.0%

Figure 3.1 Community-wide GHG Emissions by Sector (2007)



3.1 Residential Energy

The Residential Energy sector includes GHG emissions from electricity and natural gas consumed in residential buildings. In 2007, Madera's Residential Energy sector consumed 114,603,809 kWh of electricity and 6,014,954 therms of natural gas, producing 65,210 MT CO₂e. As shown in **Table 3.1** above, approximately 51% of total residential emissions (33,237 MT CO₂e) were the result of electricity consumption and 49% (31,973 MT CO₂e) were the result of natural gas use.

3.2 Commercial/Industrial Energy

The Commercial/Industrial Energy sector includes GHG emissions from electricity and natural gas consumed in commercial and industrial buildings and public facilities. Electricity and natural gas sold to commercial and industrial customers as bundled service (both energy generation and transmission/distribution) and direct access electricity usage was provided by PG&E.

Madera's Commercial/Industrial Energy sector consumed 135,975,414 kWh of bundled service electricity, 99,999 kWh of direct access electricity, and 2,809,906 therms of natural gas, producing 54,387 MT CO₂e. Approximately 73% of total Commercial/Industrial Sector emissions (39,451 MT CO₂e) were the result of electricity consumption and 27% (14,936 MT CO₂e) were the result of natural gas use.

3.3 Transportation & Mobile Sources

The Transportation & Mobile Sources sector includes GHG emissions from on-road transportation and off-road equipment. In 2007, Transportation & Mobile Sources sector emissions totaled 188,585 MT CO₂e (see **Table 3.2**). This represents approximately 58.1% of Madera's total community-wide GHG emissions. On-road transportation resulted in 86.3% of Transportation & Mobiles Sources sector emissions, which off-road

equipment resulted in the remaining 13.7% of these emissions (see sections 3.3.1 and 3.3.2 for details on these sources).

Table 3.2 Transportation & Mobile Sources GHG Emissions by Source

Source	GHG Emissions (MT CO ₂ e)	% of Total
On-Road Transportation	162,670	86.3%
Off-Road Equipment	25,915	13.7%
Total	188,585	100.0%

3.3.1 On-Road Transportation

On-road transportation emissions were derived from community VMT data and regional vehicle and travel characteristics. Community-wide VMT for 2007 was calculated by Fehr & Peers using the Madera County Transportation Commission travel demand model. The VMT for Madera captures vehicle trips generated by land uses within the city. As such, these trips originated and/or terminated within the city limits, and pass-through trips were not included.⁶ EMFAC2011 was used to calculate emissions from the VMT. EMFAC defaults for Madera County include regionally-specific information on the mix of vehicle classes and model years, as well as ambient conditions and travel speeds that determine fuel efficiency. Types of emissions accounted for include: running exhaust, idle exhaust, and starting exhaust. On-road transportation emissions totaled 162,670 MT CO₂e in 2007.

3.3.2 Off-Road Equipment

Off-road equipment emissions resulted from the combustion of gasoline, diesel, and CNG used to power off-road equipment within the city. Off-road equipment accounted for in this inventory includes agriculture equipment, lawn and garden equipment, construction vehicles and equipment, light commercial equipment, and industrial equipment. Emissions were obtained directly from the OFFROAD2007 model developed by the California Air Resources Board. The OFFROAD2007 model has built-in coefficient sets based on a region-specific mix of vehicle classes/years, speed, temperature, relative humidity, and associated fuel efficiency. The OFFROAD2007 model provides emissions data for county-wide off-road equipment usage. County-wide emissions were scaled to the local jurisdiction level based on indicators identified in **Table 3.3**.

⁶ Per standard practice, 100% of internal-internal vehicle trips (having an origin and destination within the city), 50% of internal-external/external-internal vehicle trips (having an ending or beginning in the city), and 0% of external-external vehicle trips (that pass through the city without beginning or ending in the city) were included in the VMT calculation.

Table 3.3 Equipment Type Indicators

Equipment Type	Allocation Indicator	Source
Agricultural Equipment	Agricultural jobs	U.S. Census Bureau, Center for Economic Studies, On the Map Tool
Construction and Mining Equipment	Construction and mining jobs	U.S. Census Bureau, Center for Economic Studies, On the Map Tool
Industrial Equipment	Manufacturing jobs	U.S. Census Bureau, Center for Economic Studies, On the Map Tool
Lawn and Garden Equipment	Households	California Department of Finance
Light Commercial Equipment	Commercial jobs ¹	U.S. Census Bureau, Center for Economic Studies, On the Map Tool
Recreational Equipment	Population	California Department of Finance

¹ Commercial jobs include the following NAICS industry sectors: utilities, wholesale trade, retail trade, transportation and warehousing, and accommodation and food services.

As shown in **Table 3.4** below, approximately 67% of off-road equipment emissions in 2007 came from agricultural equipment, while 20% were the result of construction and mining equipment. The remaining off-road equipment activities included in this inventory include industrial equipment, lawn and garden equipment, light commercial equipment, and recreational equipment, making up the remaining 13% of emissions collectively. Total emissions from off-road equipment for 2007 are estimated to be approximately 25,915 MT CO₂e. Of the total emissions in the off-road sector, approximately 90% were due to diesel consumption, with the remaining 10% coming from gasoline and CNG use.

Table 3.4 Off-Road Emissions by Source

Source	GHG Emissions (MT CO ₂ e)	% of Total
Agricultural Equipment	17,395	67%
Construction and Mining Equipment	5,114	20%
Industrial Equipment	1,301	5%
Lawn and Garden Equipment	490	2%
Light Commercial Equipment	1,005	4%
Recreational Equipment	610	2%
Total	25,915	100%

3.4 Solid Waste

Emissions from the waste sector are an estimate of the methane generation from the decomposition of solid waste sent to landfills in the base year (2007). In 2007, the community generated 49,194 tons of solid waste that was sent to landfills. The U.S. Community Protocol describes the standard waste composition for the State of California by year. Identifying the different types of waste in the general mix is necessary because during decomposition various materials generate methane within the anaerobic environment of landfills at

differing rates. About 75% of landfill methane emissions are captured through landfill gas collection systems, but the remaining 25% escape into the atmosphere.⁷ The solid waste sector comprised 4% of total community-wide emissions in 2007 with 12,973 MT CO₂e.

3.5 Water

This sector includes emissions from electricity and natural gas used for the distribution or transport of water. The City of Madera operates a range of water transport equipment, including water delivery pumps and storm water management pumps. Data relating to electricity consumption and natural gas use by this equipment was provided by PG&E. Emissions from water transport totaled approximately 2,840 MT CO₂e in 2007, representing 0.9% of total community-wide emissions.

3.6 Wastewater

Wastewater generated by the community is rich in organic matter and has a high concentration of carbon and nitrogen (along with other organic elements). As wastewater is collected, treated, and discharged, chemical processes in anaerobic conditions lead to the creation and emission of two GHGs: methane and nitrous oxide. Wastewater sector emissions therefore account for these process emissions, as well as emissions resulting from the electricity used to treat and transport the community's wastewater.

In 2007, the Wastewater sector generated 695 MT CO₂e, constituting 0.2% of total community-wide. Approximately 72% (497 MT CO₂e) of these emissions resulted from energy use associated with wastewater collection, treatment, and distribution. The remaining 28% of emissions (198 MT CO₂e) resulted from methane and nitrous oxide generated in the wastewater treatment process.

4.0 2020 AND 2030 EMISSIONS FORECAST

This inventory includes a 2007 "business-as-usual" forecast to 2020 and 2030, estimating emissions that would occur if no new emissions reduction policies were implemented. The year 2020 was selected for the forecast in order to maintain consistency with California State Assembly Bill (AB) 32.⁸ The year 2030 was selected to maintain consistency with the City of Madera General Plan horizon year.

⁷ US EPA AP 42.

⁸ AB 32 establishes a GHG emission target for the State of California to reduce statewide emissions to 1990 levels by the year 2020.

4.1 Methodology

The forecast is based on projected growth trends in population, jobs, and VMT. The forecast relies on population and job projections provided by the City and VMT projections provided by Fehr & Peers using the Madera County Transportation Commission travel model. The forecast is based on the assumption that the number of drivers, electricity and natural gas consumption, solid waste tonnage, water usage, and wastewater generation will increase over time in proportion to the growth in population, jobs, and VMT. As a business-as-usual projection, the forecast does not take into account legislation or regulation implemented after 2007, which will later be accounted for in the city's Climate Action Plan.

The forecasting approach varies for each sector:

- Residential Energy, Solid Waste, Water, and Wastewater sector emissions are correlated with the City of Madera's forecasted population growth, which was provided by the City.
- Commercial/Industrial Energy sector emissions are correlated with forecasted with job growth in Madera, which was also provided by the City.
- On-road Transportation subsector emissions are based on projected growth in VMT provided by Fehr & Peers and were calculated using EMFAC2011.
- Off-road Equipment subsector emissions were calculated using OFFROAD2007.

Table 4.1 Madera's Growth Projections

Growth Indicator	2007	2020	2030	Sector Applied to
Population	57,181	74,571	90,191	Residential Energy, Solid Waste, Water, Wastewater
Jobs	15,258	22,413	27,558	Commercial/Industrial Energy
Annual VMT	256,504,829	333,100,731	410,301,822	On-road Transportation

4.2 Community-wide Emissions Forecast

Under a business-as-usual scenario, Madera's community-wide emissions will grow by approximately 29% by 2020 and 58% by 2030. **Figure 4.1** and **Table 4.2** show the results of the forecast.

Figure 4.1 Community-wide GHG Emissions Forecast for 2020 and 2030

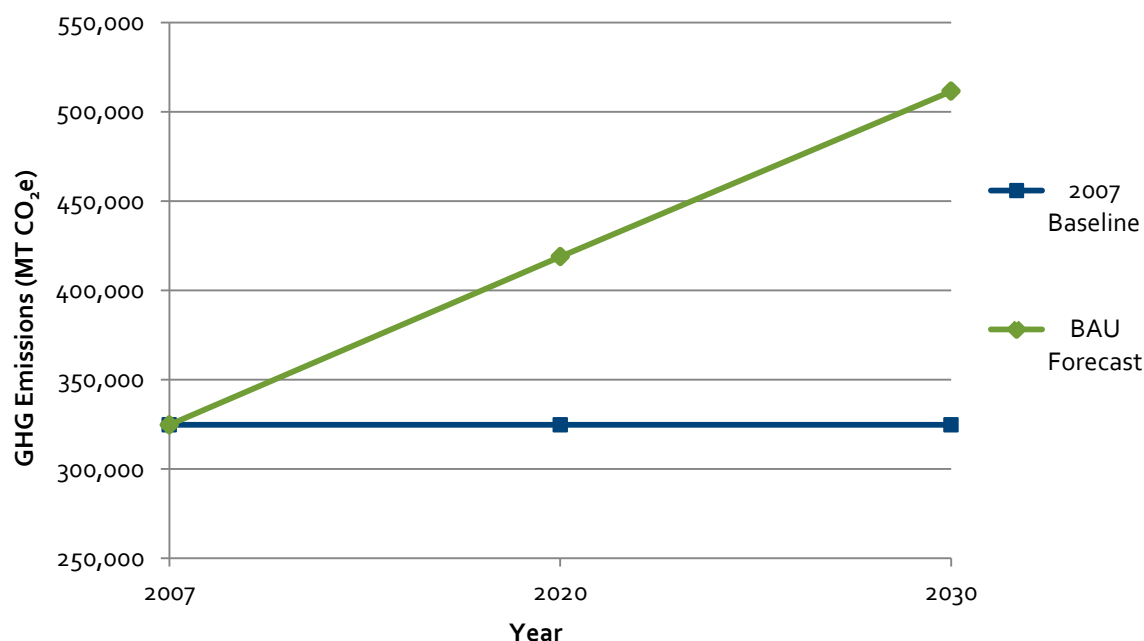


Table 4.2 Community-wide GHG Emissions Forecast for 2020 and 2030

Sector	2007 Emissions (MT CO ₂ e)	2020 Emissions (MT CO ₂ e)	2030 Emissions (MT CO ₂ e)	% Change from 2007 to 2020	% Change from 2007 to 2030
Residential Energy	65,210	85,042	102,855	30%	58%
Commercial/ Industrial Energy	54,387	79,891	98,230	47%	81%
Transportation & Mobile Sources	188,585	232,336	284,419	23%	51%
Solid Waste	12,973	16,918	20,462	30%	58%
Water	2,840	3,704	4,480	30%	58%
Wastewater	695	906	1,096	30%	58%
Total	324,690	418,797	511,542	29%	58%

5.0 CONCLUSION

This inventory will assist decision makers and stakeholders in identifying opportunities to reduce GHG emissions throughout the City of Madera. It also provides an emissions baseline that the City can use to set future emissions reduction targets. As the City develops its Climate Action Plan, it will use information in this inventory to determine which GHG emissions reduction efforts will be most effective and efficient in achieving the City's GHG emissions target.

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6.2 List of Preparers

This GHG Inventory was prepared by Rincon Consultants, Inc. under contract to the City of Madera. VMT data was provided by Fehr & Peers. Persons involved in research, analysis, report preparation, project management, and quality control include:

Joe Power, AICP CEP, Principal-in-Charge, Rincon Consultants, Inc.

Shauna Callery, MCRP, MS, Senior Project Manager, Rincon Consultants, Inc.

Christina McAdams, Associate Planner, Rincon Consultants, Inc.

Karly Kaufman, MESM, Associate Planner, Rincon Consultants, Inc.

Appendix B

City of Madera Government Operations
Greenhouse Gas Emissions Inventory

City of Madera

Government Operations

Greenhouse Gas Emissions Inventory



2007 Baseline Year Narrative Report

Supported by Pacific Gas and Electric Company

In Collaboration with the Economic Development Corporation serving Fresno County, the City of Fresno, and ICLEI-Local Governments for Sustainability USA

September 28, 2012

Credits and Acknowledgements

City of Madera

David Merchen, Director of Community Development, City of Madera

Economic Development Corporation (EDC) serving Fresno County

Kevin Smith, Program Analyst

City of Fresno

Joseph Oldham, Sustainability Manager

Pacific Gas and Electric Company (PG&E)

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ICLEI-Local Governments for Sustainability USA

Amruta Sudhalkar, Program Officer

J.R. Killigrew, Program Associate

Brian Holland, Climate Program Director

This report was prepared by a Green Communities Intern in conjunction with the Economic Development Corporation (EDC) serving Fresno County. The author(s) would like to thank the City of Madera's staff for providing much of the insight and local information necessary for the completion of this report.

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Executive Summary

City of Madera Profile

The City of Madera covers over 15.8 square miles and ranges from Fairmead to the north and the City of Fresno to the south. The City of Madera had an estimated population of 55,780 on January 1, 2007 and 56,710 on January 1, 2008. With 200 City employees in the year 2005, there was a ratio of approximately 3.52 employees per one thousand residents. The City of Madera's total budget was \$ 115,800 for fiscal year 2007-2008.

The City of Madera is located within Climate Zone 13,¹ according to the U.S. Department of Energy, and is characterized by Dry Semi-Arid environments. The City of Madera records approximately 3,600 heating degree days² and 1,100 cooling degree days per year.³

The Purpose of Conducting an Inventory

The City of Madera recognizes that the State of California has made greenhouse gas reductions a priority through the passage of AB 32, the Global Warming Solutions Act of 2006. It directed the California Air Resources Board, (ARB) to begin developing discrete early actions to reduce greenhouse gases statewide to 1990 emission levels. The state-created scoping plan indicates how these emission reductions will be achieved from significant greenhouse gas sources via regulations, market mechanisms, and other actions.

Each day, local governments operate buildings, vehicle fleets, streetlights, traffic signals, water systems, and wastewater treatment plants; local government employees consume resources commuting to work and generate solid waste which is sent for disposal. All of these activities directly or indirectly cause the release of carbon dioxide and other greenhouse gases into the atmosphere. This report presents the findings and methodology of a local government operations (LGO) greenhouse-gas emissions inventory for the City of Madera. The inventory measures the greenhouse gas emissions resulting specifically from the City of Madera's government operations, arranged by sector to facilitate detailed analysis of emissions sources. The inventory addresses where and what quantity of emissions are generated through various local government activities. Through analysis of a local government's emissions profile, the City of Madera can tailor strategies to achieve the most effective greenhouse gas emission reductions.

¹ Pacific Energy Center's Guide to: California Climate Zones, retrieved from http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california_climate_zones_01-16.pdf

² Heating and Cooling Degree Days are a measurement designed to reflect demand for energy needed to heat or cool a facility, and are calculated as the difference between the average daily temperature for a region and a baseline temperature (usually 65° or 80° F). HDD value is the summation of degrees of the average temperature per day below 65° F for the year. CDD is the summation of degrees of the average temperature per day above 80° F for the year.

³ NNDC Climate Data, retrieved from <http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp>

These emission-reduction strategies include promoting energy conservation and energy efficiency in buildings and operations, utilizing renewable energy sources where appropriate, recycling and waste reduction, and supporting alternative modes and types of transportation for employees. The benefits of these actions include lower energy bills, improved air quality, more efficient government operations, in addition to the mitigation of climate change impacts.

By conducting this inventory, the City of Madera is developing its capacity to understand and comply with future regulations and requirements around climate change, and is working to improve government services in a smart and targeted way that will benefit all of Jurisdiction's residents.

Inventory Results

Local governments provide different services to their citizens, and the scale of the services (and thus the emissions) is highly dependent upon the size and purview of the local government. For these reasons, comparisons between local government totals should not be made without keen analysis of the basis for figures and the services provided.

The following figures summarize the results of the LGO greenhouse gas emissions inventory for the City of Madera, by sector and source. As illustrated in Figure 1, the sector producing the most greenhouse gas emissions in the City of Madera is the Water and Stormwater Services sector at 35.2%, followed by the Buildings and Facilities sector at 19.5%. As shown in Figure 2, purchased electricity and gasoline are the sources with the greatest percentage of emissions (54.3% and 19.5% respectively). Table 1 delineates the different types of greenhouse gases (CO₂, CH₄, N₂O, etc.), which are assigned a standard metric of carbon dioxide equivalent (CO₂ e), and then combined to describe total emissions of the City.

Figure 1: 2007 Government Operations CO₂e Emissions by Sector

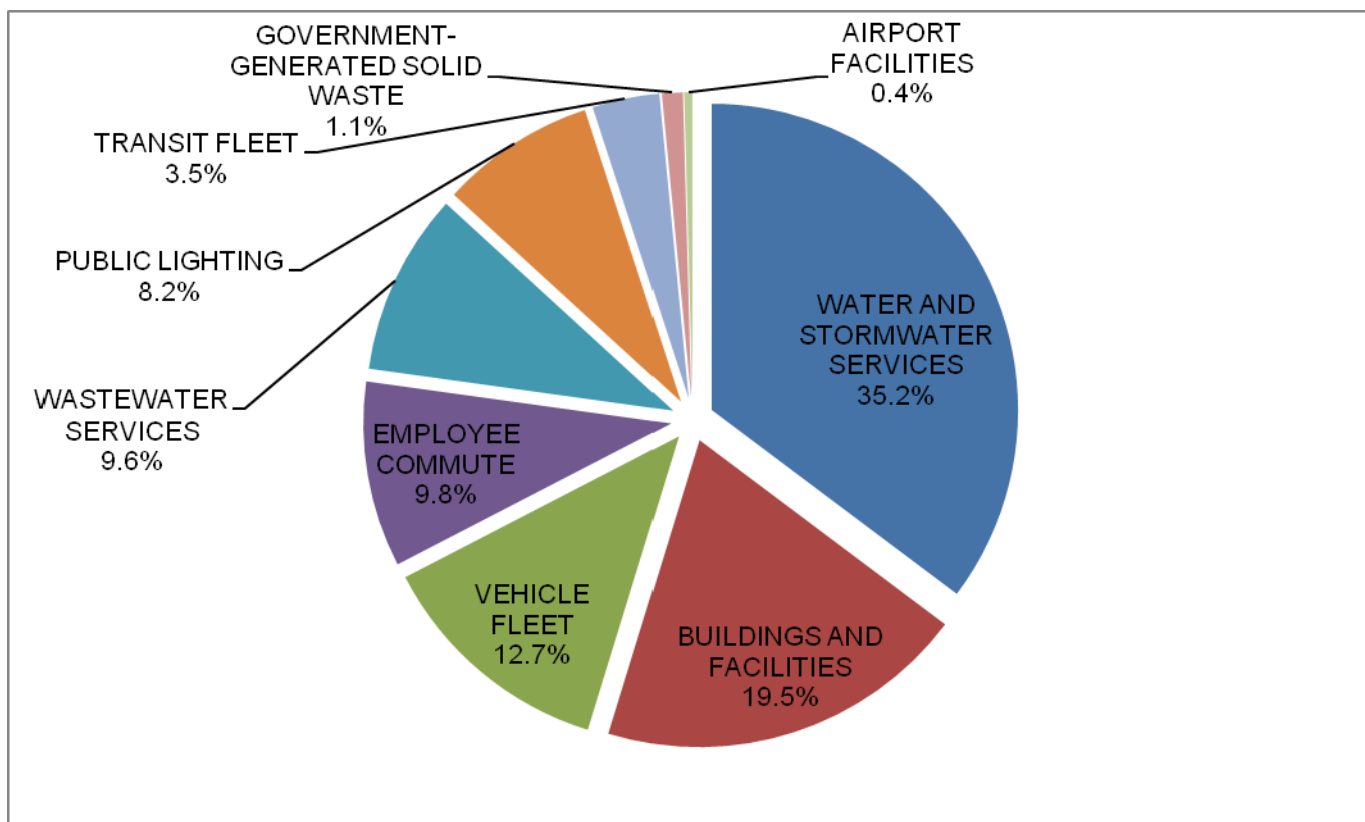


Figure 2: 2007 Government Operations CO₂e Emissions by Source

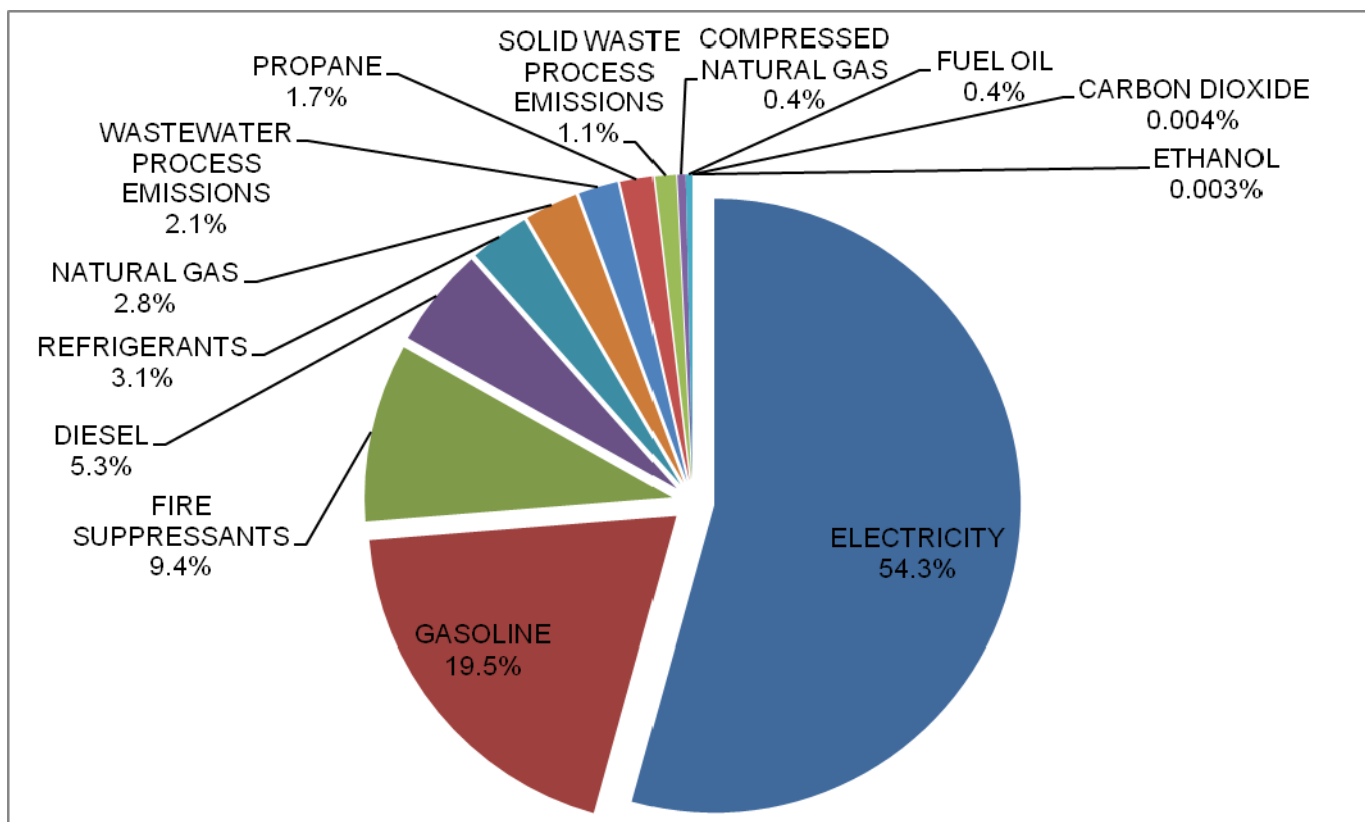


Table 1: Overall Emissions by Scope

Total Emissions								
	CO ₂ e	CO ₂	CH ₄	N ₂ O	HFC-134A	HFC-236FA	HFC-227EA	R-410A
Scope 1	2,948.70	1,654.02	2.80	0.56	0.04	0.01	0.25	0.12
Scope 2	4,594.65	4,567.99	0.21	0.07	0.00	0.00	0.00	0.00
Scope 3	920.46	818.84	4.46	0.03	0.00	0.00	0.00	0.00

For more detail on the concepts of scopes, sources, and sectors, and to review more granular data produced through the inventory study, please refer to the full report on the following pages.

Regional and Local Context

Climate Change Mitigation Activities in California

Since 2005, the State of California has responded to growing concerns over the effects of climate change by adopting a comprehensive approach to addressing emissions in the public and private sectors. This approach was officially initiated with the passage of the Global Warming Solutions Act of 2006 (AB 32), which requires the state to reduce its greenhouse gas emissions to 1990 levels by 2020. The AB 32 Scoping Plan was developed to identify strategies for meeting the AB 32 goal, and was adopted by ARB in December 2008. Among many other strategies, it encourages local governments to reduce emissions in their jurisdictions by 15 percent below current levels by 2020. In addition, it identifies the following strategies that will impact local governance:

- Develop a California cap-and-trade program
- Expand energy efficiency programs
- Establish and seek to achieve reduction targets for transportation-related related greenhouse gas (GHG) emissions
- Expand the use of green building practices
- Increase waste diversion, composting, and commercial recycling toward zero-waste
- Continue water efficiency programs and use cleaner energy sources to move and treat water
- Reduce methane emissions at landfills
- Preserve forests that sequester carbon dioxide

Other measures taken by the state include mandating stronger vehicle emissions standards (AB 1493, 2002), establishing a low-carbon fuel standard (EO # S-01-07, 2007), mandating a climate adaptation plan for the state (S-EO # 13-08, 2008), establishing a Green Collar Job Council, and establishing a renewable energy portfolio standard for power

generation or purchase in the state. The state also has made a number of legislative and regulatory changes that have significant implications for local governments:

- SB 97 (2007) required the Office of Planning and Research to create greenhouse gas planning guidelines for the California Environmental Quality Act (CEQA). In addition, ARB is tasked with creating energy-use and transportation thresholds in CEQA reviews, which may require local governments to account for greenhouse gas emissions when reviewing project applications.
- AB 811 (2007) authorizes all local governments in California to establish special districts that can be used to finance solar or other renewable energy improvements to homes and businesses in their jurisdiction.
- SB 375 (2008) revises the process of regional transportation planning by metropolitan planning organizations (MPOs), which are governed by elected officials from local jurisdictions. The statute calls on ARB to establish regional transportation-related GHG targets and requires the large MPOs to develop regional “Sustainable Communities Strategies” of land use, housing and transportation policies that will move the region towards its GHG target. The statute stipulates that transportation investments must be consistent with the Sustainable Communities Strategy and provides CEQA streamlining for local development projects that are consistent with the Strategy.

Pacific Gas and Electric Company Supported Inventory Project

With the administrative support of Pacific Gas and Electric Company (PG&E) and funding from California utility customers under the auspices of the California Public Utilities Commission, ICLEI - Local Governments for Sustainability (“ICLEI”) was contracted to work with the EDC serving Fresno County and the City of Fresno to assist in the quantification of greenhouse gas emissions in the City of Madera and the following other participating communities: the County of Fresno, the cities of Chowchilla, Clovis, Coalinga, Dinuba, Firebaugh, Fowler, Fresno, Huron, Kerman, Kingsburg, Madera, Mendota, Orange Cove, Parlier, Reedley, Sanger, San Joaquin, and Selma. ICLEI is a nonprofit association of local governments that provides information, delivers training resources, organizes conferences, facilitates networking and city-to-city exchanges, carries out research and pilot projects, and offers technical services and consultancy related to climate planning. Throughout 2012, ICLEI provided training and technical assistance to participating regional organizations, interns, and local government staff and facilitated the completion of this report.

Climate Change Mitigation Activities in the City of Madera

The City of Madera has already begun the process of emissions mitigation within City operations, which is also intended to result in higher energy efficiency and, therefore greater savings.



Introduction

General Methodology

Local Government Operations Protocol

A national standard called the Local Government Operations Protocol (LGO Protocol) has been developed and adopted by the ARB in conjunction with ICLEI, the California Climate Action Registry, and The Climate Registry. This standard provides accounting principles, boundaries, quantification methods, and procedures for reporting greenhouse gas emissions from local government operations. The LGO Protocol forms the basis of ICLEI's Clean Air & Climate Protection Software (CACP 2009), which allows local governments to compile data and perform the emissions calculations using standardized methods.

Greenhouse Gases and Carbon Dioxide Equivalent

In accordance with LGO Protocol recommendations, CACP 2009 calculates and reports all six internationally recognized greenhouse gases regulated under the Kyoto Protocol (Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride). Emissions summaries found throughout this report also use CACP 2009's ability to combine emissions from the various greenhouse gases into carbon dioxide equivalent, CO₂e. Since equal quantities of each greenhouse gas have more or less influence on the greenhouse effect, converting all emissions to a standard metric, CO₂e, allows apples-to-apples comparisons amongst quantities of all six emissions types. Greenhouse gas emissions are reported in this inventory as metric tons of CO₂e (MTCO₂e).

Table 2 exhibits the greenhouse gases and their global warming potential (GWP), a measure of the amount of warming a greenhouse gas may cause compared to the amount of warming caused by carbon dioxide.

Table 2: Greenhouse Gases

Gas	Chemical Formula	Activity	Global Warming Potential (CO ₂ e)
Carbon Dioxide	CO ₂	Combustion	1
Methane	CH ₄	Combustion, Anaerobic Decomposition of Organic Waste (Landfills, Wastewater), Fuel Handling	21
Nitrous Oxide	N ₂ O	Combustion, Wastewater Treatment	310
Hydrofluorocarbons	Various	Leaked Refrigerants, Fire Suppressants	12–11,700
Perfluorocarbons	Various	Aluminum Production, Semiconductor Manufacturing, HVAC Equipment Manufacturing	6,500–9,200
Sulfur Hexafluoride	SF ₆	Transmission and Distribution of Power	23,900

Calculating Emissions

In general, emissions can be quantified in two ways:

- 1. Measurement-based methodologies** refer to the direct measurement of greenhouse gas emissions from a monitoring system. Emissions measured this way may include those emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility. This method is the most accurate way of inventorying emissions from a given source, but is generally available for only a few sources of emissions.
- 2. Calculation-based methodologies** refer to an estimate of emissions calculated based upon measurable *activity data* and *emission factors*. Table 3 provides examples of common emissions calculations.

Table 3: Basic Emissions Calculations

Activity Data	x	Emissions Factor	= Emissions
Electricity Consumption (kilowatt hours)		CO ₂ emitted/kWh	CO ₂ emitted
Natural Gas Consumption (therms)		CO ₂ emitted/therm	CO ₂ emitted
Gasoline/Diesel Consumption (gallons)		CO ₂ emitted /gallon	CO ₂ emitted
Waste Generated by Government Operations (tons)		CH ₄ emitted/ton of waste	CH ₄ emitted

The Scopes Framework

This inventory reports greenhouse gas emissions by sector and additionally by “scope”, in line with the LGO Protocol and World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) Greenhouse Gas Emissions Protocol Corporate Standard.

Scope 1: Direct emissions from sources within a local government’s operations that it owns and/or controls, with the exception of direct CO₂ emissions from biogenic sources. This includes stationary combustion to produce electricity, steam, heat, and power equipment; mobile combustion of fuels; process emissions from physical or chemical processing; fugitive emissions that result from production, processing, transmission, storage and use of fuels; leaked refrigerants; and other sources.

Scope 2: Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling.

Scope 3: All other emissions sources that hold policy relevance to the local government that can be measured and reported. This includes all indirect emissions not covered in Scope 2 that occur as a result of activities within the operations of the local government. Scope 3 emission sources include (but are not limited to) tailpipe emissions from employee commutes, employee business travel, and emissions resulting from the decomposition of government-generated solid waste.

ICLEI and the LGO Protocol provide standard methodologies for calculating emissions from the sources shown in the following table. Other sources of emissions, such as those associated with the production of consumed products do not yet have standard calculation methodologies and are thus excluded from this inventory.

Table 4: Inventoried Emissions Sources by Scope

Scope 1	Scope 2	Scope 3
Fuel consumed at facilities	Purchased electricity consumed by facilities	Solid waste generated by government operations
Fuel consumed by vehicle fleet and mobile equipment	Purchased electricity consumed by electric vehicles	Fuel consumed by vehicles during employee commuting
Fuel consumed to generate electricity	Purchased steam	
Leaked refrigerants from facilities and vehicles	Purchased cooling (chilled water)	
Leaked / deployed fire suppressants		
Solid waste in government landfills		
Wastewater decomposition and treatment at a municipal wastewater treatment plant		

Organizational Boundaries

The organizational boundary for the inventory determines which aspects of operations are included in the emissions inventory, and which are not. Under the LGO Protocol, two control approaches are used for reporting emissions: operational control or financial control. A local government has operational control over an operation if it has full authority to introduce and implement policies that impact the operation. A local government has financial control if the operation is fully consolidated in financial accounts. If a local government has joint control over an operation, the contractual agreement will have to be examined to see who has authority over operating policies and implementation, and thus the responsibility to report emissions under operational control.

LGO Protocol strongly encourages local governments to utilize operational control as the organization boundary for a government operations emissions inventory. Operational control is believed to most accurately represent the emissions sources that local governments can most directly influence, and this boundary is consistent with other environmental and air quality reporting program requirements. For this reason, this inventory was conducted according to the operational control framework.

Types of Emissions

As described in the LGO Protocol, emissions from each of the greenhouse gases can come in a number of forms:

Stationary or mobile combustion: These are emissions resulting from on-site combustion of fuels (natural gas, diesel, gasoline, etc.) to generate heat, electricity, or to power vehicles and mobile equipment.

Purchased electricity: These are emissions produced by the generation of power from utilities outside of the jurisdiction.

Fugitive emissions: Emissions that result from the unintentional release of greenhouse gases into the atmosphere (e.g., leaked refrigerants, methane from waste decomposition, etc.).

Process emissions: Emissions from physical or chemical processing of a material (e.g., wastewater treatment).

Significance Thresholds

Within any local government's own operations there will be emission sources that fall within Scope 1 and Scope 2 that are minimal in magnitude and difficult to accurately measure. Within the context of local government operations, emissions from leaked refrigerants and backup generators may be common sources of these types of emissions. For these less significant emissions sources, LGO Protocol specifies that up to 5 percent of total emissions can be reported using methodologies that deviate from the recommended methodologies in LGO Protocol. In the context of registering emissions with an independent registry (such as the California Climate Action Registry), emissions that fall under the significance threshold are called *de minimis*.

In this report, some emissions were calculated using methods that deviate from the methods recommended in the LGO Protocol. However, the LGO Protocol identifies several alternative methods that still meet emission calculation standards. For the following areas, alternative methods were used to calculate emissions:

- Scope 1 fugitive emissions from the leakage of refrigerants from vehicles

In addition, emissions data from the following sources could not be obtained for this report and therefore emissions from these sources are not included in this inventory:

- Scope 1 fugitive emissions from the leakage of refrigerants from stationary heating, air conditioning, and refrigeration units—with the exception of some units that had up-to-date service records.
- Scope 3 emissions from Cal Fire, which is the contracted Fire Department service for the City of Madera

Information Items

Information items are emissions sources that are not included as Scope 1, 2, or 3 emissions in the inventory, but are reported here separately in order to provide a more complete picture of emissions from the City of Madera's government operations.

A common emission that is categorized as an information item is carbon dioxide emitted in the combustion of biogenic fuels. Local governments will often burn fuels that are of biogenic origin (wood, landfill gas, organic solid waste, biofuels, etc.) to generate power. Common sources of biogenic emissions are the combustion of landfill gas from landfills or biogas from wastewater treatment plants, as well as the incineration of organic municipal solid waste at incinerators.

Carbon dioxide emissions from the combustion of biogenic fuels are not included in Scope 1 based on established international principles. Methane and nitrous oxide emissions from biogenic fuels are considered Scope 1 stationary combustion emissions and are included in the stationary combustion sections for the appropriate facilities. These principles indicate that biogenic fuels (e.g., wood, biodiesel), if left to decompose in the natural environment, would release CO₂ into the atmosphere, where it would then enter back into the natural carbon cycle. Therefore, when wood or another biogenic fuel is combusted, the resulting CO₂ emissions are akin to natural emissions and should therefore not be considered as human activity-generated emissions. The CH₄ and N₂O emissions, however, would not have occurred naturally and are therefore included as Scope 1 emissions.

Understanding Totals

It is important to realize that the totals and sub-totals listed in the tables and discussed in this report are intended to represent all-inclusive, complete totals for the City of Madera's operations. However, these totals are only a summation of inventoried emissions using available estimation methods. Each inventoried sector may have additional emissions sources associated with them that were unaccounted for, such as Scope 3 sources that could not be estimated.

Also, local governments provide different services to their citizens, and the scale of the services (and thus the emissions) is highly dependent upon the size and purview of the local government. For these reasons, comparisons between local government totals should not be made without keen analysis of the basis for figures and the services provided.

It is important to understand that in the case where a local government operates a municipal utility that generates electricity for government facilities, the associated emissions should be considered Scope 1 emissions within the Power Generation Facilities sector, and not Scope 2 emissions within each of the other facilities sectors, when calculating a total. This is advised by the LGO Protocol and done to avoid reporting the same emissions twice, also known as double counting.



Inventory Results

Emissions Total

In 2007, the City of Madera's greenhouse gas emissions from government operations totaled 8,463.80 metric tons of CO₂e. This number represents a roll-up of emissions. While the roll-up is a valuable figure, information on the breakdown of emissions from local government operations by scopes, sources, and sectors allows the comparative analysis and insight needed for effective decision-making on target setting, developing GHG reduction measures, or monitoring. The LGO Protocol and ICLEI identify reporting by scopes, sources, and sectors as the strongly preferred form of reporting a greenhouse gas inventory. For more details on the breakdown of the City of Madera's emissions by scopes, sources, and sectors, refer to subsequent sections within Inventory Results in this report.

Buildings and Other Facilities

Facility operations contribute to greenhouse gas emissions in two major ways. First, facilities consume electricity and fuels such as natural gas. This consumption is associated with the majority of greenhouse gas emissions from facilities. In addition, fire suppression, air conditioning, and refrigeration equipment in buildings can emit hydrofluorocarbons (HFCs) and other greenhouse gases when these systems leak refrigerants or fire suppressants. Refrigerants and fire suppressants are very potent greenhouse gases and have Global Warming Potential (GWP) of up to many thousand times that of CO₂. For example, HFC-134a, a very common refrigerant, has a GWP of 1300, or 1300 times that of CO₂. Therefore, even small amounts of leaked refrigerants can have a significant effect on greenhouse gas emissions.

The City of Madera operates approximately 37 facilities ranging from City offices and the police headquarters, to a wastewater treatment plant. For the purpose of reporting emissions, these facilities were grouped by department when possible. Facilities that were unknown or previously uncategorized were included in this section of the inventory and were assigned to a category called "Other." Data relating to natural gas consumption were obtained from PG&E. Data relating to electricity consumption were also obtained from PG&E. Data relating to backup generators and fuel consumption were obtained from Tony Frede, the City's Electrical and Facilities Operations Manager and Zelda Leon, Administrative Assistant in the Planning Department (who had previously gathered much of the baseline year's fuel consumption data).

The Buildings and Facilities sector produced the second-largest amount of emissions by sector. Overall, these facilities produced 1,650.51 metric tons of CO₂e (19.5% of total emissions). As illustrated in Figure 3, the facility group producing the most greenhouse gas emissions in the City of Madera is the Public Works facility at 35.8%. The second largest contributor is the Administration facility at 22.6%.

As illustrated in Figure 4, the source producing the most greenhouse gas emissions in the Buildings and Facilities sector is fire suppressants at 40.6%, followed by purchased electricity at 33.8%.

Figure 3: Buildings and Other Facilities Emissions by Department

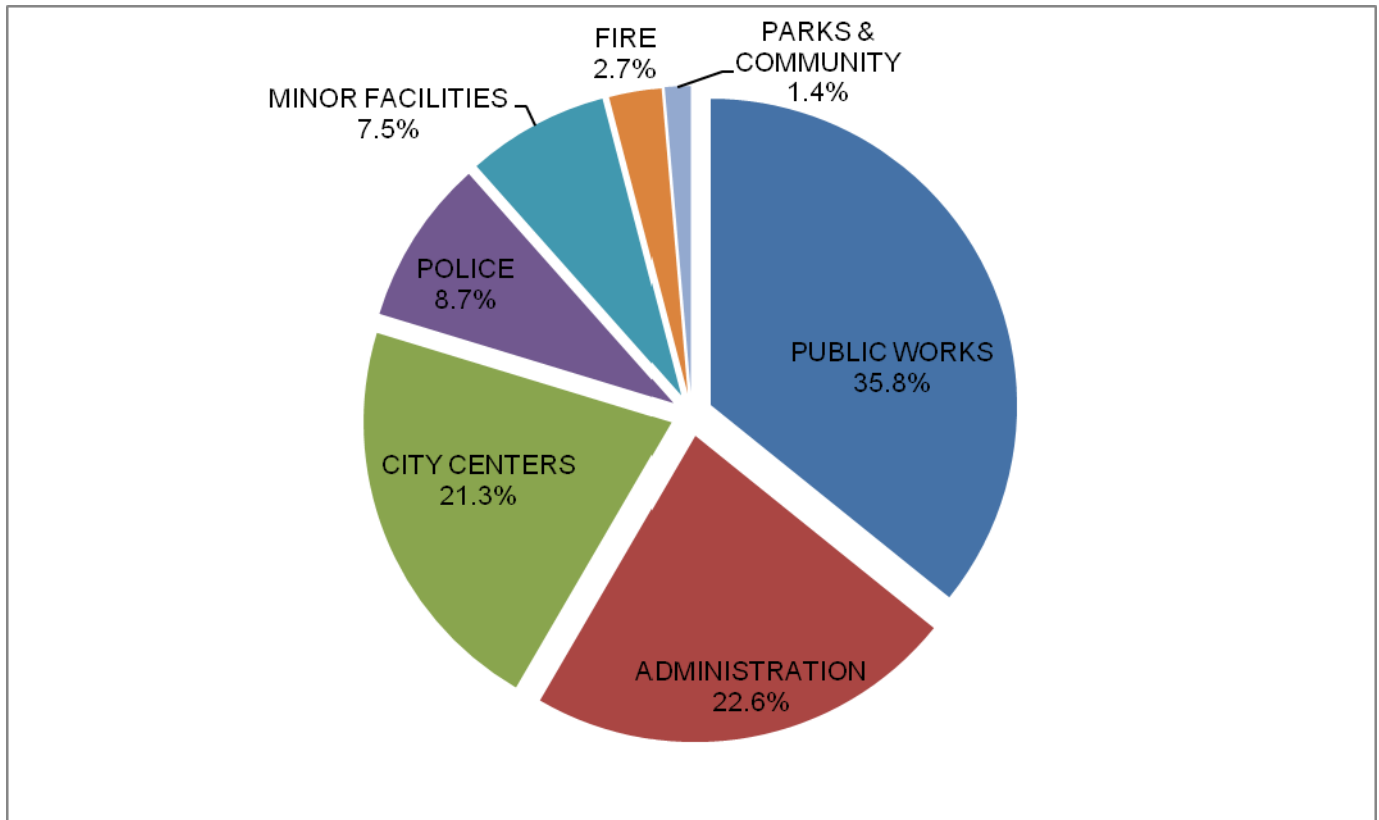


Table 5: Buildings and Other Facilities Emissions by Department

Department	metric tons CO ₂ e
Public Works	590.82
Administration	373.05
City Centers	351.78
Police	144.08
Minor Facilities	123.57
Fire	44.69
Parks & Community	22.52
Totals	1,650.51

Figure 4: Buildings and Other Facilities Emissions by Source

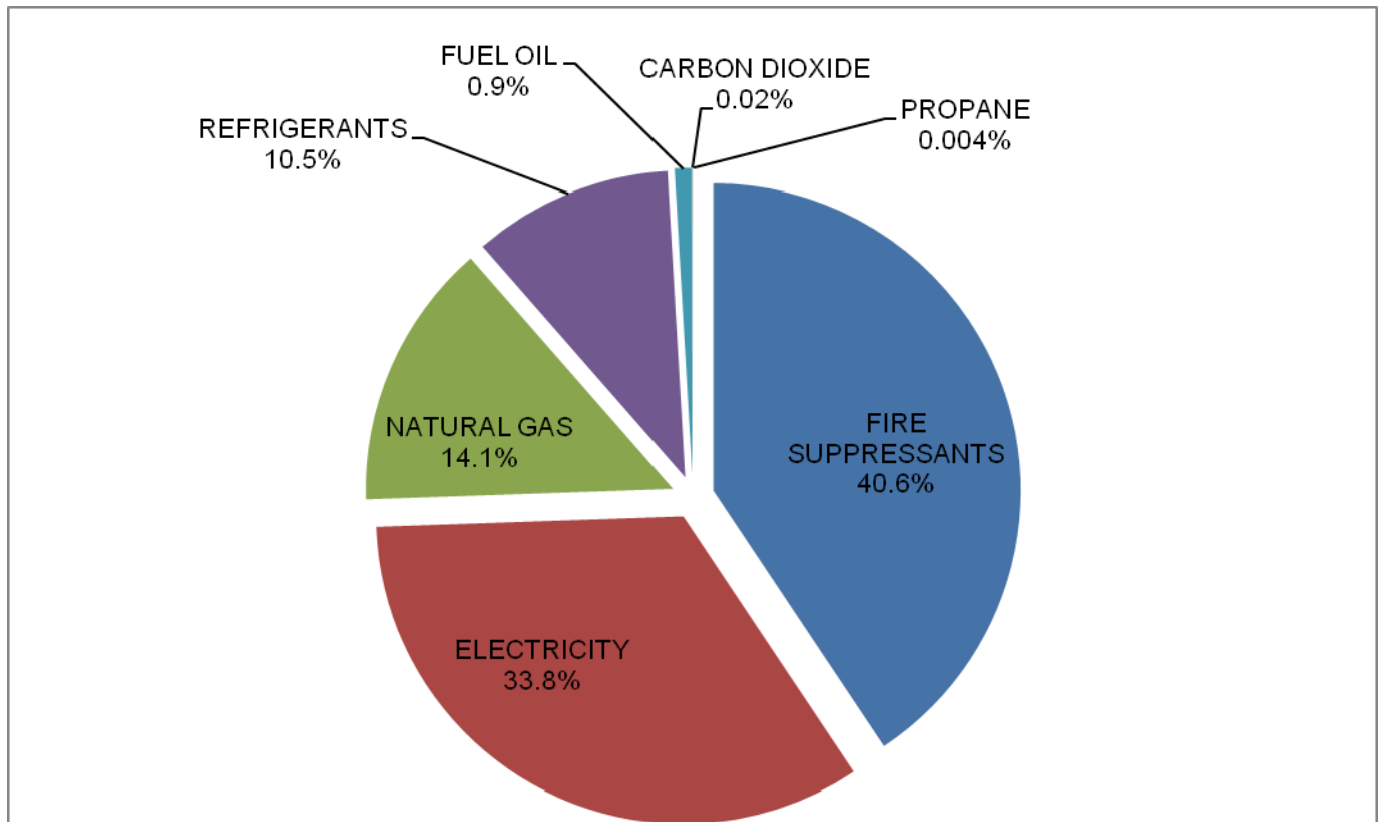


Table 6: Buildings and Other Facilities Emissions by Source

Source	metric tons CO ₂ e
Fire Suppressants	670.75
Electricity	558.19
Natural Gas	232.86
Refrigerants	173.52
Fuel Oil	14.83
Carbon Dioxide	0.30
Propane	0.06
Totals	1,650.51

Table 7: Buildings Sector Emissions by Scope and Emission Type

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)							
SCOPE 1		CO ₂ e	CO ₂	CH ₄	N ₂ O	HFC-134A	HFC-236FA	HFC-227EA	R-410A
	Stationary Combustion	247.75	247.06	0.02	0.00	0.00	0.00	0.00	0.00
	Fugitive Emissions	844.57	0.30	0.00	0.00	0.00	0.01	0.23	0.06
	Total Direct Emissions	1,092.32	247.36	0.02	0.00	0.00	0.01	0.23	0.06
SCOPE 2		CO ₂ e	CO ₂	CH ₄	N ₂ O				
	Purchased Electricity	558.19	554.96	0.03	0.01				
	Total Indirect Emissions	558.19	554.96	0.03	0.01				

Streetlights, Traffic Signals, and Other Public Lighting

Like most local governments, the City of Madera operates a range of public lighting including traffic signals, parking lighting, streetlights, etc. The majority of emissions associated with the operation of this infrastructure are due to electricity consumption. Data relating to electricity consumption for public lighting was obtained from PG&E.

While many of the streetlights located within the City of Madera are owned and operated by the City, some are owned and operated directly by PG&E. Since the City of Madera does not have operational or financial control over these lights, the emissions resulting from their operation are classified as Scope 3.

The Public Lighting sector produced the sixth-largest amount of emissions of all sectors overall. Overall, these facilities produced 692.79 metric tons of CO₂e (8.2% of total emissions). As illustrated in Figure 5 and Table 8, the subsector producing the most greenhouse gas emissions in the Public Lighting sector is Streetlights at 83.1%, followed by Park Lighting at 8.2%.

Figure 5: Public Lighting Emissions by Subsector

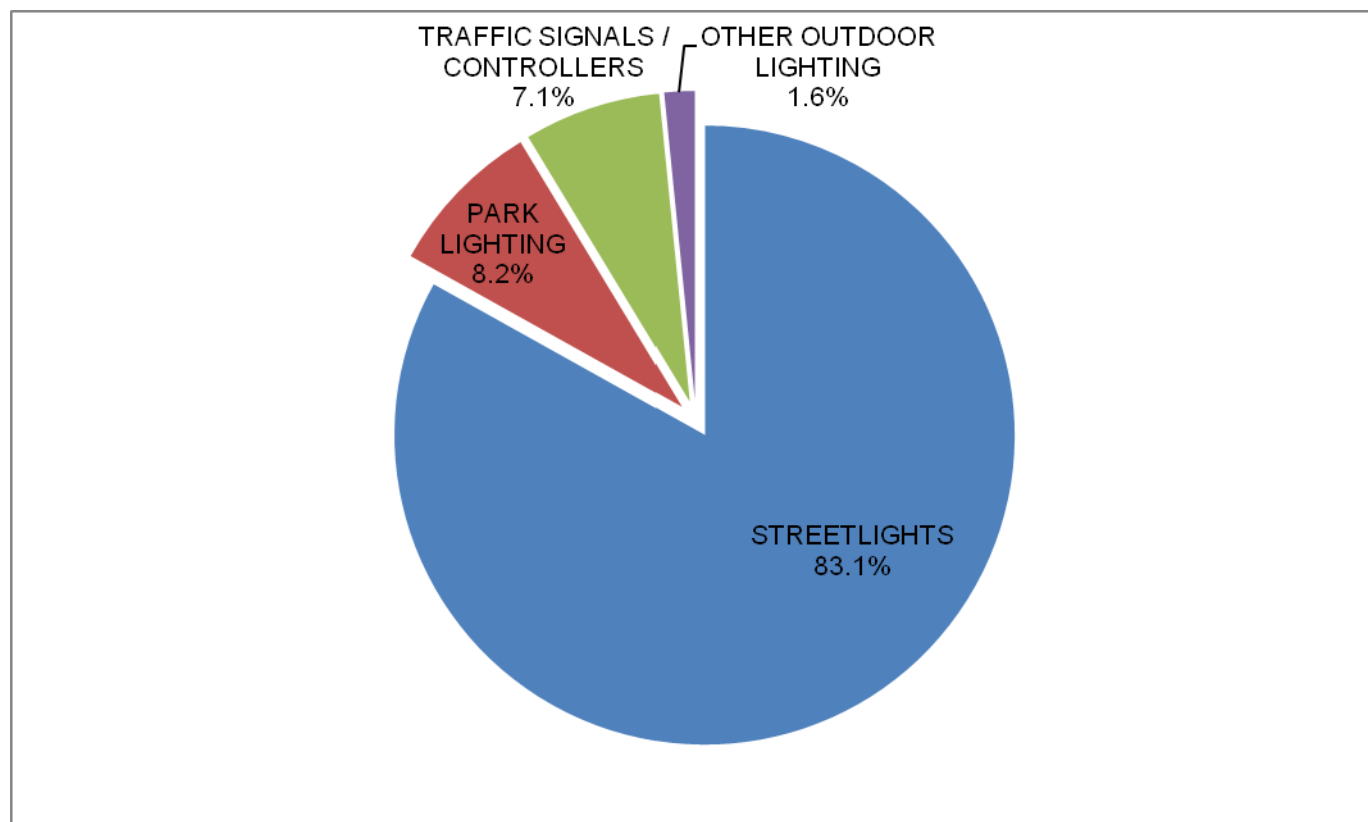


Table 8: Public Lighting Emissions by Subsector

Subsector (Light Type)	metric tons CO ₂ e	% of Sector Emissions	Electricity Use (kWh)	Cost (\$)
Streetlights	575.69	83%	1,985,011	\$344,359
Park Lighting	57.02	8%	196,613	\$27,562
Traffic Signals / Controllers	49.09	7%	169,259	\$27,120
Other Outdoor Lighting	10.99	2%	37,895	\$5,186
Totals	692.79	100%	2,388,778	\$404,227

Table 9: Public Lighting Emissions by Scope and Emission Type

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
SCOPE 2		CO ₂ e	CO ₂	CH ₄	N ₂ O
	Purchased Electricity	692.79	688.77	0.03	0.01
	Total Indirect Emissions	692.79	688.77	0.03	0.01

Water and Stormwater Services

This sector includes emissions from equipment used for the distribution or transport of water, including drinking water, sprinkler systems and irrigation. The City of Madera operates a range of water transport equipment, including water delivery pumps, sprinkler and irrigation controllers, storm water management pumps, and other water infrastructure such as sewer lift pumps. Electricity consumption and the on-site combustion of fuels such as natural gas are significant sources of greenhouse gas emissions from the operation of the City of Madera's water transport equipment. Data relating to electricity consumption was obtained from PG&E. Data relating to backup generators and fuel consumption were obtained from Tony Frede, the City of Madera's Electrical and Facilities Operations Manager.

Please also note that this sector of the inventory does not include those park sprinkler controls which could not be disaggregated from multipurpose park light and sprinkler control records.

The Water and Stormwater Services sector produced the largest amount of emissions overall, with 2,982.82 metric tons of CO₂e (35.2% of total emissions). As illustrated in Figure 6 and Table 10, the subsector producing the most greenhouse gas emissions in the Water and Stormwater Services sector is Water Delivery Pumps (Electricity) at 90.2%, followed by Water Delivery Pumps (Propane) at 4.7%.

Figure 6: Water and Stormwater Services Emissions by Subsector

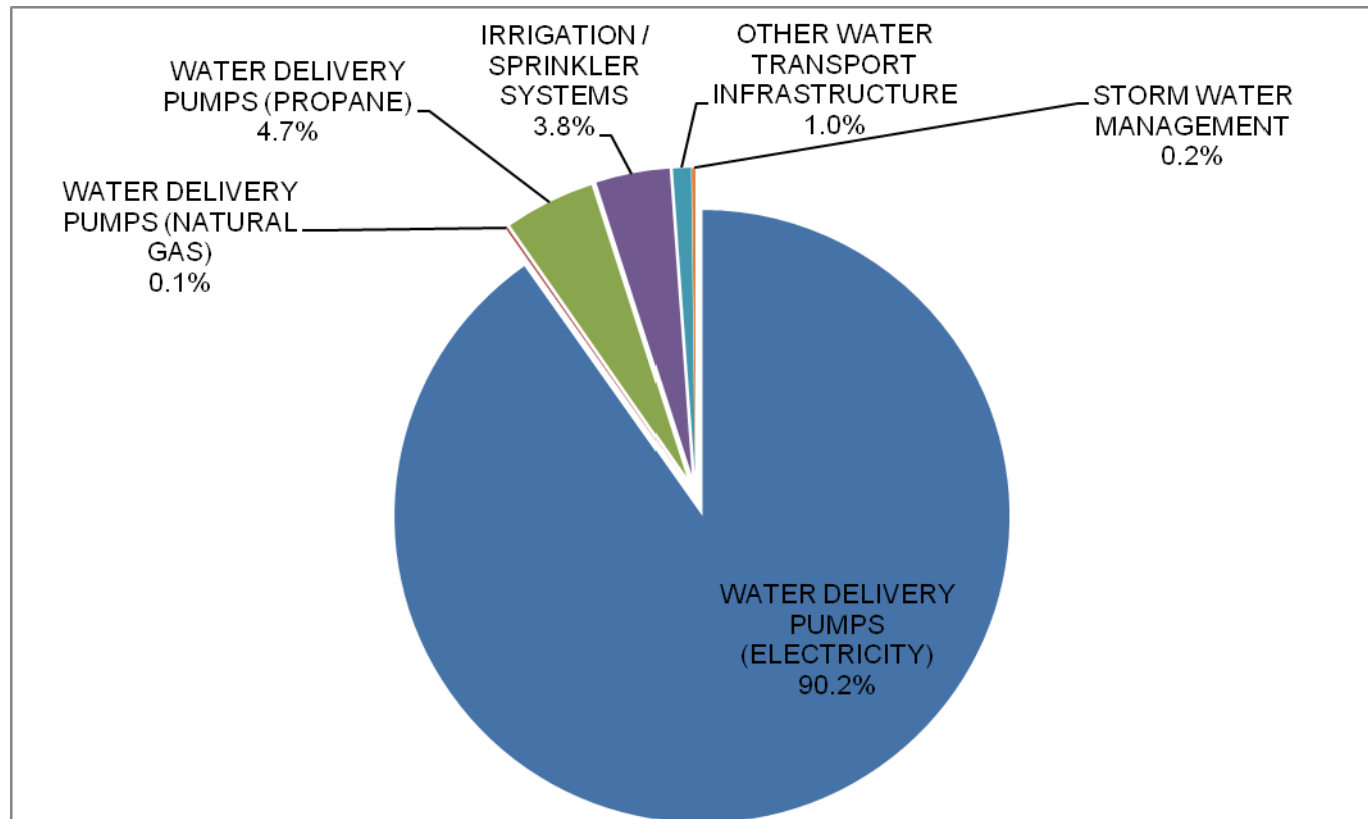


Table 10: Water and Stormwater Services Emissions by Subsector

Subsector (Equipment Type)	metric tons CO ₂ e	% of Sector Emissions	Source / Unit	Source / Quantity	Cost (\$)
Water Delivery Pumps (Electricity)	2,690.51	90%	Electricity / kWh	9,277,059	\$1,200,293
Water Delivery Pumps (Natural Gas)	2.96	0%	Natural Gas / Therms	556	\$1,173
Water Delivery Pumps (Propane)	141.38	5%	Propane / Gallons	25,045	\$1,508
Irrigation / Sprinkler Systems	113.63	4%	Electricity / kWh	391,820	\$57,586
Other Water Transport Infrastructure	28.35	1%	Electricity / kWh	97,763	\$14,251
Storm Water Management	5.99	0%	Electricity / kWh	20,663	\$5,700
Totals	2,982.82	100%		9,812,906	\$1,280,511

Table 11: Water and Stormwater Services Emissions by Scope and Emission Type

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)			
SCOPE 1		CO ₂ e	CO ₂	CH ₄	N ₂ O
Stationary Combustion		144.33	143.02	0.03	0.00
Fugitive Emissions		0.00	0.00	0.00	0.00
Total Direct Emissions		144.33	143.02	0.03	0.00
SCOPE 2		CO ₂ e	CO ₂	CH ₄	N ₂ O
Purchased Electricity		2,838.49	2,822.02	0.13	0.04
Total Indirect Emissions		2,838.49	2,822.02	0.13	0.04

Wastewater Treatment Facilities

Wastewater coming from homes and businesses is rich in organic matter and has a high concentration of carbon and nitrogen (along with other organic elements). As wastewater is collected, treated, and discharged, chemical processes in aerobic and anaerobic conditions lead to the creation and emission of two greenhouse gases: methane and nitrous oxide. Local governments that operate wastewater treatment facilities, including treatment plants, septic systems, collection lagoons, and other facilities, must therefore account for the emission of these gases.

Electricity consumption and the on-site combustion of fuels such as natural gas and diesel are also significant sources of greenhouse gas emissions from the operation of wastewater treatment facilities. Data relating to electricity consumption was obtained from PG&E. Data relating to backup generators and fuel consumption were obtained from Wayne Clay, the City of Madera's Wastewater Treatment Plant Operations Manager.

The City of Madera has operated the wastewater treatment plant at 13048 Road 21 ½ since 1972, and had a plant expansion and upgrade completed in 2007. The treatment plant covers approximately 320 acres and has a design capacity of 10.1 million gallons per day. The City of Madera Wastewater Treatment Plant is the regional facility for disposal of wastewater. The treatment plant handles wastewater and sewage from approximately 10,000 residential, commercial and industrial accounts. The primary goal of the Wastewater Treatment Division is protection of public health and safety in addition to complying with many State and Federal discharge and laboratory testing requirements.

The City of Madera Waste Water Treatment Facility, originally constructed in 1972, provides primary and secondary treatment. A plant expansion and upgrade was completed in 2007 with current technology to provide a treatment capacity of 10.1 M.G.D. (Million Gallons per Day). The treatment process consists of screening, grit removal, sedimentation, oxidation ditches (activated sludge), and final clarification. Also included in the plant expansion were an odor control and a water reclamation system to provide water for plant purposes. In addition, the Division is charged with preventative maintenance and upkeep of all mechanical equipment and facilities, maintaining energy efficient plant operations, pretreatment program administration, ground water monitoring, septic waste management, and maintenance of grounds, landscaping and effluent disposal fields. The plant has 320 acres of land for effluent percolation and evaporation⁴. In 2007, these facilities served approximately 55,780 people, including residents and businesses throughout the area.

The Wastewater Treatment sector produced the fifth-largest amount of emissions in this inventory. Overall, these facilities produced 813.34 metric tons of CO₂e (9.6% of total emissions). As illustrated in Figure 7 and Table 12, the subsector producing the most greenhouse gas emissions in the Wastewater Treatment sector is Facility Energy Use at 57.6%, followed by Nitrification/Denitrification at 16.7%.

⁴ <http://www.cityofmadera.org/web/guest/waste-water-treatment>

Figure 7: Wastewater Treatment Facilities Emissions by Subsector

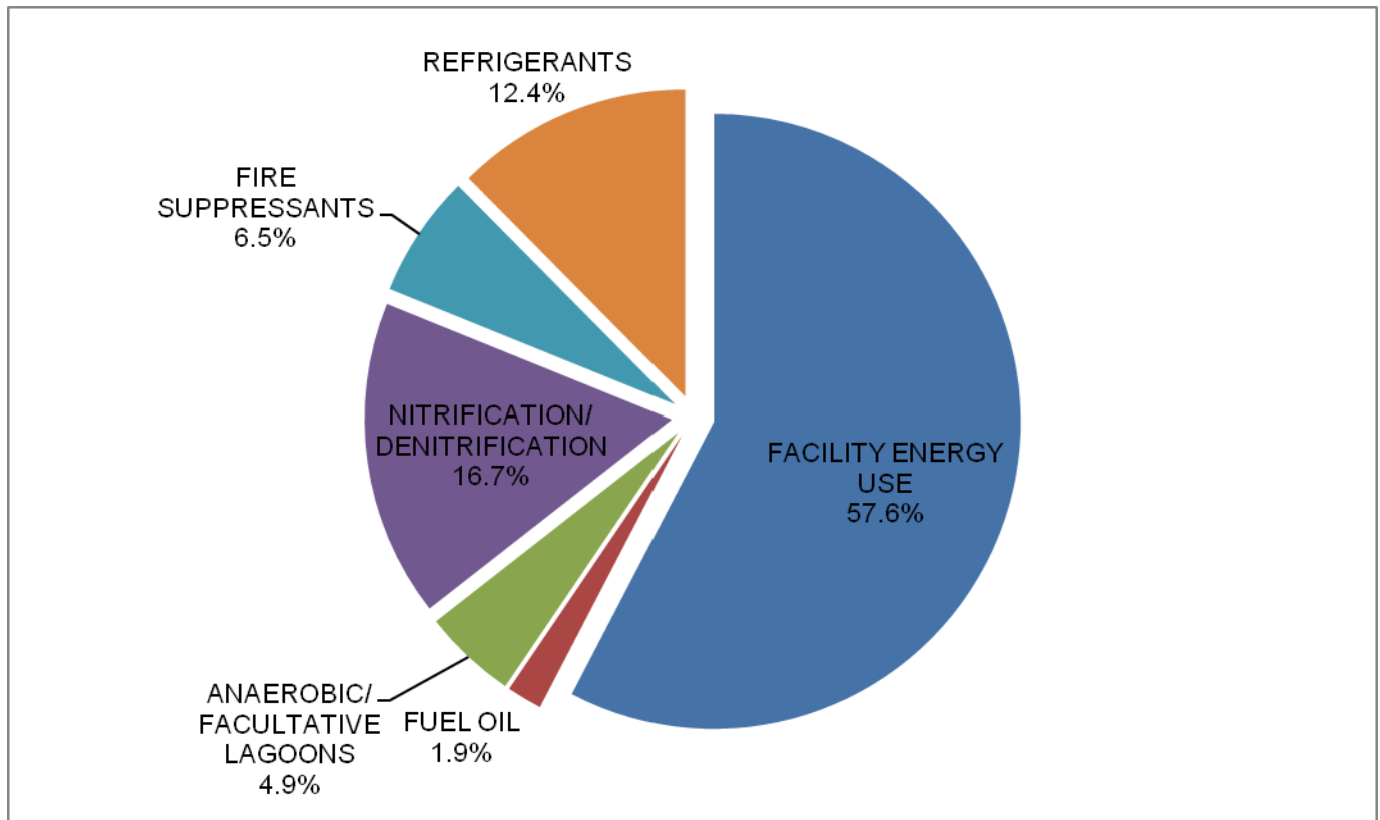


Table 12: Wastewater Treatment Facilities Emissions by Subsector

Subsector	metric tons CO ₂ e
Facility Energy Use	468.75
Fuel Oil	15.17
Anaerobic/ Facultative Lagoons	40.24
Nitrification/ Denitrification	135.63
Fire Suppressants	52.61
Refrigerants	100.95
Totals	813.34

Table 13: Wastewater Treatment Facilities Emissions by Scope and Emission Type

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)							
SCOPE 1		CO ₂ e	CO ₂	CH ₄	N ₂ O	HFC-134A	HFC-236 FA	HFC-227EA	R-410A
	Stationary Combustion	15.17	15.07	0.00	0.00	0.00	0.00	0.00	0.00
	Fugitive Emissions	153.56	0.00	0.00	0.00	0.00	0.00	0.02	0.06
	Process Emissions	175.86	0.00	1.92	0.44	0.00	0.00	0.00	0.00
	Total Direct Emissions	344.59	0.00	1.92	0.44	0.00	0.00	0.02	0.06
SCOPE 2		CO ₂ e	CO ₂	CH ₄	N ₂ O				
	Purchased Electricity	468.75	466.03	0.02	0.01				
	Total Indirect Emissions	468.75	466.03	0.02	0.01				

Airport Facilities

Electricity consumption and the on-site combustion of fuels such as natural gas and diesel are significant sources of greenhouse gas emissions from the operation of the City of Madera's Airport Facilities. Data relating to electricity consumption was obtained from PG&E. Data relating to backup generators and fuel consumption were obtained from Zelda Leon, the City of Madera's Planning Department's Administrative Assistant.

The Airport Facilities sector produced the least amount of emissions in this inventory. Overall, these facilities produced 37.19 metric tons of CO₂e (0.4% of total emissions). As illustrated in Table 14, the emission type producing the most greenhouse gas emissions in the Airport Facilities sector was Scope 2 Purchased Electricity with 36.43 metric tons of CO₂e, followed by Scope 1 Stationary Combustion with 0.73 metric tons of CO₂e.

Table 14: Airport Facilities Emissions by Scope and Emission Type

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)				
SCOPE 1		CO ₂ e	CO ₂	CH ₄	N ₂ O	HFC-134A
	Stationary Combustion	0.73	0.73	0.00	0.00	0.00
	Fugitive Emissions	0.04	0.00	0.00	0.00	0.00
	Total Direct Emissions	0.76	0.73	0.00	0.00	0.00
SCOPE 2		CO ₂ e	CO ₂	CH ₄	N ₂ O	
	Purchased Electricity	36.43	36.22	0.00	0.00	
	Total Indirect Emissions	36.43	36.22	0.00	0.00	

Vehicle Fleet and Mobile Equipment

The vehicles and mobile equipment used in the City of Madera's daily operations include: heavy and light trucks used for landscape and maintenance tasks; passenger cars, light trucks, and sport utility vehicles (SUVs) driven on a variety of site visits, including building inspections; and other vehicles as noted. Most vehicles consume gasoline, some consume diesel, some consume compressed natural gas (CNG), and each results in greenhouse gas emissions. Gasoline and diesel-powered maintenance equipment contributes to greenhouse gas emissions as well and has been noted in this report. In addition, vehicles with air conditioning or refrigeration equipment use refrigerants that can leak from the vehicle.

In 2007, the City of Madera operated a vehicle fleet with 300 vehicles and approximately 30 pieces of equipment. The largest group of vehicles in the fleet (25%) were used in the Police Department. Other vehicles, as well as those associated with the Police Department, were shared across a variety of divisions (e.g. Water, Streets, Park Maintenance, etc.). Other vehicles were used by the Water Department, Fire Department, and Streets Department, among others.

The emissions resulting from the consumption of fossil fuels by the City of Madera's contracted waste hauler were reported within this sector as Scope 3 emissions. As to better ascertain emissions in the future, vehicle fuel consumption from Allied Waste could be configured. This is due to the fact that the City of Madera does not have operational or financial control over this particular vehicle fleet (*refer to Organizational Boundaries*). However, the LGO Protocol recommends that, if available, this Scope 3 emission be reported for the sake of transparency and policy relevance.

While refrigerants are estimated to have contributed 56.55 metric tons of CO₂e (5.3% of total emissions), it should be noted that the default emission rates method was used to estimate emissions from leaked refrigerants. While this method can significantly overestimate the actual amount of leaked refrigerant, this method is in line with LGO Protocol methods. The figure generated here is a conservative amount in lieu of exact amounts, which were not available. Once again, the default method and other methods will be discussed in greater detail in the "Inventory Methodologies" section. Emissions from ozone depleting chemicals used as refrigerants in vehicles produced before 1995 (e.g. R-12) were included as an information item in this inventory since these chemicals are regulated by the Montreal Protocol and are currently being phased out of use.

The Vehicle Fleet sector produced the third-largest amount of emissions in this inventory. Overall, this sector produced 1,072.29 metric tons of CO₂e (12.7% of total emissions). As illustrated in Figure 8 and Table 15, the source producing the most greenhouse gas emissions in the Vehicle Fleet sector was gasoline at 76.4%, followed by diesel at 15.3%. Emissions from vehicle fleet use by department are illustrated in Figure 9.

Figure 8: Vehicle Fleet Emissions by Source

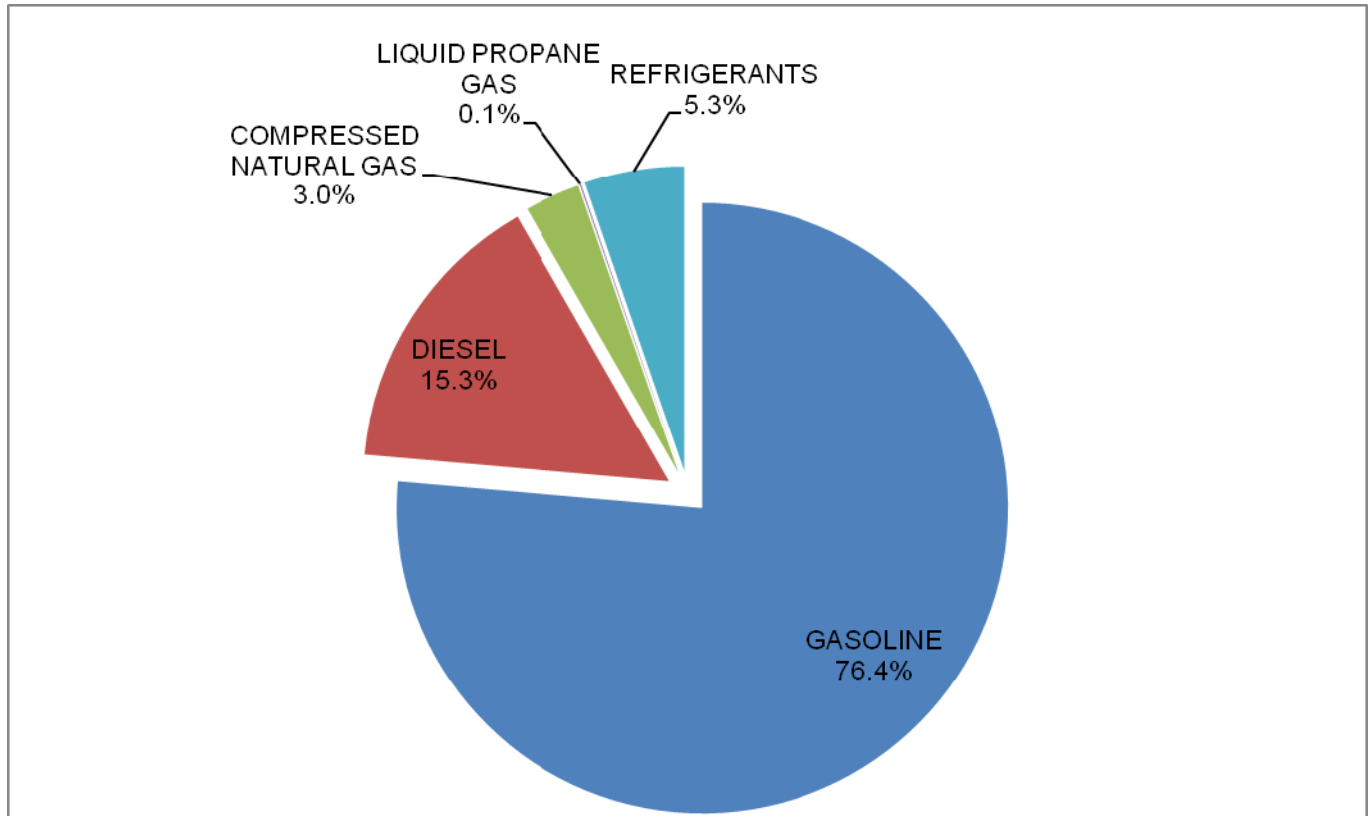


Table 15: Vehicle Fleet Emissions by Source

Source	metric tons CO ₂ e	Consumption Quantity	Consumption Units	Cost (\$)
Gasoline	819.21	1,697,968.33	Gallons	\$235,728
Diesel	164.19	203,968.65	Gallons	41,131.49
Compressed Natural Gas	31.68	637,023.10	Gallons	64,712.81
Liquid Propane Gas	0.65	112.84	Gallons	278.95
Refrigerants	56.55	0.04	Tonnes	0.00
Totals	1,072.29			\$341,851

Figure 9: Vehicle Fleet Emissions by Department

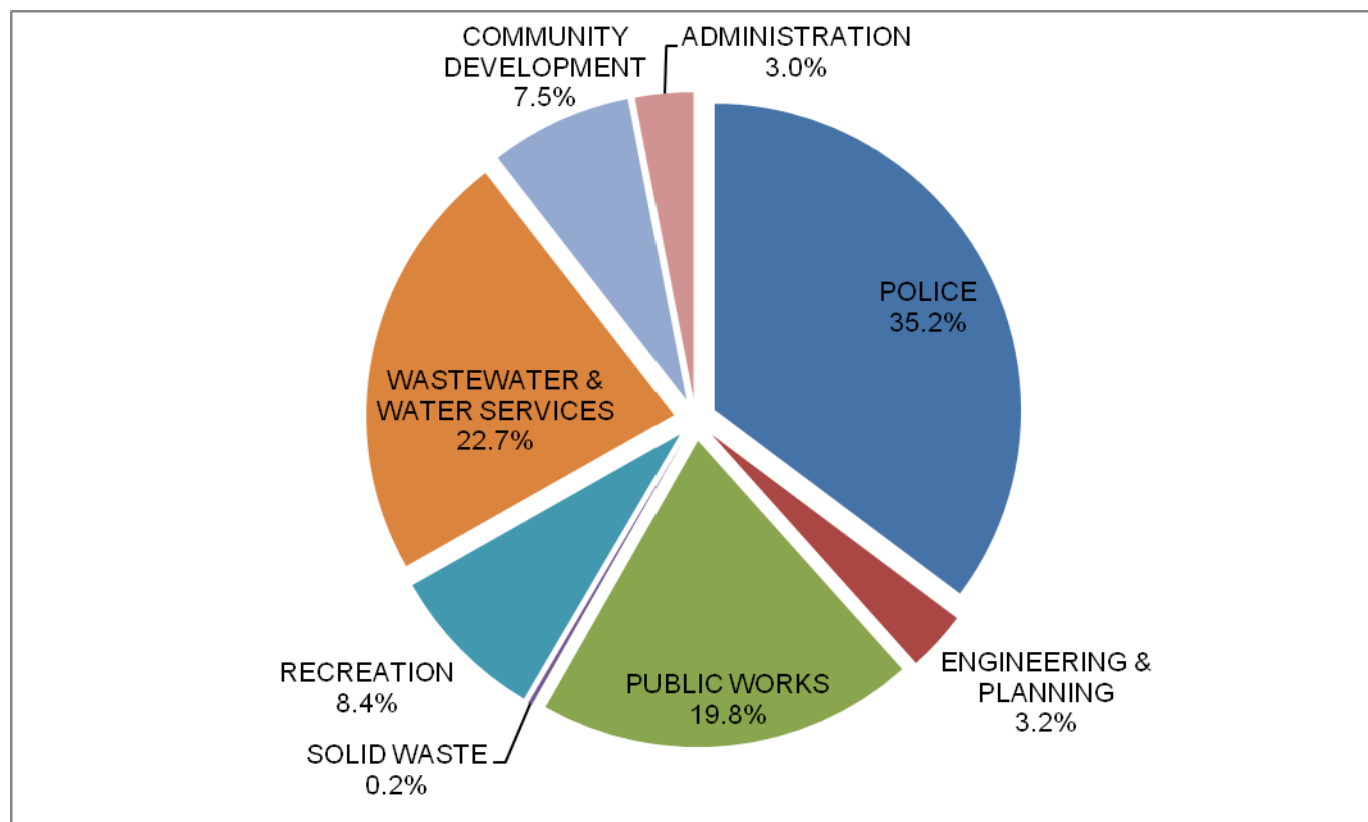


Table 16: Vehicle Fleet Emissions by Scope and Emission Type

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)				
SCOPE 1		CO ₂ e	CO ₂	CH ₄	N ₂ O	HFC-134A
	Mobile Combustion	1,015.74	965.89	0.74	0.11	0.00
	Fugitive Emissions	56.55	0.00	0.00	0.00	0.04
	Total Direct Emissions	1,072.29	965.89	0.74	0.11	0.04

Transit Fleet

The vehicles and mobile equipment used in the City of Madera's public transportation operations, including buses, shuttles, and others, burn diesel and compressed natural gas, resulting in greenhouse gas emissions. In addition, vehicles with air conditioning or refrigeration equipment use refrigerants that can leak from the vehicle.

The Transit Fleet sector produced the seventh-largest amount of emissions in this inventory. Overall, this sector produced 294.4 metric tons of CO₂e (3.5% of total emissions). As illustrated in Figure 10 and Table 17, the source producing the most greenhouse gas emissions in the Transit Fleet sector was compressed natural gas at 95.9%, followed by refrigerants at 2.5%.

Figure 10: Transit Fleet Emissions by Source

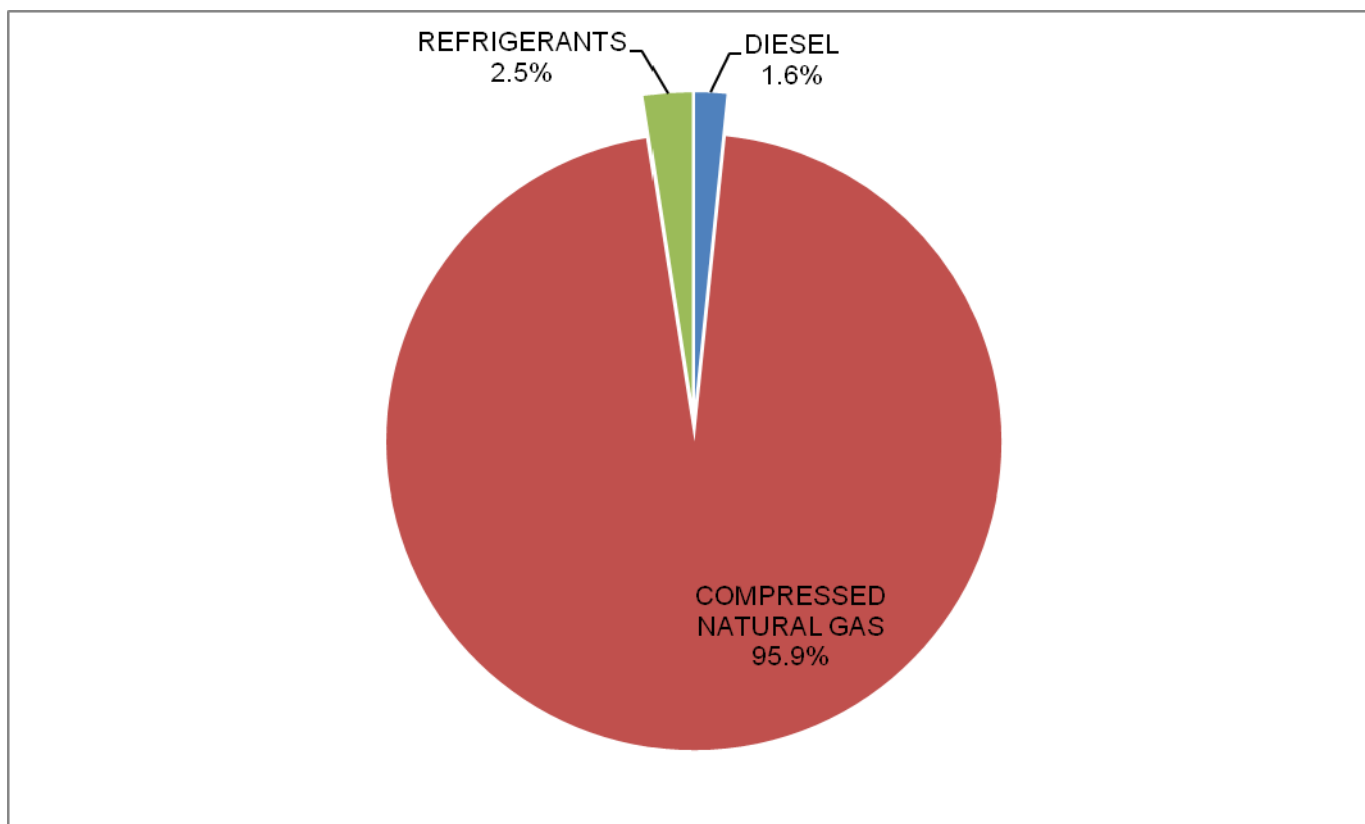


Table 17: Transit Fleet Emissions by Source

Source	metric tons CO ₂ e	Consumption Quantity	Consumption Units	Cost (\$)
Diesel	4.79	54,786.43	Gallons	\$6,931
Compressed Natural Gas	282.36	310,451.40	Gallons	\$68,367
Refrigerants	7.25	0.00	Tonnes	\$0
Totals	294.40			\$75,297

Table 18: Transit Fleet Emissions by Scope and Emission Type

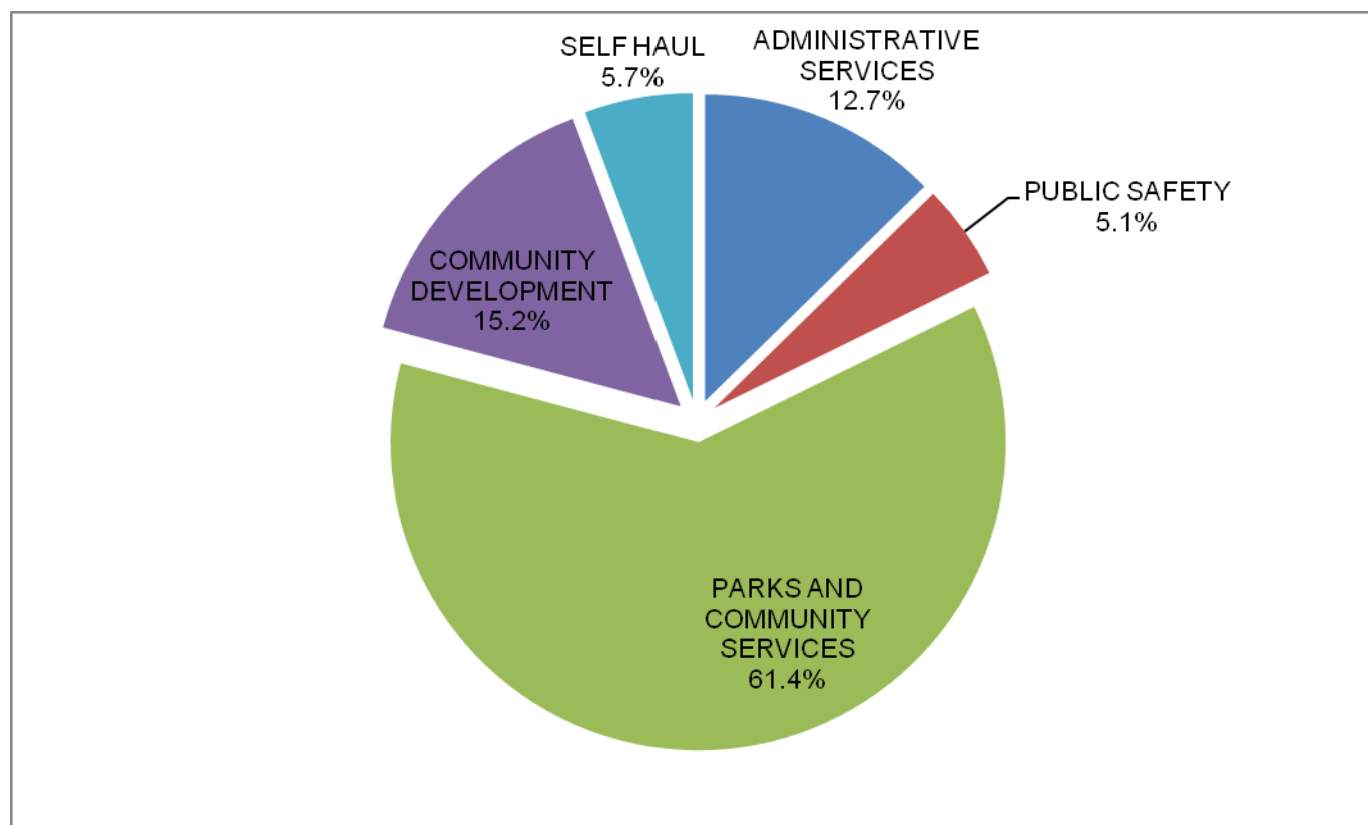
Scope	Emission Type	Greenhouse Gas Emissions (metric tons)				
SCOPE 1		CO ₂ e	CO ₂	CH ₄	N ₂ O	HFC-134A
	Stationary Combustion	287.16	281.95	0.10	0.01	0.000
	Fugitive Emissions	7.25	0.00	0.00	0.00	0.004
	Total Direct Emissions	294.40	281.95	0.10	0.01	0.004

Government-Generated Solid Waste

Many local government operations generate solid waste, much of which is eventually sent to a landfill. Typical sources of waste in local government operations include paper and food waste from offices and facilities, construction waste from public works, and plant debris from parks departments. Organic materials in government-generated solid waste (including paper, food scraps, plant debris, textiles, wood waste, etc.) generate methane as they decay in the anaerobic environment of a landfill. Emissions from the waste sector are an estimate of methane generation that will result from the anaerobic decomposition of all organic waste sent to landfill in the base year. It is important to note that although these emissions are attributed to the inventory year in which the waste is generated, the emissions themselves will occur over the 100+ year timeframe that the waste will decompose.

The Solid Waste sector produced the eighth-largest amount of emissions in this inventory. Overall, this sector produced 92.69 metric tons of CO₂e (1.1% of total emissions). Data was sufficient to determine departmental shares of waste generation, and it was possible to disaggregate the data according to type of waste. This method relied on default proportions defined by the California Integrated Waste Management Board's (CIWMB) 1999 Waste Characterization Study – Public Administration Group,⁵ and were bundled and reported to fit the waste categories defined in CACP 2009. According to this categorization, the type of waste producing the most emissions in the Solid Waste sector is paper products at 39.4%, followed by plant debris at 17.0%, food waste at 9.8%, and wood/textiles at 6.7%.

Figure 11: Government Waste Emissions by Subsector



⁵ Report available at: <http://www.calrecycle.ca.gov/WasteChar/BizGrpCp.asp>

Table 19: Government Waste Emissions by Subsector

Department	metric tons CO ₂ e
Administrative Services	11.74
Public Safety	4.69
Parks and Community Services	56.93
Community Development	14.09
Self Haul	5.25
Totals	92.69

Table 20: Government Waste Emissions by Scope and Emission Type

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)
SCOPE 3		CO ₂ e
	Waste All Facilities	92.69
INDICATORS		
	Short tons of solid waste	365.49

Employee Commute

Emissions in the Employee Commute sector are due to combustion of fuels in vehicles used by government employees for commuting to work at the City of Madera. Results from a survey designed by ICLEI and administered by the City of Madera are shown below. Current full-time City staff members were surveyed and 170 responses were collected, resulting in a sample of approximately 57% of employees at 2007 staff levels. The survey was used to collect the data needed to calculate emissions and also capture other information that will help the City of Madera set effective policy addressing this sector.

The Employee Commute sector produced the fourth-largest amount of emissions in this inventory. Overall, this sector produced 827.77 metric tons of CO₂e (9.8% of total emissions). As illustrated in Figure 12 and Table 21, the vehicle class producing the most greenhouse gas emissions in the sector is the Passenger Car category at 52%, followed by Light Truck/SUV/Pickup/Van at 47 %. Nearly all vehicles are fueled by gasoline, with only a few using ethanol.

Tables 23 through 25 present summary information from preference-based questions included in the survey. This information is intended to inform the City of Madera about potential transportation options to increase convenience and productivity while reducing the City's impact on the environment.

Figure 12: Employee Commute Emissions by Vehicle Class

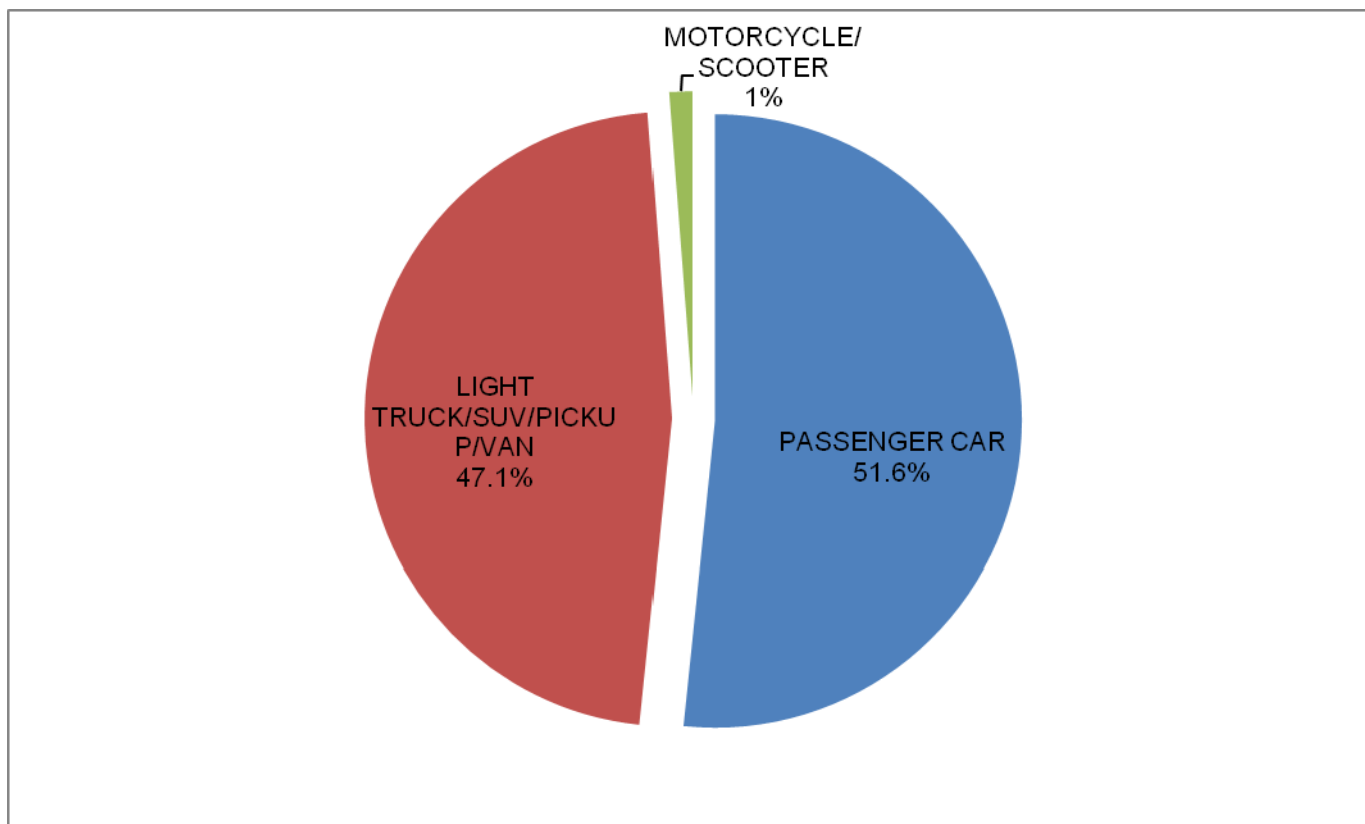


Table 21: Employee Commute Emissions by Vehicle Class

Vehicle Class	metric tons CO ₂ e
Passenger Car	427.45
Light Truck/SUV/Pickup/Van	390.21
Motorcycle/Scooter	10.10
Totals	827.77

Table 22: Employee Commute Emissions by Scope and Emission Type

Scope	Emission Type	Greenhouse Gas Emissions (metric tons)
SCOPE 3		CO ₂ e
	Waste All Facilities	827.77
INDICATORS		
	Vehicle miles traveled	1,921,944
	Number of vehicles	170

Table 23: Employee Commute - Travel Mode Data

Mode	Percentage
Drive Alone	88%
Carpooling/Vanpooling	11%
Public Transportation	0%
Bicycling	1%
Walking	1%
Telecommute/Other	0%
Split Modes	0%

Table 24: Employee Commute - Miles from Work Data

Miles	Percentage
0-5	35%
6-10	20%
11-15	12%
15-20	7%
21-25	7%
26-30	7%
31-35	7%
36-40	1%
41-45	3%
46-50	1%
51-75	1%
76-100	1%
Over 100	0%

Table 25: Employee Commute - Time to Work Data

Time (Minutes)	Percentage
Less than 5	32%
6 to 15	31%
16 to 25	11%
26 to 35	18%
36 to 45	4%
Over 45	4%



Next Steps

ICLEI's Five Milestone Process

While the City of Madera has already begun to reduce greenhouse gas emissions through its actions, this inventory represents the first step in a systematic approach to reducing Madera's emissions. This system, developed by ICLEI, is called the Five Milestones for Climate Mitigation. This Five Milestone process involves the following steps:

- Milestone One:** Conduct a baseline emissions inventory and forecast
- Milestone Two:** Adopt an emissions reduction target for the forecast year
- Milestone Three:** Develop a local climate action plan
- Milestone Four:** Implement the climate action plan
- Milestone Five:** Monitor progress and report results

Figure 13: ICLEI's Five Milestones for Climate Mitigation



ICLEI staff are available to local governments who are members and should be contacted to discuss the full range of resources available at each stage of the Milestone process. The following sections provide a glimpse at next steps and help capture the lessons learned in conducting this inventory.

Setting Emissions Reduction Targets

This inventory provides an emissions baseline that can be used to inform Milestone Two of ICLEI's Five-Milestone process—setting emissions reduction targets for the City of Madera's municipal operations. The greenhouse gas emissions reduction target is a goal to reduce emissions to a certain percentage below base year levels by a chosen planning horizon year. An example target might be a 30 percent reduction in emissions below 2007 levels by 2020. A target provides an objective toward which to strive and against which to measure progress. It allows a local government to quantify its commitment to fighting global warming—demonstrating that the jurisdiction is serious about its commitment and systematic in its approach.

In selecting a target, it is important to strike a balance between scientific necessity, ambition, and what is realistically achievable. The City of Madera should give itself enough time to implement chosen emissions reduction measures—noting that the farther out the target year is, the more the City of Madera should pledge to reduce. ICLEI recommends that regardless of the chosen long-term emissions reduction target (e.g., 15-year, 40-year), the City of Madera should establish linear interim targets for every two- to three-year period. Near-term targets facilitate additional support and accountability, and linear goals help to ensure continued momentum around local climate protection efforts. To monitor the effectiveness of its programs, the City of Madera should plan to re-inventory its emissions on a regular basis; many jurisdictions are electing to perform annual inventories. ICLEI recommends conducting an emissions inventory every three to five years.

The Long-Term Goal

ICLEI recommends that near-term climate work should be guided by the long-term goal of reducing its emissions by 80 percent to 95 percent below the 2007 baseline level by the year 2050. By referencing a long-term goal that is in accordance with current scientific understanding, the City of Madera can demonstrate that it intends to do its part towards addressing greenhouse gas emissions from its internal operations.

It is important to keep in mind that it will be next to impossible for local governments to reduce emissions by 80 to 95 percent without the assistance of state and federal policy changes that create new incentives and new sources of funding for emissions reduction projects and programs. However, in the next 15 years, there is much that local governments can do to reduce emissions independently. It is also important that the City of Madera works to reduce its emissions sooner, rather than later: the sooner a stable level of greenhouse gases in the atmosphere is achieved, the less likely it is that some of the most dire climate change scenarios will be realized. Additionally, if cost saving projects can be undertaken now – why wait to increase the quality of local government service and operations, while reducing taxpayer costs?

State of California Targets and Guidance

An integral component of the State of California's climate protection approach has been the creation of three core emissions reduction targets at the community level. While these targets are specific to the community-scale, they can be

used to inform emissions targets for government operations as well. On June 1, 2005, California Governor Schwarzenegger signed Executive Order S-3-05 establishing climate change emission reductions targets for the State of California. The California targets are an example of near-, mid- and long-term targets:

- Reduce emissions to 2000 levels by 2010
- Reduce emissions to 1990 levels by 2020
- Reduce emissions to 80 percent below 1990 levels by 2050

The AB 32 Scoping Plan also provides further guidance on establishing targets for local governments; specifically the Plan suggests creating an emissions reduction goal of 15 percent below “current” levels by 2020. This target has informed many local government’s emission reduction targets for municipal operations—most local governments in California with adopted targets have targets of 15 to 25 percent reductions under 2007 levels by 2020.

Departmental Targets

If possible, ICLEI recommends that the City of Madera consider department-specific targets for each of the departments that generate emissions within its operations. This allows the City of Madera staff to do a more in-depth analysis of what is achievable in each sector in the near, mid and long-term, and also encourages department leaders to consider their department’s impact on the climate and institute a climate-conscious culture within their operations.

Creating an Emissions Reduction Strategy

This inventory identifies the major sources of emissions from the City of Madera’s operations and, therefore, where policymakers will need to target emissions reductions activities if they are to make significant progress toward adopted targets. For example, since Water and Stormwater Services was a major source of emissions from the City of Madera’s operations, it is possible that the City of Madera could meet near-term targets by implementing a few major actions within the Water and Stormwater Services sector. Medium-term targets could be met by focusing emissions reduction actions on Buildings and Facilities, the Vehicle Fleet, and other major sectors, and the long term (2050) target will not be achievable without major reductions in all of these sectors.

Please note that, whenever possible, reduction strategies should include cost-saving projects that both reduce costs (such as energy bills) while reducing greenhouse gas emissions. These “low hanging fruit” are important because they frequently represent win-win situations in which there is no downside to implementation. Selecting these projects in the order of largest to smallest benefit ensures that solid, predictable returns can be realized locally. These projects lower recurring expenditures, save taxpayer dollars, create local jobs, and benefit the community environmentally.

Given the results of the inventory, ICLEI recommends that the City of Madera focus on the following tasks in order to significantly reduce emissions from its government operations:

General:

- Participate in Phase II of Green Communities: Community-Wide Inventories, in order to gather necessary data to develop effective policies which result in extensive reductions through implementation of a Climate Action Plan for the larger community⁶;
- Promote training, education, rewards, incentives, encouragement and support for emissions reductions across the board;

Buildings and Facilities:

- Change procurement policy to specify energy star compliant HVAC systems and refrigerators;
- Comprehensive municipal retrofit of existing buildings including lighting, insulation, windows and HVAC systems for improved energy efficiency, cost savings, and building performance;
- Develop an equipment database to help with the reuse of old furniture and fixtures;
- Install smart lighting fixtures with occupancy sensors;
- Perform a comprehensive energy retrofit of existing buildings, especially the older buildings;
- Procure solar or other low-carbon based electricity;
- Review feasibility of alternative energy production at City facilities;
- Switch to refrigerants that have a lower GWP (global warming potential);

Public Lighting:

- Analyze reduction potential for streetlights and other public lighting;
- Analyze reduction potential for the LS-1 designated streetlights;
- Switch traffic signals and public lighting from incandescent bulbs to Light Emitting Diodes (LEDs);

Wastewater Sector:

- Additional treatment to effluent water to reduce process methane emissions;

Government Generated Waste:

- Change procurement policy to recommend recycled, reusable and recyclable materials, including office supplies (e.g. paper, cardboard, cans, toner cartridges);
- Comprehensive analysis of waste stream;
- Implement paper and toner reduction strategies to reduce excess paper and toner usage, e.g. double-sided printing and fonts that use less ink (i.e., Century Gothic, Times New Roman and Calibri);
- Increase office reuse and recycling (e.g. paper, cardboard, cans, toner cartridges);

⁶ The City's General Plan includes an Action Item calling for the preparation of a Climate Action Plan (CAP), and reduction targets are specified.

Vehicle Fleet:

- Exploration of biofuels to replace vehicle fleet fuel usage;
- Explore implementing a no-idling policy for fleet vehicles;
- Reduce usage of city-owned vehicles, replace those which are not fuel efficient, and change procurement policy to specify high fuel efficiency for each vehicle class;
- Promote procurement of plug-in hybrids where practical, which can reduce vehicle emissions by up to 50% in PG&E territory;
- Specify high fuel efficiency during procurement for new vehicles of all classes;

Employee Commute:

- Encourage and incentivize telecommuting to reduce emissions from employee commute;
- Encourage employees to use alternative modes of transportation by offering enhanced commuter benefits;
- Explore various policies to encourage walking and biking in good weather by employees that live within 5 miles, and to encourage carpooling by all employees;
 - Give incentives for employees to use the transit system or carpool;
 - Implement a Commute Trip Reduction (CTR) program (e.g. carpooling and biking incentives) (<http://www.vtapi.org/tdm/tdm9.htm>);
- Implement employee commute programs aimed at reducing greenhouse gas emissions;
- Recommend and incentivize carpooling to reduce emissions from employee commute.

Using these strategies as a basis for a more detailed overall emissions reductions strategy, or climate action plan, the City of Madera should be able to reduce its impact on global warming. In the process, it may also be able to improve the quality of its services, reduce costs, stimulate local economic development, and inspire local residents and businesses to redouble their own efforts to combat climate change.

Appendix A: Inventory Methodologies

ICLEI's Clean Air & Climate Protection Software (CACP 2009) software made it possible to calculate greenhouse gas emissions for the following greenhouse gases: Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride. Activity data was collected for a number of operations through a number of methods. Activity data was stored in Master Data Workbook (MDWB), which serves as a tool for organizing and conditioning data, and, in some cases, calculating emissions. Data collection methods range from LGO Protocol-recommended, to LGO Protocol-alternative and non-LGO Protocol (but ICLEI-approved) alternatives. The methods used depend on the availability and format of data. Inputting activity data into CACP 2009, along with the correct emission factor, resulted in the calculation of greenhouse gas emissions for the City of Madera's 2007 government operations.

Activity Data

The data that was used for the baseline 2007 year for the City of Madera's Carbon Emissions Report, comes from many sources, including the Accounts Payable Department, Plan Operations Managers, and even the routine of checking the types and sizes of fire extinguishers within the City's facilities. In the end, most of the data had a paper trail that was traceable and applicable to the 2007 baseline year.

The Accounts Payable Department had receipts that covered a vast majority of the items to be accounted for. However, due to the lack in records for vehicles that were recharged and/or equipment replaced, this list is not complete. What are accounted for are items considered to be of "one-time-use", such as materials purchased from companies like Praxair, for welding and facilities equipment.

Several items should be noted, as they were not accounted for in this baseline year's report. These include several Scope 3 items from Cal Fire, which supplies the City's contracted fire department services, and Allied Waste, which is the City of Madera's waste hauler. Also, to go with notes on Allied Waste, the transportation, fuel consumption, and disposal processes were not included in this 2007 baseline report. In order to perform more accurate calculations of emissions for future reports, it is advised that this information be accounted for as part of contractor services.

Emissions Factors

The emissions factors used for the City of Madera are duly noted within each individual table and tab of the Master Data Workbook. Further reference can be found in ICLEI's "LGO Inventory Instructions for Data Gathering", as referenced on pages 35-38, pages 45, 47, and 51-52, of the LGO Inventory Instructions. It should also be noted here that line items for Scope 3 emissions in the form of Fleet Vehicle coolants were done through the default process as also outlined by ICLEI in the LGO Inventor Instructions. The City's vehicles were looked up by type and coolant requirement given through the Department of Motor Vehicles.

As noted, the baseline year for the City of Madera consisted of items and facilities from the year 2007, with Government-Generated Waste having a proxy year of 2011. Issues that arose during the data collection stage and report periods consisted of minor issues with logs for the City's emergency generators, as well as lack of availability or knowledge relating to data for fire suppressing materials used in the base year and coolants supplied and recharged in the Fleet Vehicles. One of the largest challenges came in the form of missing information due to the destruction of documents more than five years old. This made it difficult to collect data on the suppressing materials and coolants, but ultimately supplied information about the Scope 3 industrial items purchased and used in the 2007 baseline year.

Calculation

Once the data had been gathering into the Master Data Workbook, ICLEI's CACP (2009) program was used to surmise the total emissions for the City of Madera. The input data was broken down from the Summary Tab, which gave the total therms, kWh, and costs attributed to each sector and scope. Input was then broken down by Scope 1, Scope 2, and Scope 3 emissions. Therefore, each facility had an input tab in the CACP for Scope 1 consumption and combustion of fuel and Scope 2 consumption of electricity as supplied by PG&E. Finally, the data was exported into a Microsoft Excel Spreadsheet where it was tallied once again by sector, use, cost and consumption to generate the tables and charts used in this 2007 baseline report.

Buildings and Other Facilities

When it came to obtaining information about the City's facilities, including the number of emergency power generators, Mr. Tony Frede, the City's Electrical and Facilities Operations Manager, was able to supply the majority of the information. Included in this were details about how long, approximately, the emergency generators ran during the baseline year, why they were ran, and any maintenance/service attributes to HVAC systems at the City's facilities.

Facilities that have notations of electricity consumed, as well as natural gas that may have been supplied to the facility, have records of such that were provided by John Joseph, PG&E's Rate Data Analyst, in spreadsheet form. These data

were organized and summarized by facility and/or action item (i.e. sewage lift pumps and other water transportation infrastructure).

Streetlights, Traffic Signals, and Other Public Lighting

Public lighting, traffic signals, and other lightning information was supplied to the data collector and report organizer from John Joseph, PG&E's Rate Data Analyst. These data came in spreadsheet form. These data were organized and summarized by facility and/or action item, sometimes associated with City parks, and then formatted for selected Master Data Workbook tabs. There was slight variability in these data as the format often came as a combination of two items (i.e. traffic signal controller combined with a particular intersection string of traffic lights). This formatting followed the same as most other sectors and was then listed under various designated titles in the CACP data input and carbon output.

Water and Stormwater Services

Data related to the City of Madera Water and Stormwater Services also came in a spreadsheet format that was generated by John Joseph of PG&E. The formatting and data input for Master Data Workbook and CACP input was the same as all other sectors. There were several categorized items that could have been listed under the Wastewater Treatment Plant tabs; these included Scope 2 electricity consumption for water lift pumps that were directly associated with wastewater treatment and transportation. In future emission inventories, it is encouraged that these items be listed under the WWTP energy consumption tabs, among the working, raw, and final data tabs of Master Data Workbook.

Wastewater Treatment Facilities

Wastewater Treatment Facility information was provided by John Joseph of PG&E as well as Mr. Wayne Clay, the City of Madera's Wastewater Treatment Plant Operations Manager. Such data were used in the spreadsheet supplied by PG&E and combined with the informational items listed in the Master Data Workbook. In the end, these items were populated in the CACP program, resulting in a carbon emissions report and count for this summary report and detailed in each particular chart or table generated for visual comprehension.

Airport Facilities

Airport Facilities items and consumption were collected via John Joseph of PG&E, as well as Tony Frede, the City of Madera's Electrical and Facilities Operations Manager. These data items were logged in the raw information tab of the Master Data Workbook designated for the Airport Facilities. These data items were then processed as all other items in

the inventory count and summarized in the CACP program for a carbon emissions count as displayed in this summary report.

Vehicle Fleet and Mobile Equipment

Most of the data had a paper trail that was traceable and applicable to the 2007 baseline year. Zelda Leon, the Administrative Assistant in the Planning Department, had already gathered a great deal of the Vehicle Fleet Data. Her efforts had brought in several nearly complete spreadsheets that held records from Tesi Petroleum (now Madera Petroleum). The data only required some sorting, as well as correlation of the unit numbers to the department in which they belonged. Overall, the Vehicle Fleet data had the needed gallons used per vehicle (unit) and the total vehicle miles traveled for the baseline year.

Transit Fleet

The Transit Fleet items hold their own category, but really have had very few transit fleet vehicles that attributed to emissions for the 2007 baseline year. The transit vehicles use CNG for combustion, ultimately lowering the emissions count for this sector. The information was supplied to the data collector and report organizer in receipt form from the Accounts Payable Department. Tesi Petroleum (now Madera Petroleum) supplied the fuel for the transit vehicles and each vehicle had a monthly consumption in gallons as well as the monthly cost per vehicle listed on the receipt. These receipts were tallied and used to bring a full view on the amount of fuel consumed and the cost therein.

Government-Generated Solid Waste

Government-generated solid waste was generated from a spreadsheet collected from Annette Kwock, the City's Solid Waste and Recycling Coordinator. Such data came in the form of total tonnage hauled, the number of containers at each City facility, and the cost associated with the hauling throughout the year. This information was information that was proxy for the 2007 baseline year. The proxy year was 2011. Further emissions could be recorded in the future by contacting Allied Waste, the City of Madera's solid waste contract hauler. This then could generate data for the amount (tonnage) that was taken to a landfill, as well as the Scope 1 and Scope 2 emissions involved in the overall process.

Employee Commute

Employee Commute data was gathered from a shortened version of the ICELI Employee Commute Survey. Mr. David Merchen, Director of Community Development, City of Madera, took the shortened survey that had already been adapted by the data collector and modified it. The survey was structured to collect informational items in the form of

distance an employee travels to work, type of vehicle the employee drives (passenger car, light truck, heavy truck or SUV), and the employee interest in carpooling—if the employee does not already do so.

The returned surveys were tallied by the data collector. The data was loaded into a working Microsoft Excel Spreadsheet and then loaded in the Master Data Workbook, under the “EC-Working Data Tab”. Primary raw data that came from the returned surveys were not listed in the Master Data Workbook as the survey results and edition varied from the one used and commonly recorded by ICLEI.

Other Process and Fugitive Emissions from Government Operated Industry

As the City of Madera contains no power generation facilities within its meets and bounds, no data were collected concerning power generated by the City for community or industrial use. On the other hand, various receipts were received from the Accounts Payable Department that allowed the data collector and emissions reporter to log fire repressing items, HVAC systems and other coolants (such as used by the Fleet Vehicle sector). Most of the items listed come from industrial companies for industrial use (i.e. welding and maintenance shop materials). These items are also one-time-use items that did not have a log for materials recovered. Most often, this returned canisters that were emptied upon full use. New materials were then purchased and the used canister was returned.

The information gained through the Accounts Payable Department displays how many canisters were used throughout the 2007 baseline year, the cost for each canister, and the materials that were contained in each canister; ultimately leading to the data collector’s determination of what items generated and counted as Scope 3 items for emission.

Appendix B: Project Resources

ICLEI created various tools for the City of Madera to use to assist with greenhouse gas emissions inventories. These tools are designed to work in conjunction with LGO Protocol, which is the primary reference document for conducting an emissions inventory. The following tools should be saved as resources and supplemental information to this report:

- The “Master Data Workbook”, an Excel-based tool that contains most or all of the raw data (including emails), data sources, emissions, notes on inclusions and exclusions, and reporting tools;
- The “Data Gathering Instructions”, an instructions guide on the types of emissions and data collection methodology for each inventory sector;
- The “Quality Control Checklist for Master Data Workbook”, a checklist which provides a list of items to review in the Master Data Workbook to ensure information was entered correctly;
- The “CACP 2009 Data Entry Instructions”, an instructions guide on how to enter data collected in the Master Data Workbook into the Clean Air and Climate Protection Software (CACP 2009), ICLEI’s greenhouse gas emissions calculator;
- The CACP 2009 “Backup” files, a group of files which contain the calculations of emissions based on inputs from the Master Data Workbook into CACP 2009. The CACP 2009 software is required to open the Backup files;
- The “Checklist for Reviewing the Government Analysis Inputs/Outputs, Details Export” a checklist which provides a list of items to review in this CACP 2009 export file to ensure information was entered correctly;
- CACP 2009 “Government Analysis Inputs/Outputs, Summary with Notes Export”, an Excel-based export file which contains a summary report of all calculated emissions, with explanatory notes included;
- CACP 2009 “Government Analysis Inputs/Outputs, Details Export”, an Excel-based export file which contains a detailed report of all calculated emissions;
- The “Completing the Inventory Report”, an instructions guide from ICLEI on how to report greenhouse gas emissions according to the LGO Protocol;
- The “Charts and Tables Data Conditioning Sheet”, an Excel-based tool created by ICLEI and completed by the author to aid in creating the charts and tables within the Master Data Workbook;
- A presentation with slides completed by the author to summarize findings from the greenhouse gas inventory.

Appendix C

Technical Assumptions



Appendix C

Technical Assumptions

This appendix outlines the assumptions, data sources, and performance criteria used to estimate the GHG emissions reduction potential for each measure identified in Chapter 3 and the State-level regulations identified in Chapter 2. The quantification of GHG reductions was based primarily on calculation methods detailed in the California Air Pollution Control Officers Association's (CAPCOA) report, *Quantifying Greenhouse Gas Mitigation Measures* (August 2010). The calculations utilize emissions factors and results from the City of Madera Community-wide GHG Emissions Inventory (2014) and City of Madera Government Operations GHG Emissions Inventory (2012), and assumptions made about the degree of implementation in the years 2020 and 2030.

TABLE C-1: TECHNICAL ASSUMPTIONS FOR GHG REDUCTIONS FROM LOCAL MEASURES

Measure	2020 GHG Reduction (MT CO ₂ e)	2030 GHG Reduction (MT CO ₂ e)	Assumptions
LG-1: Municipal Energy Efficiency and Conservation	74	148	In 2007, the City's buildings and facilities used a total of 1,924,688 kWh of electricity and 43,806 therms of natural gas, producing approximately 1,651 MT CO ₂ e. The City's street and traffic signal lights used a total of 2,388,778 kWh of electricity, producing approximately 693 MT CO ₂ e. This measure assumes that energy consumption in City buildings and facilitates and public lighting would be reduced by 5% by 2020 and 10% by 2030, which would correspond to a 5% reduction in associated emissions by 2020 and a 10% reduction by 2030. (City of Madera Government Operation GHG Inventory [Government Operations GHG Inventory], 2012; CAPCOA, 2010)
LG-2: Municipal	445	611	This measure assumes a total of 1,265 kW of municipal

Renewable Energy			<p>solar PVs would be installed by 2020 and 1,427 kW of municipal solar PVs would be installed by 203. Please note, the City has already met this objective for 2020, installing 1,265 kW of solar between 2007 and 2014. This measure also assumes that in addition to the solar PV installation objectives, the City will procure 10% of its electricity from renewable sources by 2020 and 20% of its electricity from renewable sources by 2030. (City of Madera, 2014)</p>
LG-3: Fuel Efficient and Low-Carbon Vehicle Fleet	58	105	<p>This measure assumes a total of 10 light duty vehicles are replaced with 3 hybrid or electric vehicles with a combined average fuel economy of 55 mpg and 7 CNG fueled vehicles between 2007 and 2020. The City already replaced 6 traditional light-duty vehicles with one hybrid vehicle and 5 CNG vehicles between 2007 and 2014. This measure also assumes an additional 12 light-duty vehicles are replaced with 5 hybrid or electric vehicles with combined average fuel economy of 55 mpg and 7 CNG fueled vehicles. This measure also assumes a total of 10 heavy-duty vehicles are replaced with CNG fueled vehicles by 2020 and an additional 6 heavy-duty vehicles are replaced with CNG vehicles by 2030. The City already replaced 10 heavy-duty vehicles with CNG vehicles between 2007 and 2014. The reduction in GHG emissions varies depending on vehicle type, year, and associated fuel economy. The following assumptions were made based on a review of baseline data provided in the GHG Emissions Inventory: average annual light-duty VMT is 9,472; average annual heavy-duty VMT is 7,489; average fuel economy of replaced light-duty vehicles is 17 mpg; average fuel economy of replaced heavy-duty vehicles is 12 mpg; average fuel economy of light-duty hybrid replacement vehicles is 55 mpg; average fuel economy of light-duty CNG replacement vehicles is 33 mpg; average fuel economy of heavy-duty CNG replacement vehicles is 18 mpg. (Government Operations GHG Emissions Inventory, 2012; City of Madera, 2014; CAPCOA, 2010, Measure VT-3)</p>
LG-4: City Employee Commute Alternatives	41	66	<p>In 2007, emissions from City employee commutes totaled 828 MT CO₂e (approximately 1,921,944 average annual VMT). A 5% reduction would bring employee commute VMT to 1,825,847 by 2020 and an 8% reduction would bring employee commute VMT to 1,768,188 by 2030, which would proportionately reduce associated emissions. (Government Operations GHG Emissions Inventory, 2012; City of Madera, 2014)</p>
LG-5: Municipal Solid Waste Diversion	19	28	<p>In 2007, municipal facilities and operations landfilled 366 tons of solid waste. A 20% reduction would bring municipal landfilled solid waste to 293 tons in 2020 and</p>

			<p>a 30% reduction would bring municipal landfilled solid waste to 256 tons in 2030, which would proportionately reduce associated emissions.</p> <p>(Government Operation GHG Emissions Inventory, 2012; CAPCOA, 2010, Measure SW-1)</p>
LG-6: Tree Planting on City Property	16	33	<p>This measure assumes that 100 trees will be planted between 2007 and 2020 and 100 more will be planted by 2030 (for a total of 200 trees planted on municipal properties between 2007 and 2030). Please note, the City has already planted 85 trees on City property, and therefore, must plant an additional 15 trees by 2020 and an additional 100 trees by 2030. This measure also assumes that 3 acres of vegetation will be planted on City properties by 2020 and an additional 3 acres of vegetation will be planted by 2030. Please note, the City has already planted 2 acres of vegetation, and therefore, must plant an additional one acre by 2020 and an additional 3 acres by 2030. Average carbon sequestration rate: 0.0354 MT CO₂e per tree, 4.31 per acre grassland.</p> <p>(City of Madera, 2014; CAPCOA, 2010, Measure V-1)</p>
E-1: Energy Efficiency and Conservation in Existing Buildings	10,707	30,163	<p>This measure assumes that residential and commercial energy usage is reduced by 10% by 2020 and by 15% by 2030 as a result of participation in energy efficient upgrade and retrofit programs.</p> <p>(Community-wide GHG Emissions Inventory, 2014)</p>
E-2: Energy Efficient New Construction	531	7,670	<p>The 2020 and 2030 forecast assumes that the growth in emissions from natural gas and electricity in the residential and commercial/industrial sectors is from new construction. This calculation assumes that all new non-residential buildings built after 2030 will achieve net zero energy. It also assumes that by 2020, 10% of new residential and commercial development will exceed Title 24 standards by 20% and that by 2030, 25% of new residential development will exceed Title 24 standards by 30%.</p> <p>(Community-wide GHG Emissions Inventory, 2014)</p>
E-3: On-Site Small-Scale Renewable Energy	1,813	3,014	<p>Assumes that 4,000 kW of residential solar and 1,500 kW of non-residential solar will be installed on existing buildings by 2020 and an additional 2,720 kW of residential solar and 500 kW of non-residential solar will be installed by 2030 (for a total of 2,000 kW of residential solar and 6,720 kW solar installed between 2007 and 2030).</p> <p>Assumes 400 residential solar water heaters and 200 non-residential solar water heaters installed on existing buildings by 2020 and an additional 350 residential solar water heaters and 200 non-residential solar water heaters installed by 2030 (for a total of 750 residential solar water heaters and 400 commercial solar water heaters installed between 2007 and 2030). Assumes</p>

			10% electric and 90% natural gas. Average expected solar water heater savings: 2,945 kWh/yr; 139 therms/yr. This calculation does not double-count with reductions from E-1. (California Solar Initiative, 2012)
T-1: Infill and Mixed Use Development	5,613	21,292	Assumes a 4% reduction in VMT by 2020 as a result of a 30% increase in density within the City. Also assumes a combined 12% reduction in VMT by 2030 as a result of smart growth development (increased service population density to 50%, diversity of land uses, and destination accessibility) within the City. Conservative VMT reduction estimates were used based on the following ranges presented in CAPCOA: increase density (0.8-30%), diversity of land use (9-30%), destination accessibility (6.7%-20%), combined total reduction not to exceed: compact infill = 30%; suburban center = 10%; suburban = 5%. (City of Madera, 2014; Community-wide GHG Emissions Inventory, 2014; CAPCOA, 2010)
T-2: Bicycle and Pedestrian Environment	1,053	3,454	As a rule of thumb, the Center for Clean Air Policy (CCAP) Guidebook attributes a 1% to 5% reduction associated with comprehensive bicycle programs. Assume low-middle range of CCAP reduction estimates: 1% reduction by 2020 and 3% reduction by 2030 (to account for both bicycle and pedestrian trips). (CCAP Guidebook, 2005; Community-wide GHG Emissions Inventory, 2014; CAPCOA, 2010)
T-3: Transit Travel	2,404	4,757	Assumes an increase in transit ridership to 2% of the city's service population by 2020 and 4% of the service population by 2030. Average round-trip transit trip: 14 miles in 2020, 12 miles in 2020. This equates to a 2% reduction in light-duty VMT by 2020 and a 4% reduction in light-duty VMT by 2030. (Fehr & Peers, 2014; CAPCOA, 2010)
T-4: Commute Trip Reduction	1,188	1,977	VMT reductions from TDM programs range from 5.2% to 19% depending on the level of support provided and the density of the area in which the TDM is implemented. Conservatively assumes low range estimates for voluntary TDM (5.2% reduction in commute VMT in 2020 and 8% reduction in 2030). Also assumes 19.41% of 2020 VMT from commute trips and 19.17% 2030 VMT from commute trips. (Fehr & Peers, 2014; CAPCOA, 2010)
T-5: Traffic Flow and Vehicle Idling	265	401	Traffic Signalization: According to the Federal Highway Administration, there is evidence of a 4-13% reduction in fuel consumption for signal coordination projects. This calculation assumes 10% reduction from reduced idling in 2020 and 13% reduction in 2030. (FHWA, 2011; CAPCOA, 2010)
T-6: Low Carbon Fuel Vehicles and Infrastructure	4,255	11,061	Assumes 2.5% increase in purchase of electric vehicles above Advanced Clean Cars in 2020 and 6% increase in 2030. Assumes 6% of heavy-duty vehicles switch to a

			CARB-approved low carbon fuel (CNG was used for the purposes of this calculation) by 2020 and 15% switch by 2030. (CARB, 2010)
T-7: Construction and Off-Road Equipment	135	584	This measure includes two components, which separately reduce emissions: <ul style="list-style-type: none"> Alternative Fuels: Assumes 5% of off-road equipment switches to electric or alternative fuels by 2020 and 10% switch by 2030 (assumes 10% electric and 90% alternative fuels). Xeriscaping: As a result of xeriscaping, which reduces the need for landscaping maintenance, this measure assumes 15% reduction in lawn and garden equipment and associated GHG emissions in 2020 and 30% reduction in 2030 as a result of low-maintenance landscaping. (Community-wide GHG Emissions Inventory, 2014; CAPCOA, 2010)
W-1: Exceed SB X7-7 Water Conservation Target	494	653	Assumes 5% reduction in per capita water use beyond SB X7-7 in 2020; 10% reduction in per capita water use beyond SB X7-7 in 2030. Reduced water use also results in reduced wastewater and associated GHG emissions. (Community-wide GHG Emissions Inventory, 2014)
W-2: Recycled Water	68	165	Assumes 5% of the city's water use will come from recycled water in 2020 and 10% will come from recycled water in 2030. Recycled water use in Northern California can result in up to 40% reduction in MT CO ₂ e if 100% reclaimed water. Reduced water use due to use of recycled water similarly results in reductions in wastewater-related emissions. (Community-wide GHG Emissions Inventory, 2014; CAPCOA, 2010)
W-3: Wastewater Treatment Plant Upgrades	158	170	This measure assumes that methane and nitrous oxide emissions will be reduced by 50% by 2030 as a result of process efficiency improvements. This measure also assumes that energy use will be reduced by 10% by 2030 as a result of cogeneration. (Community-wide GHG Emissions Inventory, 2014)
S-1: Solid Waste Reduction and Recycling	4,230	5,921	Assumes 25% increase in diversion of solid waste by 2020; 35% increase by 2030. This is equivalent to landfilling no more than 48,115 tons of solid waste in 2020 and 55,139 tons in 2030. Please note, the Madera community generated 49,194 tons of solid waste in 2007; this amount declined to 42,308 tons in 2013. (Community-wide GHG Emissions Inventory, 2014).
U-1: Trees and Vegetation	34	68	This measure assumes that 600 trees will be planted between 2007 and 2020 and 600 more will be planted by 2030 (for a total of 1,200 trees planted between 2007 and 2030). This measure also assumes that 3 acres of vegetation will be planted in the community by 2020

			and an additional 3 acres of vegetation will be planted by 2030. Average carbon sequestration rate: 0.0354 MT CO ₂ e per tree, 4.31 per acre grassland. (CAPCOA, 2010, Measure V-1)
A-1: Climate Change Vulnerability	NA	NA	This measure would not reduce GHG emissions.
A-2: Public Health and Safety	NA	NA	This measure would not reduce GHG emissions.
A-3: Water Management	NA	NA	This measure would not reduce GHG emissions.
A-4: Biodiversity and Habitat	NA	NA	This measure would not reduce GHG emissions.
A-5: Infrastructure	NA	NA	This measure would not reduce GHG emissions.
A-6: Agriculture	NA	NA	This measure would not reduce GHG emissions.

TABLE C-2: TECHNICAL ASSUMPTIONS FOR GHG REDUCTIONS FROM STATE REGULATIONS

State Regulation	2020 GHG Reduction (MT CO ₂ e)	2030 GHG Reduction (MT CO ₂ e)	Assumptions
Pavley Clean Car Standard (AB 1493)	29,460	44,015	CARB anticipates that the Pavley I standard will reduce GHG emissions from new California passenger vehicles by about 22 percent in 2012 and about 30 percent in 2016. Reductions in GHG emissions from the Pavley I standard were calculated using CARB's EMFAC2011 model for Madera County. To account for this standard, EMFAC2011 integrates the reductions into the mobile source emissions portion of its model. (CARB EMFAC2011 Model)
Advanced Clean Cars	3,408	20,448	CARB anticipates that by 2020, Advanced Clean Cars will reduce CO ₂ e emissions by 3 percent and by 2025, CO ₂ e emissions would be reduced approximately 12 percent from 2008 baseline levels. The reduction increases to a 27 percent reduction from 2008 baseline levels in 2035 and even further to a 33 percent reduction in 2050. Reductions in GHG emissions from the Advanced Clean Cars program were calculated by taking 3 percent reduction from 2008 baseline transportation emissions from light-duty vehicles in 2020 and 18 percent reduction in 2030. The 18 percent reduction in 2030 was interpolated between 2025 and 2035 reduction estimates from the CARB.

Low Carbon Fuel Standard	19,947	21,996	The Low Carbon Fuel Standard (LCFS) requires a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020. Reductions in GHG emissions from the LCFS standard were calculated for on-road and off-road vehicles by taking a 10 percent reduction of total business-as-usual emissions for each sector. For on-road transportation, the 10 percent reduction was taken after applying Pavley I and Advanced Clean Cars in order to account for the combined effectiveness of the three regulations. LCFS would reduce emissions from on-road transportation by approximately 17,325 MT CO ₂ e in 2020 and 19,319 MT CO ₂ e in 2030. LCFS would reduce emissions from off-road vehicles by approximately 2,622 MT CO ₂ e in 2020 and 2,677 MT CO ₂ e in 2030. (CARB EMFAC2011 Model)
Title 24 Energy Efficiency Building Standards	4,876	11,870	The California Energy Commission (CEC) estimates that the 2008 standards reduce consumption by 10 percent for residential buildings and 5 percent for commercial buildings, relative to the previous standards. For projects implemented after January 1, 2014, the CEC estimates that the 2013 Title 24 energy efficiency standards will reduce consumption by 25 percent for residential buildings and 30 percent for commercial buildings, relative to the 2008 standards. These percentage savings relate to heating, cooling, lighting, and water heating only and do not include other appliances, outdoor lighting that is not attached to buildings, plug loads, or other energy uses. Therefore, these percentage savings were applied to the percentage of energy use covered by Title 24. The calculations and 2020 GHG emissions forecast assume that all growth in the residential and commercial/industrial sectors is from new construction. (CEC, 2008; Statewide Energy Efficiency Collaborative [SEEC], 2011)
Renewable Portfolio Standard	55,365	64,785	PG&E must have a renewable portfolio of 33% by 2020. In order to calculate future emissions that take into account the Renewable Portfolio Standard, the projected 2020 emissions factor for PG&E was applied to projected bundled electricity usage and the CEC's 2020 grid

			average emissions factor was applied to direct access electricity. PG&E and CEC grid average emissions factors were retrieved from PG&E and the Statewide Energy Efficiency Collaborative report, Greenhouse Gas Forecasting Assistant (October 2011).
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Appendix D

Cost & Savings Analysis



Appendix D

Cost & Savings Analysis

This appendix details the methodology, sources, and assumptions for the cost and savings estimates included in the CAP (see **Table D-2**). Estimates are based on market research and represent the best available information at the time this CAP was developed. Costs associated with each measure are presented as the aggregated total for the measure, and are also broken out by the type of cost (i.e., capital cost, staff time, etc.) and how often it would occur (i.e., one time or annually). Costs account for the expense that would occur beyond the cost of conducting business-as-usual (i.e., without implementation of the CAP). All existing and/or completed efforts and General Plan policies and action items identified in Chapter 3 are considered costs associated with conducting business-as-usual. Costs presented in **Table D-2** are costs for implementation of additional implementation actions. Savings are generally presented as the amount that would occur annually upon completion of the measure. For each measure, potential costs and savings are estimated for the City and the community (private costs/savings). Private costs/savings include costs/savings to the general public, businesses, and private developers where applicable. Costs and savings are categorized as none, very low, low, medium, high, and very high. These categories correspond to a range, as shown in **Table D-1** below, as costs for each measure are highly variable.

TABLE D-1: MEASURE COSTS AND SAVINGS

City Cost/Savings		Private Cost/Savings	
None:	\$0	None:	\$0
Very Low:	\$1 - \$10,000	Very Low:	\$1 - \$1,000
Low:	\$10,001 - \$50,000	Low:	\$1,001 - \$5,000
Medium:	\$50,001 - \$100,000	Medium:	\$5,001 - \$10,000
High:	\$100,001 - \$200,000	High:	\$10,001 - \$20,000
Very High:	\$200,001 or greater	Very High:	\$20,001 or greater

TABLE D-2: MEASURE COST AND SAVINGS ANALYSIS

Measure	City Cost	City Savings	City Cost/Savings Discussion*	Private Cost	Private Savings	Private Cost/Savings Discussion
Local Government						
LG-1 Municipal Energy Efficiency and Conservation	Low - Medium	High - Very High	<p>City Costs: Upfront costs include staff time to establish a prioritized list of projects, identify staff that could benefit from additional training, and to obtain funding (approximately 60 hours, at \$50-\$100/hour = \$3,000-\$6,000). It is assumed that the upgrades would be funded through a grant, utility program, energy performance contract, or other mechanism. Annual costs include staff time to track municipal energy consumption through the PG&E Portfolio Manager and to attend energy-related training events (approximately 40 hours per year, at \$50-\$100/hour = \$2,000-\$4,000). Aggregated cost (over lifetime of plan, 15 years): \$33,000-\$66,000. Costs to coordinate with PG&E and the Madera Energy Watch partnership are costs associated with business-as-usual.</p> <p>City Savings: Based on an average electricity cost of \$0.21/kWh and a total reduction of 1,129,771 kWh by 2030, the City would save an estimated \$237,252 annually upon completion (PG&E, 2015). In addition, many actions to improve energy efficiency will generate costs savings through the</p>	None	None	<p>Private Costs: None</p> <p>Private Savings: None</p>

			reduced need for operations & maintenance.			
LG-2 Municipal Renewable Energy	Very Low	Very High	<p>City Costs: Upfront costs include staff time to obtain funding and conduct feasibility study (approximately 100 hours, at \$50-\$100/hour = 5,000-\$10,000). It is assumed that solar PVs would be funded through a grant, utility program, energy performance contract, or other mechanism.</p> <p>City Savings: Based on an average electricity cost of \$0.21/kWh and a total of 2,188,920 kWh provided by renewable energy sources by 2030, the City would save an estimated \$459,673 annually upon completion.</p>	None	None	<p>Private Costs: None</p> <p>Private Savings: None</p>
LG-3 Fuel Efficient and Low-Carbon Vehicle Fleet	High	Low	<p>City Costs: One-time upfront costs include staff time to update the City's procurement policies, to obtain funding, and to conduct staff training (approximately 80 hours, at \$50-\$100/hour = \$4,000-\$8,000). It is assumed that funding would be received to help purchase alternative and fuel efficient vehicles and equipment. However, the difference in purchase price between standard and fuel efficient vehicles was estimated for informational purposes. Based on an average difference in purchase price for a hybrid Honda Civic above a standard Honda Civic of \$6,445, and a total of 7 additional vehicles replaced by 2030, the new hybrid vehicles would cost the</p>	None	None	<p>Private Costs: None</p> <p>Private Savings: None</p>

			<p>City an estimated \$45,115 more than purchasing 7 new gasoline vehicles (USDOE, 2015). Based on an average difference in purchase price for a natural gas Honda Civic above a standard Honda Civic of \$8,450, and a total of 9 additional vehicles replaced by 2030, the new natural gas vehicles would cost the City an estimated \$76,050 more than purchasing 9 new gasoline vehicles (USDOE, 2015). For heavy-duty vehicles, the cost of the CNG conversion in the F-650s is \$14,800, or \$3,800 more than for a diesel F-650 (Berg, 2014). The 6 new CNG heavy-duty vehicles would cost the City an estimated \$22,800. No staff time needed above that required for purchasing standard vehicles. Note: costs will decrease as the price of hybrid and compressed natural gas vehicles decrease. Aggregated cost of staff time plus purchase cost: \$147,965-\$151,965.</p> <p>City Savings: Based on current fuel prices and an average annual mileage of 7,601, the City would save approximately \$1,109 in annual fuel costs per hybrid vehicle or \$7,763 for all 7 new hybrid vehicles annually upon replacement, \$985 in annual fuel costs per light-duty CNG vehicle or and \$8,865 for all 9 new CNG vehicles annually upon replacement. Based on</p>			
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			<p>an average annual heavy-duty VMT of 7,248, the City would save approximately \$934 in annual fuel costs per heavy-duty CNG vehicle or \$5,604 for all 6 new CNG vehicles annually upon replacement. In addition, savings for the 9 new light-duty CNG vehicles and 6 new heavy-duty CNG vehicles would be achieved through lower maintenance costs from reduced wear and tear of the engine and less frequent oil changes and tune-ups. Some fleet operators have reduced maintenance costs by as much as 40 percent by converting their vehicles to CNG (Agee, 2015). Please note that the amount saved will change as fuel prices change. Aggregated annual savings: \$22,232.</p>			
LG-4 Employee Commute Alternatives	Very Low	None	<p>City Costs: First year costs would include City staff time to develop and implement incentives to use transportation alternatives and to facilitate outreach and community events (approximately 20 hours at \$50-\$100/hour = \$1,000-\$2,000). Annual costs would include City staff time to promote program (approximately 4 hours at \$50-\$100/hour = \$200-\$400). Aggregated cost (over life of the plan, 15 years) = \$4,000-\$8,000.</p> <p>City Savings: No direct savings for the City, although participating employees would save on commute costs, and</p>	None	None	<p>Private Costs: None Private Savings: None</p>

			potential benefits through the program, such as transit pass discounts or reduced travel costs.			
LG-5 Municipal Solid Waste Diversion	Very Low	None	<p>City Costs: This measure would require approximately 40 hours of staff time to conduct an audit to identify opportunities to increase material recovery (at \$50-\$100/hour = \$2,000-\$4,000).</p> <p>City Savings: No added savings.</p>	None	None	<p>Private Costs: None</p> <p>Private Savings: None</p>
LG-6 Tree Planting on City Property	Medium - High	Very Low	<p>City Costs: This measure assumes an average cost of \$250/15-gallon tree and an average annual maintenance cost of \$15-\$65/tree (including pruning, administration, inspection, etc.)(Peters Brothers Nursery, 2015; McPherson et al., 2005). This measure also assumes an installation cost of \$2,000 to \$4,000 per acre for seeding native prairie grasses and forbs (USEPA, 2012). Please note that grants and private funding have the potential to cover a portion of the cost associated with this measure. Planting of 115 trees at \$250 per tree is estimated to cost approximately \$28,750. Annual maintenance of 115 trees over the lifetime of the plan (15 years) is estimated to cost \$25,875-\$112,125. Seeding 4 acres at \$2,000-\$4,000 per acre is estimated to cost approximately \$8,000-\$16,000. Upfront costs would also include City staff time to obtain funding</p>	None	None	<p>Private Costs: None</p> <p>Private Savings: None</p>

			<p>(approximately 40 hours at \$50-\$100/hour = \$2,000-\$4,000). Aggregated cost (over life of the plan, 15 years) = \$64,625-\$160,875</p> <p>City Savings: Although the benefits of urban forestry can vary considerably by community and tree species, a study of urban forestry programs in five U.S. cities showed that the benefits (from energy savings due to shading of buildings) are almost always higher than the costs. The study found that, on a per-tree basis, cities accrued benefits ranging from about \$1.50-\$3 for every dollar invested. These cities spent roughly \$15-\$65 annually per tree, with net annual benefits ranging from approximately \$30-\$90 per shade tree (McPherson et al., 2005). For this measure, it is assumed that 25 percent of the trees would be planted to shade buildings. Annual savings for planting 28 shade trees is approximately \$840-\$2,520.</p>			
Energy						
E-1: Energy Efficiency and Conservation in Existing Buildings	Medium - High	None	<p>City Costs: Annual costs are associated with City staff time needed to collaborate with PG&E and conduct outreach and promotional activities (approximately 80 hours at \$50-\$100/hour = \$4,000-\$8,000/year). Over the lifetime of the plan (15 years) this would total \$60,000-\$120,000.</p> <p>City Savings: None</p>	None	Varies	<p>Private Costs: No mandatory costs, as implementation would be voluntary. For participating residents and businesses, costs would vary based on the degree of implementation, available rebates and other financial incentives. For informational purposes, the typical price to hire a home energy auditor</p>

						costs between \$646 and \$942 (Home Advisor, 2015). However, low-cost or free audits are often offered by local utilities. Energy efficient windows (including installation) can cost between \$270-\$800 per/window (Houselogic, 2015). Installing batt wall insulation can cost about \$1.18-\$1.58 per square foot (Homewyse, 2014. Attic insulation can cost about \$0.70-\$3 per square foot depending on the type of insulation installed (Choice Roofing Group, 2015). PG&E currently offers up to \$1,500 in rebates to upgrade heating or cooling systems, up to \$1,500 in rebates for window upgrades, and up to \$2,000 for attic upgrades (PG&E, 2015). ENERGY STAR washers range from \$550-\$1,000 and ENERGY STAR refrigerators range from \$540-\$1,600 (The Home Depot, 2015). There are also several energy savings projects that can be completed for under \$50 including: energy-efficient lighting (\$3-\$15/bulb), power strip (\$12-\$35), water heater blanket (\$25), foam pipe insulation (\$4-\$5 for 6-foot length), programmable thermostat (starting at \$25), door sweep (\$3.50-\$20), clothesline (\$10),
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						<p>timers for lights (\$7-\$13) (Pahl, 2012).</p> <p>Private Savings: Savings to participating residents and business owners varies based on total reduction in kWh of electricity. Average electricity cost is \$0.20/kWh (PG&E, 2015). Upgrading to ENERGY STAR qualified windows can reduce annual household energy bills by 7-15 percent, or roughly \$71-\$501 annually, depending on your geographic location and the type of window being replaced (USDOE, 2010). ENERGY STAR-qualified clothes washers and refrigerators are 20-35 percent more energy efficient than standard models (USEPA, 2013). Overall, making energy efficiency upgrades identified in an energy audit could result in a 5-30 percent reduction on your energy bill (USDOE, 2013).</p>
E-2: Energy Efficient New Construction	Low	None	<p>City Costs: Annual costs are associated with City staff time needed to provide support to and recognition of developers (approximately 20 hours at \$50-\$100/hour = \$1,000-\$2,000/year). Over the lifetime of the plan (15 years) this would total \$15,000-\$30,000.</p> <p>City Savings: None</p>	None	Varies	<p>Private Costs: No mandatory costs, as implementation would be voluntary. For participating developers, upfront construction costs would be 4-6 percent higher for ultra-energy efficient homes over standard homes (Lozanova, 2014).</p> <p>Private Savings: Savings to residents or tenants residing in</p>

						energy efficient buildings varies based on total reduction in kWh of electricity. Average electricity cost is \$0.20/kWh (PG&E, 2015). Drawing on national data for 100 green buildings and an in-depth review of several hundred existing studies, one study found that green buildings are a cost-effective investment. The report concluded that minimal increases in upfront costs of about 2-5 percent to support green design would, on average, result in life cycle savings of 20 percent of total construction costs — more than ten times the initial investment (Rutgers, 2013).
E-3: On-Site Small-Scale Renewable Energy	Low - Medium	None	<p>City Costs: Annual costs are associated with City staff time needed to conduct outreach and promotional activities (approximately 60 hours at \$50-\$100/hour = \$3,000-\$6,000/year). Over the lifetime of the plan (15 years) this would total \$45,000-\$90,000.</p> <p>City Savings: None</p>	None	Varies	<p>Private Costs: No mandatory costs, as implementation would be voluntary. For participating residents, businesses, and developers costs vary based total kW installed. The current average installed cost for a residential solar electric system in California is between \$4-\$7/watt, while larger commercial and institutional systems typically cost \$3-\$7/watt (cost estimate does not include subsidies or financial assistance) (Center for Sustainable Energy, 2015). The initial cost to install a solar water heating system generally ranges between \$6,000-</p>

						<p>10,000. The net cost of installing a solar water heater (accounting for tax credits and rebates) ranges from approximately \$1,800 to \$5,000 depending on both the rebates available and whether or not the homeowner was going to replace their water heater regardless (Fast Water Heater Company, 2015). The California Solar Initiative Program offers cash rebates for solar water heating systems and for solar installations on homes and businesses. The federal government also offers tax rebates for solar installations.</p> <p>Private Savings: Savings for participating residents, businesses, and developers varies based on total kW installed and overall reduction in kWh of electricity. Average electricity cost is \$0.20/kWh (PG&E, 2015). On average, solar water heater installation results in a 50–80 percent drop in water heating bills (USDOE, 2012).</p>
Transportation and Land Use						
T-1: Infill and Mixed-Use Development	Low - Medium	None	<p>City Costs: Annual costs are associated with City staff time needed to conduct outreach and promotional activities and to showcase infill and mixed-use projects (approximately 60 hours at \$50-\$100/hour = \$3,000-\$6,000/year).</p>	None	Varies	<p>Private Costs: No mandatory costs, as implementation would be voluntary. For participating developers, costs of infill and mixed-use development would not increase over business-as-usual.</p>

			Over the lifetime of the plan (15 years) this would total \$45,000-\$90,000. Costs associated with coordinating with MCTC are costs associated with business-as-usual. City Savings: None			Private Savings: Private savings to residences and employees occupying the infill and mixed-use development would vary depending on the individual reduction in VMT. Savings for participating developers would vary based on incentives provided. Reductions in per capita vehicle travel would reduce direct and indirect transportation costs.
T-2: Bicycle and Pedestrian Environment	Low - Medium	None	City Costs: Pursuing funds to expand the City's bicycle and pedestrian network is a cost associated with doing business-as-usual as City staff regularly does this. There would be annual costs associated with City staff time needed to establish design criteria for pedestrian and bicycle circulation and to conduct outreach and promotional activities (approximately 40 hours at \$50-\$100/hour = \$2,000-\$4,000/year). Over the lifetime of the plan (15 years) this would total \$30,000-\$60,000. City Savings: None	None	Varies	Private Costs: No mandatory costs, as implementation would be voluntary. For participating developers, costs associated with incorporating bicycle and pedestrian infrastructure into new development are costs associated with doing business-as-usual. Private Savings: Private savings to participating community members would vary depending on the individual reduction in VMT. Switching from single-occupant vehicle to walking or biking reduces fuel and vehicle costs. The average cost to own and operate a sedan in the US is 59.2 cents per mile, or \$8,876 per year, based upon 15,000 miles of annual driving (AAA, 2014).
T-3: Transit Travel	Low	None	City Costs: Annual costs are associated with City staff time needed to conduct outreach and promotional activities (approximately 30 hours at \$50-\$100/hour = \$1,500-\$3,000/year). Over	None	Varies	Private Costs: No mandatory costs, as implementation would be voluntary. For participating developers, costs associated with providing safe routes to adjacent

			<p>the lifetime of the plan (15 years) this would total \$22,500-\$45,000. In addition, this measure would require minimal additional City staff time needed for project review and approval processing; this cost would be absorbed through development/permitting fees.</p> <p>City Savings: None</p>			<p>transit stops and constructing bus turnouts and shelters are costs associated with doing business-as-usual. For participating businesses, costs would vary based on the level of incentives provided (e.g., public transit vouchers).</p> <p>Private Savings: Private savings to participating community members would vary depending on the individual reduction in VMT. The measure would encourage people to utilize public transportation and would reduce VMT and associated fuel and vehicle costs to community members. The average cost to own and operate a sedan in the US is 59.2 cents per mile, or \$8,876 per year, based upon 15,000 miles of annual driving (AAA, 2014).</p>
T-4: Commute Trip Reduction	Low - Medium	None	<p>City Costs: Annual costs are associated with City staff time needed to conduct outreach and promotional activities (approximately 60 hours at \$50-\$100/hour = \$3,000-\$6,000/year). Over the lifetime of the plan (15 years) this would total \$45,000-\$90,000.</p> <p>City Savings: None</p>	None	Varies	<p>Private Costs: No mandatory costs, as implementation would be voluntary. For participating businesses, costs would vary based on the level of incentives provided (e.g., employer-based TDM programs).</p> <p>Private Savings: Private savings to participating community members would vary depending on the individual reduction in VMT. This measure would encourage people to commute via modes other than single occupancy automobiles. This</p>

						would reduce fuel and vehicle costs for community members. The average cost to own and operate a sedan in the US is 59.2 cents per mile, or \$8,876 per year, based upon 15,000 miles of annual driving (AAA, 2014).
T-5: Traffic Flow and Light-Duty Passenger Vehicle Idling	None	None	City Costs: Costs associated with coordinating traffic signals and intersection improvements are costs associated with doing business-as-usual as these are policies and programs in the General Plan. City Savings: None	None	Varies	Private Costs: None Private Savings: Private savings to community members would vary based on the type of vehicle being driven, delay time, and travel distance. Traffic signal synchronization and other traffic flow management techniques result in reduced travel time and fuel consumption, which can result in monetary savings. On average, avoiding idling can reduce fuel costs from \$0.01-\$0.02/min and participating in efficient driving techniques can reduce fuel costs from \$0.11-\$0.71/gallon (USDOE, 2015).
T-6: Low Carbon Fuel Vehicles and Infrastructure	Low - Medium	None	City Costs: Upfront costs include staff time to obtain funding (approximately 60 hours, at \$50-\$100/hour = \$3,000-\$6,000). It is assumed that the fueling stations would be funded through a grant. Annual costs are associated with City staff time needed to develop an alternative fuel resources page and conduct outreach and promotional activities (approximately 30 hours at	None	Varies	Private Costs: No mandatory costs, as implementation would be voluntary. For participating home owners, home charging equipment can cost between \$500 and \$1,100; however, this is expected to decline over time, with higher volume production. Home installation costs range from a few hundred dollars to over \$2,000 depending on the age

			<p>\$50-\$100/hour = \$1,500-\$3,000/year). Aggregated cost over the lifetime of the plan (15 years) = \$25,500-\$51,000. City Savings: None</p>			<p>of the home, the home's total electrical capacity and existing electrical loads (Drive Clean, 2015). For participating businesses, public DC fast charging stations can cost more than \$10,000, and installations of a single unit can cost up to \$50,000 (SJVAPCD, 2014). The cost of a compressed natural gas fueling station depends on the size, capacity, and type of compressed natural gas it dispenses. Average costs to install a natural gas charging station range from \$5,500 for a one vehicle time-fill fueling station to \$1.8 million for large fast-fill station (USDOE, 2014). Private costs for participating community members may also voluntarily result from purchase of low carbon and alternatively fueled vehicles. The difference in purchase price for hybrid Honda Civic above a standard Honda Civic is about \$6,445 (USDOE, 2015). The difference in purchase price for a CNG Honda Civic above a standard Honda Civic is about \$8,450 (USDOE, 2015). Private Savings: Private savings to participating community members would vary depending on the individual reduction in fuel purchases. Savings associated with</p>
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						<p>low carbon/alternative fuel vehicle use include savings from reduced fuel consumption. The difference in operating costs between a standard Honda Civic and a hybrid Honda Civic is \$0.02/mile (USDOE, 2015). On average the difference in fuel costs between gasoline vehicles and electric vehicles is currently \$1.30/ (e)gallon (AAA, 2015; USDOE, 2013). At the current time, CNG does not provide a cost reduction over current gasoline prices. However, savings associated with CNG vehicles would be achieved through lower maintenance costs from reduced wear and tear of the engine and less frequent oil changes and tune-ups. Some fleet operators have reduced maintenance costs by as much as 40 percent by converting their vehicles to CNG (Agee, 2015). Please note that the amount saved will change as fuel prices change.</p>
T-7: Construction and Off-Road Equipment	Low	None	<p>City Costs: Annual costs are associated with City staff time needed to conduct outreach and promotional activities (approximately 30 hours at \$50-\$100/hour = \$1,500-\$3,000/year). Aggregated cost over the lifetime of the plan (15 years) = \$22,500-\$45,000.</p> <p>City Savings: None</p>	None	Varies	<p>Private Costs: No mandatory costs, as implementation would be voluntary. Costs to participating businesses and residents would vary depending on the vehicle/equipment replacement type.</p> <p>Private Savings: Private savings to participating businesses and residents would vary based on</p>

						vehicle/equipment replacement type and frequency of maintenance. Private savings associated with electrically-powered or CNG-fuelled off-road equipment include savings from reduced fuel prices. Private savings would also result from reduced fuel usage in lawn and garden equipment. Savings would vary based on type of equipment and frequency of maintenance.
Water and Wastewater						
W-1: Exceed SB X7-7 Water Conservation Target	Low - Medium	None	City Costs: Annual costs are associated with City staff time needed to develop water conservation programs and conduct outreach and promotional activities (approximately 60 hours at \$50-\$100/hour = \$3,000-\$6,000/year). Aggregated cost over the lifetime of the plan (15 years) = \$45,000-\$90,000. City Savings: None	None	Varies	Private Costs: No mandatory costs, as implementation in homes and businesses would be voluntary. For participating businesses and residents, costs would vary based on degree of implementation and total reduced water consumption. Private Savings: Private savings to participating businesses and residents would be those associated with reduced water bills. Savings would vary depending on water rates and water usage.
W-2: Recycled Water	Low - Medium	None	City Costs: Annual costs are associated with City staff time needed to provide technical assistance and conduct outreach and promotional activities (approximately 40 hours at \$50-\$100/hour = \$2,000-\$4,000/year). Aggregated cost over the lifetime of the plan (15 years) = \$30,000-\$60,000	None	Varies	Private Costs: No mandatory costs, as implementation in homes and business would be voluntary. For participating businesses and residents, costs would vary based on degree of implementation and total reduced water consumption. Private Savings: Private savings to

			City Savings: None			participating businesses and residents would be those associated with reduced water bills. Savings would vary depending on water rates and water usage.
W-3: Wastewater Treatment Plant Upgrades	Very Low	Low	City Costs: Upfront costs include staff time to obtain funding for solar PV installation, and to manage flow rates to identify ways to enable process efficiency (approximately 80 hours, at \$50-\$100/hour = 4,000-\$8,000). It is assumed that solar PVs would be funded through a grant, utility program, energy performance contract, or other mechanism. City Savings: Based on an average electricity cost of \$0.21/kWh and a total of 106,767 kWh provided by renewable sources by 2030, the City would save an estimated \$22,421 annually upon completion.	None	None	Private Costs: None Private Savings: None
Solid Waste						
S-1: Solid Waste Reduction and Recycling	Very Low - Low	None	City Costs: Annual costs are associated with City staff time needed to conduct outreach activities (approximately 10 hours at \$50-\$100/hour = \$500-\$1,000/year). Aggregated cost over the lifetime of the plan (15 years) = \$7,500-\$15,000 City Savings: None	None	None	Private Costs: None Private Savings: None
Urban Greening						
U-1: Trees and Vegetation	Very Low	None	City Costs: Upfront costs are associated with City staff time needed to obtain funding and develop a tree	None	Varies	Private Costs: No mandatory costs, as implementation would be voluntary. For participating

			planting program (approximately 80 hours at \$50-\$100/hour = \$4,000-\$8,000). City Savings: None			community members, the average cost of 15-gallon tree is \$250/tree and average annual maintenance costs range from \$15-\$65/tree (Peters Brothers Nursery, 2015; McPherson et al., 2005). Private Savings: Private savings to participating residents would result from energy savings due to shading of buildings. Indirect savings would be the same as for the City, with net annual benefits ranging from approximately \$30-\$90 per shade tree (McPherson et al., 2005).
Adaptation						
A-1: Climate Change Vulnerability	Very Low	None	City Costs: This measure would result in costs associated with City staff time to participate in meetings and planning activities and incorporate new adaptation measures into City documents as appropriate (approximately 40 hours, or \$2,000-\$4,000). City Savings: None	None	None	Private Costs: None Private Savings: None
A-2: Public Health and Safety	Very Low	None	City Costs: This measure would result in costs associated with staff time to coordinate with other agencies and community-based organizations (approximately 20 hours, or \$1,000-\$2,000) City Savings: None	None	None	Private Costs: None Private Savings: None
A-3: Water Management	None	None	City Costs: There are no costs associated with this measure as it is a continuation of business-as-usual.	None	None	Private Costs: None Private Savings: None

			City Savings: None			
A-4: Biodiversity and Habitat	Very Low	None	City Costs: This measure would result in costs associated with staff time to identify location for native species and coordinate with other agencies (approximately 20 hours, or \$1,000-\$2,000). City Savings: None	None	None	Private Costs: None Private Savings: None
A-5: Infrastructure	Very Low	None	City Costs: This measure would result in costs associated with staff time to incorporate climate change consideration in infrastructure planning (approximately 40 hours, or \$2,000-\$4,000). City Savings: None	None	None	Private Costs: None Private Savings: None
A-6: Agriculture	Very Low	None	City Costs: This measure would result in costs associated with staff time to collaborate with resource conservation districts, cooperative extensions, and other agricultural organizations (approximately 40 hours, or \$2,000-\$4,000). City Savings: None	None	None	Private Costs: None Private Savings: None

*Cost of City staff time assumed to range from \$50-\$100/hour

Appendix E

CAP Consistency Worksheet



Appendix E

CAP Consistency Worksheet

This appendix sets forth a CAP consistency worksheet that future project applicants may use to help demonstrate project compliance with the CAP. The worksheet is designed to help the City determine if a project is consistent with the CAP but does not define which measures would need to be implemented for the consistency determination, as requirements may vary by project type. This worksheet should be filled out for each new project, subject to discretionary review of the City of Madera.

The applicant should complete Sections A and B below, providing project-level details in the space provided. Generally, only projects that are consistent with the General Plan land use designations and population and employment projections, upon which the GHG emissions modeling and CAP is based, can apply for a determination of consistency with the CAP. If an action is not applicable to the proposed project, please identify and explain.

If the project cannot meet one or more of the requirements (as defined by the City), substitutions may be allowed if the applicant can demonstrate how substituted actions would achieve equivalent reductions to the City's satisfaction. The applicant would also be required to demonstrate that the project would not substantially interfere with implementation of the CAP. If it is determined that the proposed project is not consistent with the CAP, further CEQA analysis would be required.

A: PROJECT INFORMATION

Date:	
Project Name:	
Project Address:	
Project Type:	
Project Size:	
Land Use Designation(s):	
Zoning Designation(s):	
Project Service Population (Residents + Employees):	
Brief Project Description:	
Compliance Worksheet Prepared By:	

B: CAP COMPLIANCE WORKSHEET

Measure Name	Project Actions	Project Compliance (Yes/No/NA)	Description/Details*
E-2 Energy Efficient New Construction	Is the project consistent with applicable policies of the Conservation Element of the General Plan?		
	Does the project exceed Title 24 Energy Efficiency Building Standards, meet the state's Green Building Standards voluntary tier levels, or is LEED Greenpoint, or ENERGY STAR rated?		
E-3 On-Site Small-Scale Renewable Energy	Does the project include solar PV systems or solar hot water heaters?		
T-1: Infill and Mixed-Use Development	Is the project consistent with the land use designation(s) shown on the General Plan Land Use Map and with the applicable policies of the Land Use Element of the General Plan policies?		
	Is the project consistent with the Madera County Blueprint?		
	Does the project include mixed-use, higher density (22.5 to 50 units per acre), or infill development?		
	Is the project located within 1/4 mile of transit stops or in existing community centers/downtown?		
T-2 Bicycle and Pedestrian Environment	Is the project consistent with applicable policies of the Community Design and Circulation Elements of the General Plan?		
	Is the project consistent with the Bicycle Master Plan?		
	Does the project meet minimum design criteria for bicycle and pedestrian circulation?		
	Does the project provide adequate and secure bicycle		

	parking?		
T-3 Transit Travel	Is the project consistent with applicable policies of the Circulation and Community Development Elements of the General Plan?		
	Does the project provide safe routes to adjacent transit stops, where applicable?		
	Does the project finance and/or construct bus turnouts and shelters where transit demand warrants such improvements?		
	Does the project provide public transit vouchers to its employees?		
T-4 Commute Trip Reduction	Is the project consistent with applicable policies of the Community Development Element of the General Plan?		
	Does the project include and/or promote TDM programs?		
T-5 Traffic Flow and Vehicle Idling	Does the project include measures to improve traffic flow?		
T-6 Low Carbon Fuel Vehicles and Infrastructure	Is the project consistent with applicable policies of the Community Development Element of the General Plan?		
	Is the project consistent with the San Joaquin Valley Plug-in Electric Vehicle (PEV) Readiness Plan?		
	Does the project include alternative fueling stations or EV charging stations?		
T-7 Construction and Off-Road Equipment	Would construction of the project use alternatively fueled construction vehicles/equipment (i.e., repowered engines, electric drive trains, CARB-approved low carbon fuel, electrically-powered)?		
	Would the project include low-maintenance native landscaping or xeriscaping?		
W-1 Exceed SB	Does the project incorporate		

X7-7 Water Conservation Target	water efficiency and water conservation measures?		
W-2 Recycled Water	Is the project consistent with applicable policies of the Conservation Element of the General Plan?		
	Does the project incorporate recycled/reclaimed water?		
U-1 Trees and Vegetation	Is the project consistent with applicable policies of the Community Design Element of the General Plan?		
	Does the project include the planting of new trees or new acres of vegetated land?		

*Please attach additional pages as needed to complete the description and provide project details.