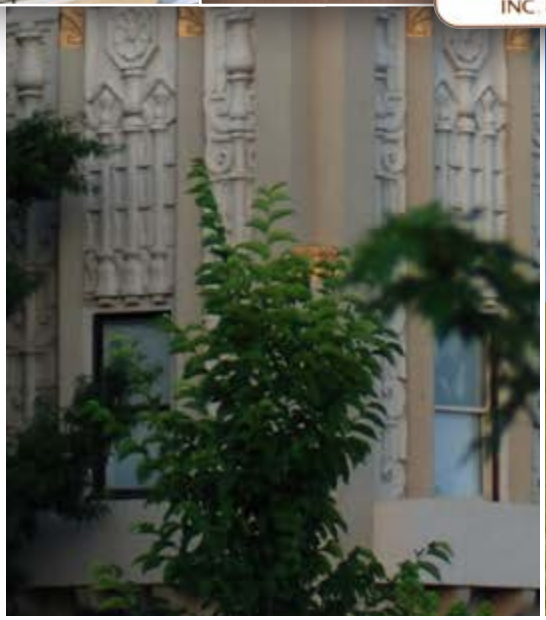
City of Chico 2020 Climate Action Plan

CITY OF CHICO
INC. 1872



Final Draft

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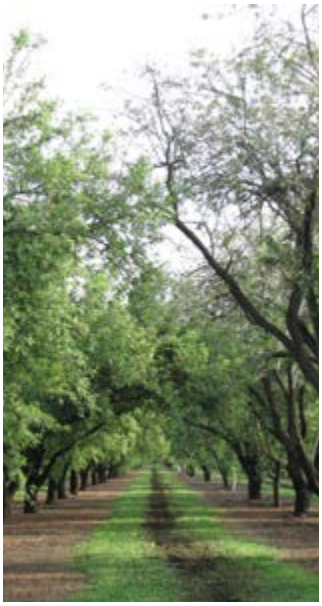

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List of Abbreviations

GHGs	Greenhouse Gasses
CO2	Carbon Dioxide
CH4	Methane
N2O	Nitrous Oxide
EPA	Environmental Protection Agency
IPCC	International Panel on Climate Change
CEC	California Energy Commission
CFCs	Chlorofluorocarbons
CARB	California Air Resources Board
CEQA	California Environmental Quality Act
BCAG	Butte County Association of Governments
CNRA	California Natural Resource Agency
ACUPCC	American College and University Presidents' Climate Commitment
USCMCPA	U.S. Conference of Mayors' Climate Protection Agreement
STF	Sustainability Task Force (City of Chico)
ICLEI	International Council for Local Environmental Initiatives
MtCO2e	Metric Tons of Carbon Dioxide Equivalent Emissions
CAP	Climate Action Plan
ISD	Institute for Sustainable Development (CSU, Chico)
GPU	General Plan Update (City of Chico)
CACP	Clean Air and Climate Protection Software
PG&E	Pacific Gas & Electric
BAU	"Business-As-Usual" Emissions Scenario

Chapter One
2005-2010: Context for Chico's Climate Action Plan

The City of Chico's 2020 Climate Action Plan outlines strategies, organized within a flexible ten-year framework, for a significant reduction of greenhouse gas emissions that are directly and indirectly generated by local activities. The Plan includes actions to reduce energy, water, and fuel consumption and to reduce the amount of waste going into the landfill.

While Chico plays a very small role in the global problem of climate change, the City of Chico is committed to reducing greenhouse gas (GHG) emissions as a part of its sustainability efforts. The Chico 2030 General Plan states this goal, and in support, calls for implementation of a Climate Action Plan (CAP or Plan). The State of California has set ambitious goals to combat climate change by lowering GHG emissions. Local governments are following suit by taking the initiative to reduce locally-generated greenhouse gas emissions. Local governments like the City of Chico have influence and, in some cases, exclusive authority over activities that contribute to direct and indirect GHG emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations.

The purpose of the Climate Action Plan is to provide the means for Chico to meet its GHG reduction goal of 25% below 2005 emission levels by the end of 2020. The CAP lists, and estimates GHG emission reductions for, actions that will directly or indirectly reduce emissions from local activities. It distinguishes between actions that can be taken by the City and those that require action by the local community. To meet the 2020 goal, the Plan divides actions into two phases, with the first phase ending in 2015. Full implementation of the Plan is intended to significantly reduce GHG emissions as well as yield economic and other benefits, such as cleaner air, reduced traffic, less dependence on fossil fuels, improved quality of life, and greater resilience to the affects of climate change.

2030 General Plan

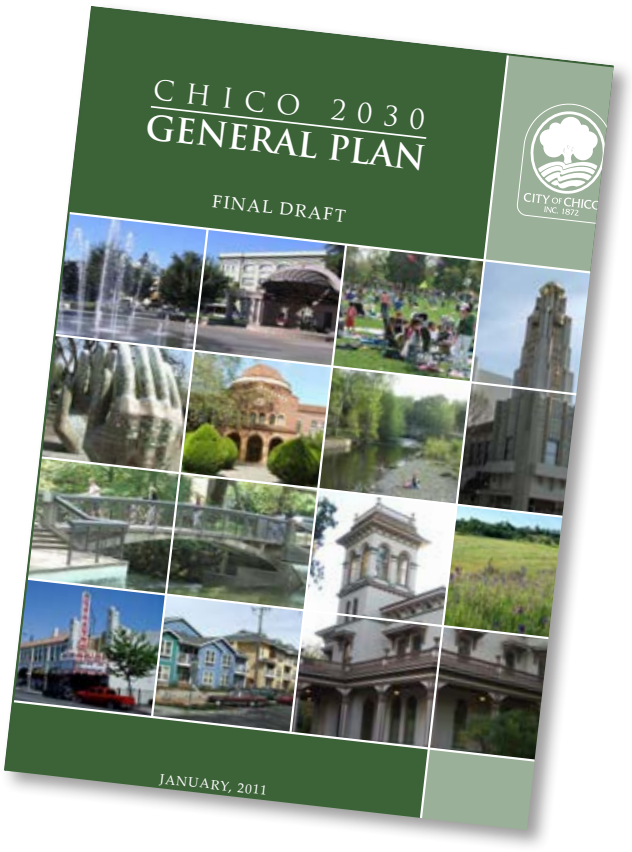
In April 2011, the City of Chico adopted the 2030 General Plan, which guides the growth and preservation of Chico. Many of the actions in the Climate Action Plan are mandated in the twelve elements of the General Plan. Implementation of the 2030 General Plan may arguably be the most important and efficacious action the City can take to reduce local sources of GHG emissions.

Strategies in the General Plan that will help reduce greenhouse gas emissions include promoting compact, walkable, infill and mixed-use development; focusing redevelopment along transit corridors and at other central locations; promoting the efficient use of energy and resources; improving local air quality; directing waste diversion and reduction; and establishing energy and water conservation measures in building, landscaping, and municipal operations.

In particular, the Sustainability Element contains goals, policies, and actions that confirm and support the City's ongoing commitment to reducing GHG emissions, including policies and actions directing adoption and implementation of a Climate Action Plan. This element identifies several actions for increasing energy efficiency, such as increased coordination with PG&E to provide education about reducing energy use, and consideration of a City-sponsored low-interest loan program for energy efficiency improvements and renewable energy devices.

The City can help reduce GHG emissions locally through the wise utilization of land. The Land Use Element, therefore, identifies and promotes efficient development patterns, including compact development, infill and mixed-use development, redevelopment, and complete neighborhoods. Growth consistent with the Land Use Diagram and policies throughout the General Plan will result in reduced contributions to global climate change, reduced reliance on oil and other fossil-fuel sources, and decreased per capita consumption of natural resources.

Additional goals, policies, and actions in the other General Plan elements directly or indirectly support the reduction of GHG emissions. For example, the Circulation Element promotes infrastructure that fosters walking and bicycling to reduce the need for single occupant vehicle trips and other transportation related GHG emissions, the Open Space and Environment Element preserves natural resources and helps improve local air quality, and the Parks, Public Facilities, and Services Element includes policies to reduce waste, and water and energy use. Goals from the General Plan that are related to Climate Action Plan actions are cross-referenced under each applicable CAP action in Chapter Three.



Greenhouse Gas Emissions and Climate Change

To understand global climate change, it is important to recognize the naturally occurring "greenhouse effect" and to define the greenhouse gases (GHGs) that contribute to this phenomenon. Parts of the Earth's atmosphere act as an insulating blanket of just the right thickness to trap sufficient solar energy to keep the global average temperature in a suitable range. The "blanket" is a collection of atmospheric gases called "greenhouse gases," that trap heat like the glass walls of a greenhouse. These GHG, consist mainly of water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), ozone (O_3), and chlorofluorocarbons (CFCs), and all act as effective global insulators, reflecting back to earth infrared radiation, as demonstrated in Figure 1.1. Carbon dioxide is an example of a greenhouse gas that is emitted to the atmosphere both naturally, through the Earth's carbon cycle, and through human activities, such as the burning of fossil fuels (natural gas, coal, gasoline, etc.) or cement production. Other greenhouse gases, fluorinated gases for example, are created and emitted solely through human activities.

Over the past century, humans have contributed to the amount of GHGs in the atmosphere by activities such as burning fossil fuels to power cars, factories, and utilities. The gases produced from these activities, primarily carbon dioxide and methane, are enhancing the natural greenhouse effect and likely contributing to an increase in global average temperature and related climate changes. (sources: http://epa.gov/climatechange/science/index.html).

Because GHGs have variable potencies, a common metric of carbon dioxide equivalents (CO_2e) is used to report a combined potency from all GHGs. The potency of each GHG is measured as a combination of the volume of its emissions and its global warming potential (U.S. EPA), and is expressed as a function of the potency with respect to the same mass of CO_2. Thus, by multiplying the individual gas volume by its global warming potential, the emissions of each individual gas can be measured in terms of metric tons of carbon dioxide equivalent emissions ($MtCO_2e$).

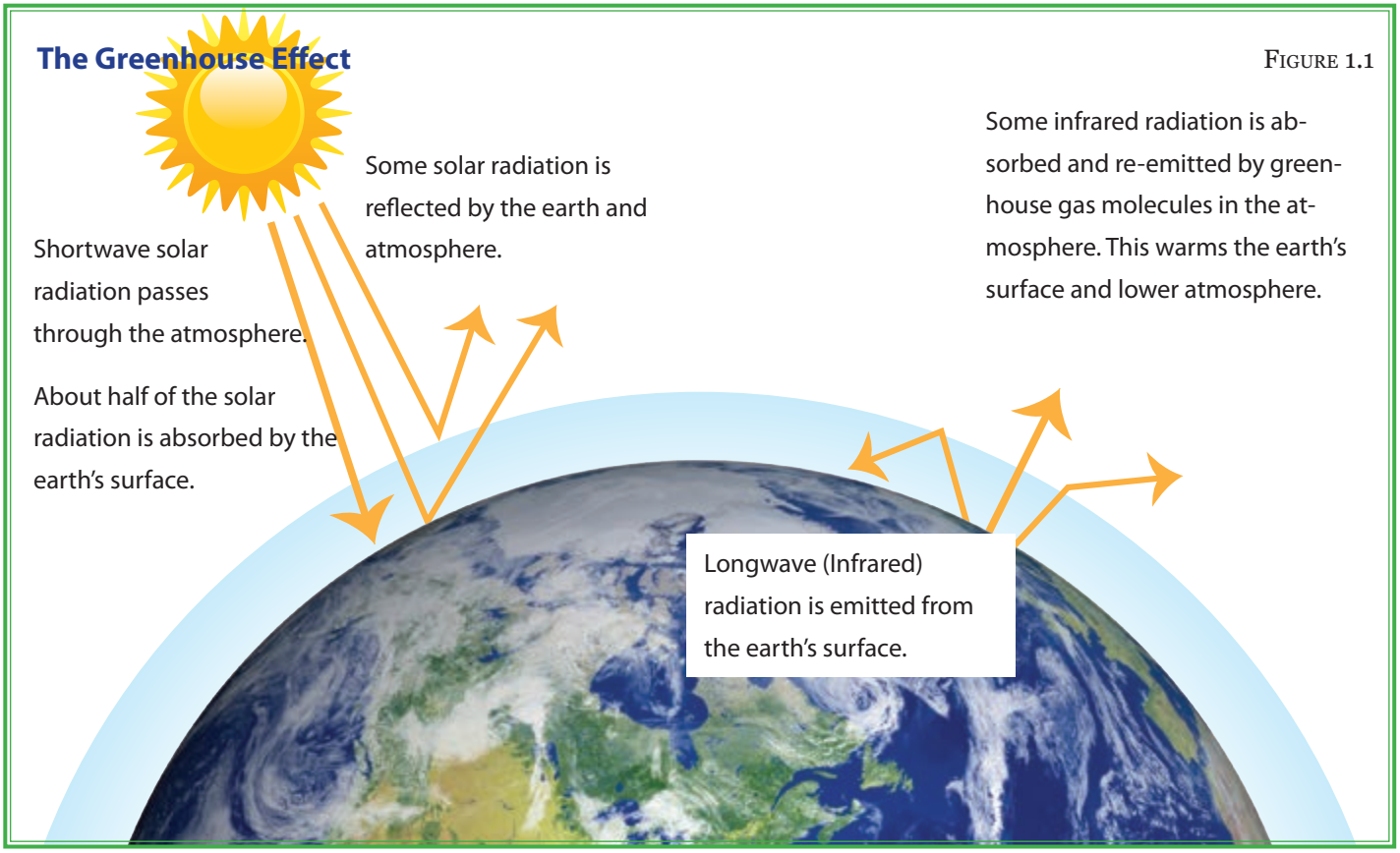


Figure 1.1

Implications of Climate Change for California

The State of California developed a plan for adapting to potential impacts of climate change entitled, "2009 California Climate Adaptation Strategy."

The Plan identified the potential impacts of climate change in California with collaboration from the California Air Resources Board, California Department of Water Resources, California Environmental Protection Agency, California Energy Commission, and the Union of Concerned Scientists. The broad-ranging impacts identified have the potential to negatively affect agriculture, forestry, water resources, coastal areas, energy production, air quality, public infrastructure, sensitive species and habitats, public health and safety, and, as a result, multiple economic sectors throughout the state. The potential impacts will not occur evenly throughout the state. Those most likely to affect the local region are described below. The City's efforts to prepare for adaptation to these impacts are discussed later in this chapter.

Public Health

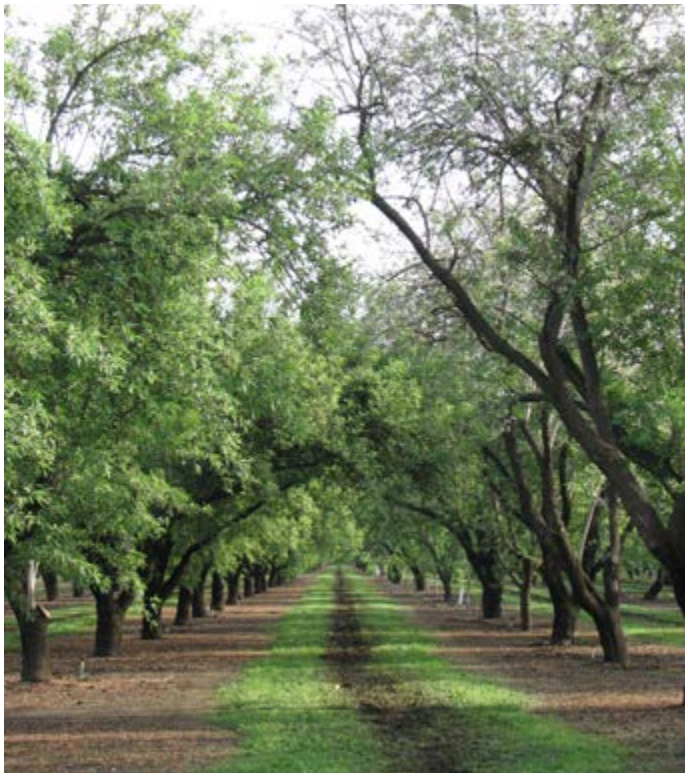
Climate change could affect Californians' health by intensifying heat waves, exacerbating air pollution, and expanding the range of infectious diseases. The primary concern is not as much a change in average climate but the projected increase in extreme conditions, such as extreme heat, which pose the most serious health risks.

Californians would face greater risks of dehydration, heat stroke, heat exhaustion, heart attack, stroke, and respiratory distress with exposure to extreme heat. The elderly, children, people who are already ill, and the poor, who may lack access to air conditioning and medical assistance, are the most vulnerable to the effects of extreme heat. Warmer temperatures, when combined with increased precipitation, also can encourage mosquito-breeding, thereby increasing the risk of exposure to diseases carried by mosquitoes, such as the West Nile Virus.

Air Quality

Higher temperatures are expected to increase the frequency, duration, and intensity of conditions that are conducive to the formation of unhealthy air pollution: ozone and particulate matter (O3, PM10, and PM2.5). An increase in air pollutants can cause or aggravate a wide range of health problems, including asthma, other acute respiratory diseases, cardiovascular diseases, and decreased lung capacity for the elderly and children. In California, more than 90% of the population is living in areas that already violate the state's air quality standards, and Butte County has been designated as an area that does not meet the State and Federal standards for ozone and fine particulate matter (PM 2.5).

In hot weather, air pollution also worsens due to increases in natural hydrocarbon emissions and evaporative emissions of fuels and solvents. The greater number of wildfires predicted to accompany climate change will also contribute to higher levels of fine particulate matter in the air, which significantly impacts human health, natural ecosystems, and indirectly, the economy.



Water Supply

California already faces challenges in providing water for its large and growing population. Climate change is predicted to exacerbate these challenges through increased temperatures, and possibly, changes in precipitation patterns. The California Natural Resources Agency anticipates that the variability in hydrologic trends experienced during the last century will likely intensify this century.

While most climate models project relatively moderate changes in precipitation over this century, rising global temperatures are expected to result in reductions in snowpack for the Sierra Nevada, with precipitation changing from snow to rain. The Sierra Nevada snowpack acts as natural water storage by holding winter precipitation and releasing it as snow melt during the spring and early summer months. Reductions of the winter snowpack would result in water storage shortages, while an increased proportion of precipitation in the form of rain, together with larger storms, would mean more frequent severe flood events.

With California's unpredictable patterns of rain and snowfall, elaborate systems of dams and reservoirs keep a steady supply of water available and handle flood control. As snow and rain patterns shift, it becomes increasingly difficult to know when to keep reservoirs full and when to allow them to empty and make space for flood control. In addition, diminished stream flows will reduce groundwater recharge and surface water supplies. These impacts on surface and groundwater supplies would affect California's farms, municipalities, ecosystems, and the generation of hydro-electric power.

Agriculture

Potential impacts on California's agriculture industry include a reduced water supply, potential droughts, increased winter floods, increased pests and plant diseases, and hotter growing seasons. Many farms, especially in the fruit, nut and rice industries prevalent around Chico, require long-term investments which necessitate advance preparation to adapt to climate change.

Forests & Wildfires

Extended periods of heat and drought make forests particularly susceptible to pests and diseases that could compromise forest health. Extended periods of heat and drought also may compromise a forest's ability to provide habitat, protect the watershed from erosion and excess runoff, and store carbon. Climate models suggest that the factors contributing to catastrophic fire risk (fuel loads, high temperatures, dry conditions, wind, etc.) may be more prevalent under future climate conditions, likely leading to increases in the number and severity of wildfires. The California Regional Assessment Group in its 2002 report "Preparing for a Changing Climate -The Potential Consequences of Climate Variability and Change" already noted an increase in the number and extent of areas burned by wildfires in recent years. Larger and more frequent wildfires will impact California's economy by increasing costs for fire suppression, interagency emergency response, post-fire recovery efforts, and expenses for replacing structures, timberlands, water supplies, and lost tourism and recreation opportunities.

Ecosystems

Predicted increases in temperature and changes in precipitation patterns would likely shift California's current vegetation and habitat zones northward by approximately 100 to 400 miles, as well as upwards in elevation by 500 to 1,500 feet. The distribution, abundance, and vitality of species and their habitats strongly depend on climatic and microclimatic conditions. Changes in these conditions, particularly decreased groundwater supply, would affect those plant and aquatic species that live and depend on shallow aquifers. Changes in climatic conditions could also necessitate the geographic movement of species in accordance with the predicted shifts in habitats, making native plant habitats vulnerable to invasive species, and could present problems for many species that are unable to migrate.

Summary of Projected Global Warming Impacts to California, 2070–2099 as compared with 1961-1990

Figure 1.2

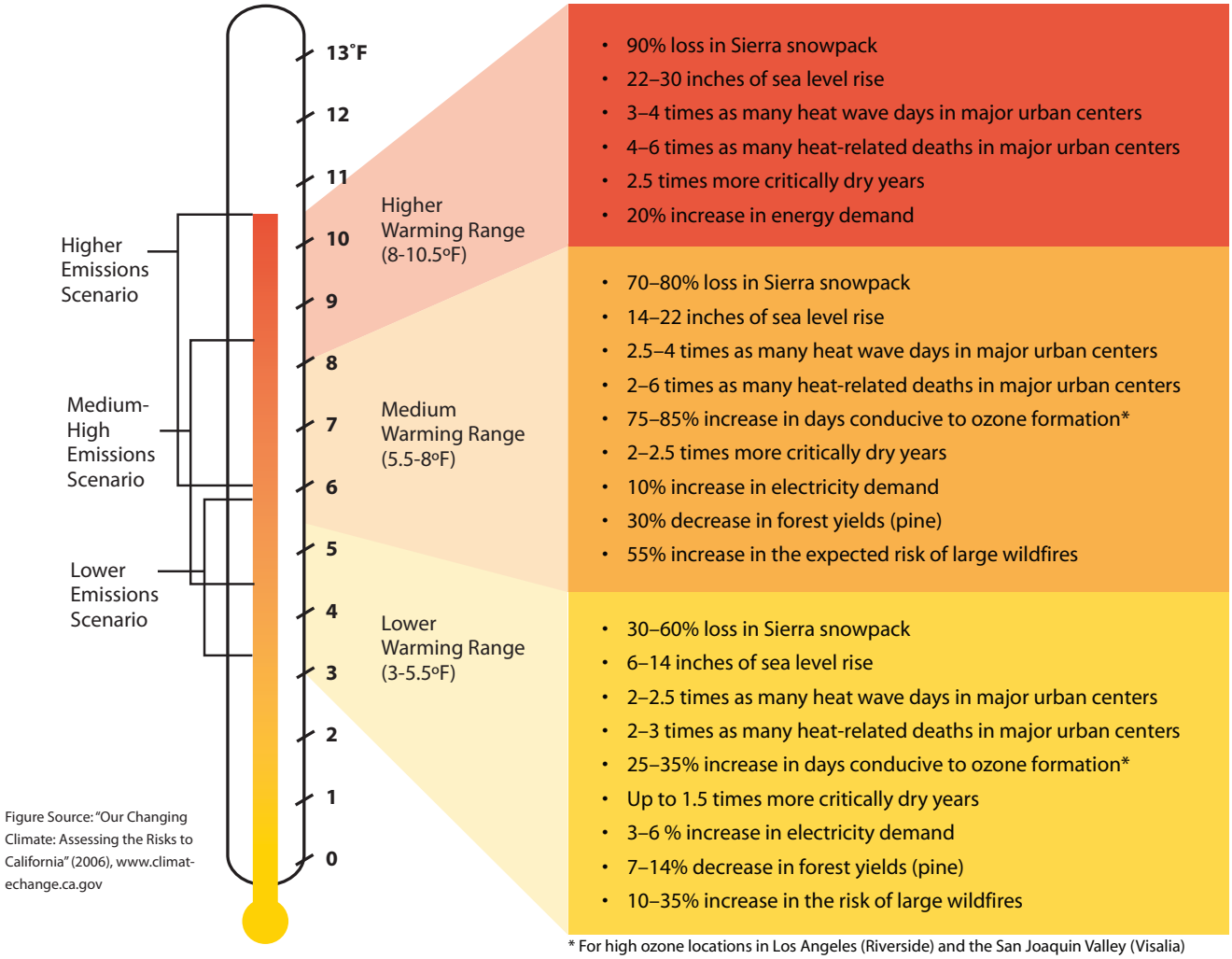


Figure Source: "Our Changing Climate: Assessing the Risks to California" (2006), www.climatechange.ca.gov

* For high ozone locations in Los Angeles (Riverside) and the San Joaquin Valley (Visalia)

Fish & Fishing

Potential hydrological changes associated with global climate change could influence the aquatic life in California, with particularly negative effects on cold-water fish. For example, according to the Department of Water Resources, if climate change raises air temperature by just a few degrees Celsius, water temperatures could rise above the tolerance of salmon and trout in many streams, and result in an environment favorable to non-native fish such as sunfish and carp. Rises in summer temperatures would be particularly problematic for many of the threatened and endangered fish that spend summers in cold-water streams, but could also threaten and endanger fish that are currently in plentiful supply.

Economic Impacts

The same impacts from climate change that threaten our physical environment also have economic implications. Industries that are directly dependent on natural systems, such as forestry, fishing, and agriculture, would be compromised by climate change if their product or product's habitat were impacted by environmental changes. Other businesses and economic sectors would be indirectly impacted by climate change through associated costs such as preparing for or responding to natural events such as flooding, extreme weather, challenges to water supplies, reduced hydro-electric power, increased food and lumber costs, and threats to public health.

Climate Change Regulations

In an effort to stabilize GHG emissions and reduce impacts associated with climate change, international agreements, as well as federal and state actions were implemented as early as 1988. The international, federal, state, regional, and local government agencies discussed below work jointly, as well as individually, to address GHG emissions through legislation, regulations, planning, policy-making, education, and a variety of programs.

International and Federal Climate Actions

International Climate Action - Kyoto Protocol

In 1994, the United States signed onto the United Nations Framework Convention on Climate Change (UNFCCC). The Kyoto Protocol, adopted in 1997 by 37 industrialized nations, is a treaty made under the UNFCCC, which sets binding targets for GHG reductions over a five-year period from 2008 to 2012 to meet a goal to reduce GHG emissions below 1990 levels. It was estimated that if the commitments outlined in the Kyoto Protocol are met, global GHG emissions would have been reduced by an estimated 7% from 1990 levels by 2012. However due to international failure to meet the Kyoto commitments, the rate of global GHG emissions increased during the target period. It should be noted that although the United States is a signatory to the Kyoto Protocol, Congress has not ratified the Protocol and the U.S. is not bound by the Protocol's commitments.

Federal Climate Action

In lieu of the Kyoto Protocol's mandatory framework, the United States has opted for a voluntary, incentive-based approach toward reducing its 25% of the world's global warming pollutants. The Climate Change Technology Program is a multi-agency research and development coordination effort which is charged with carrying out the President's National Climate Change Technology Initiative.

The United States Environmental Protection Agency (USEPA) is responsible for implementing federal policy to address global climate change. The Federal government administers a wide array of public-private partnerships to reduce GHG emissions. These voluntary programs focus on energy efficiency, renewable energy, methane and other non-CO2 gases, agricultural practices, and implementation of technologies to achieve GHG reductions.

In 2010, the USEPA issued a "Final Rule" using the Clean Air Act permitting process to address GHG emissions from stationary sources, such as fossil fuel and industrial gas suppliers, direct GHG emitters, and manufacturers of heavy-duty and off-road vehicles and engines. The Rule does not regulate the generation of GHG emissions, but instead requires mandatory monitoring and reporting of GHG emissions from sources that exceed a GHG emissions threshold of 75.000 MtCO2e per year.

California Climate Action

With the largest population in the United States and an economy that is larger than that of most countries, California produces about 1.4% of worldwide GHG emissions and 6.2% of U.S. GHG emissions (State of California, 2011). During the last decade, California emerged as the leading state taking actions to reduce GHG emissions. On the private side, alternative energy industries have flourished in California. On the public policy side, California has enacted unprecedented climate legislation. In addition to statewide legislation, a local grassroots action to address climate change has also taken hold in California. Of the 677 colleges and universities in the country that have signed onto the American Colleges and Universities Presidents' Climate Commitment (ACUPCC), 66 (or nearly 10%) are in California (ACUPCC, 2011).

Prior to action at the federal level, and ahead of any other state in the nation, California has enacted the following series of standards:

Executive Order S-3-05

In June 2005, Governor Arnold Schwarzenegger issued a landmark executive order establishing GHG reduction targets for the entire state:

- By 2010, reduce emissions to 2000 levels;
- By 2020, reduce emissions to 1990 levels;
- By 2050, reduce emissions to 80% below 1990 levels to reach a stable level.

Assembly Bill 32

To support these GHG-reduction targets, the California Legislature adopted the California Global Warming Solutions Act of 2006, also known as Assembly Bill 32. The law requires the California Air Resources Board (CARB) to develop regulatory and market mechanisms to reduce statewide GHG emissions to 1990 levels by 2020. Three new regulations are proposed as discrete preliminary GHG reduction measures, including:

- A low carbon fuel standard;
- Reduction of HFC-34a emissions from non-professional servicing of motor vehicle air conditioning systems;
- Improved landfill methane capture (CARB 2007).

CARB has estimated that statewide GHG emissions for the year 1990 were 427 million MtCO2e and for the period of 2002-2004 were 469 million MtCO2e. CARB also determined that in the absence of action to reduce or mitigate GHG emissions the state would emit 596 million MtCO2e by 2020. CARB's 2020 projection is known as a business as usual (BAU) projection. To achieve the AB 32 GHG emission reduction goal to reduce emissions to 1990 levels by 2020, the state of California would have to reduce 2020 BAU emissions by approximately 30%.

In December 2008, CARB adopted the Climate Change Scoping Plan, which outlines the State's strategy to achieve the AB 32 GHG reduction goal for 2020. This Scoping Plan proposes a cap-and-trade program and a comprehensive set of actions designed to reduce overall GHG emissions in California, improve the environment, reduce dependence on oil, diversify energy sources, save energy, create new jobs, and enhance public health. The Scoping Plan also identifies reducing emissions to 15% below "current" levels (which is defined as emissions generated during the years between2005 and 2008) as the equivalent of reaching the 1990 GHG emissions level.

The State's measures listed in the Scoping Plan will also have a local impact, helping Chico achieve its GHG emissions reduction goal. Where possible, those projected local emissions reductions from State actions have been accounted for in this Climate Action Plan.

Senate Bill 97

Enacted in 2007, this legislation amended the California Environmental Quality Act (CEQA) to establish that GHG emissions and their effects are appropriate subjects for CEQA analysis. SB 97 directed the California Office of Planning and Research (OPR) to draft State CEQA Guidelines "for the mitigation of GHG emissions or the effects of GHG emissions" and directed the Resources Agency to certify and adopt the State CEQA Guidelines.

Senate Bill 375

This bill, signed in 2008, links regional transportation plans with state GHG-reduction goals. Under SB 375, state agencies and local metropolitan planning organizations, such as the Butte County Association of Governments (BCAG), must develop Sustainable Community Strategies to reduce GHG emissions. The focus of the legislation is to reduce single passenger vehicle trips through smart growth and sustainable land use decisions.

Executive Order S-13-08

In November 2008, the governor instructed the California Natural Resources Agency (CNRA) to spearhead the creation of a climate adaptation strategy. The resulting 2009 Climate Adaptation Strategy, a cooperative effort among multiple state agencies, articulates how the state could respond to consequences of climate change, such as rising temperatures and sea levels, new rainfall patterns, and extreme weather events. In November 2010, the state released the First Year Progress Report to detail how the Adaptation Strategy was being implemented.

2010 California Green Building Standards Code CALGreen

California's Energy Efficiency Standards for Residential and Nonresidential Buildings (California Code of Regulations Title 24, Part 6) were first established in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated periodically to allow for consideration and incorporation of new energy efficiency technologies and methods. Energy efficient buildings require less electricity, which is often produced from fossil fuels resulting in GHG emissions, and the increased energy efficiency results in decreased GHG emissions.

In 2010, Title 24 was updated to include the "California Green Building Standards Code", referred to as CALGreen. CALGreen requires that new buildings reduce water consumption, increase system efficiencies, divert construction waste from landfills, and install low pollutant-emitting finish materials. CALGreen has approximately 52 nonresidential mandatory measures and an additional 130 optional provisions. This landmark code will significantly contribute to reducing GHG emissions, energy consumption, and water conservation throughout the state.

Chico Climate Action Efforts

Chico is the largest city in Butte County, with approximately 87,000 people living within the city limits and about 100,000 residing in the Chico urban area. Recognizing the impact of its GHG emissions on the northern portion of the Sacramento Valley, the City of Chico did not wait for state directives to address GHG emissions and climate change. Following are some of the early steps the city has undertaken on its own accord:

Mayor's Climate Protection Agreement

In 2006, the City signed the U.S. Conference of Mayors' Climate Protection Agreement (USCMCPA), adding Chico to a group of over 1,000 municipalities, 138 of which are in California, united in pledging to reduce greenhouse gas emissions.

Under the USCMCPA, Chico committed to take the following three actions:

1. Strive to meet or beat the Kyoto Protocol targets through actions such as anti-sprawl land-use policies, urban forest restoration projects, and public information campaigns.
2. Urge state and federal governments to enact policies and programs to meet or beat the GHG-emission reduction target suggested for the United States in the Kyoto Protocol.
3. Urge the U.S. Congress to pass bipartisan GHG reduction legislation which would establish a national emission-trading system.

Formation of Sustainability Task Force

Signing the Mayors' Climate Protection Agreement precipitated the creation of the Sustainability Task Force (STF) in 2007. Members of the STF represent various sectors of the community to provide input to the City Council on sustainability issues. One of the primary tasks of the STF is to assist the City in meeting the objectives of the Mayor's Agreement and to conduct preliminary steps to develop a Climate Action Plan (CAP).

In preparation for drafting the CAP, the STF formed the following Ad-Hoc Committees: Outreach & Education, Sustainable Business Outreach, Innovators' Pilot Outreach, Transportation Planning, and Climate Change Adaptation & Resiliency. The STF designated these Committees to focus resources on the development and implementation of specific components of the CAP, and to represent and promote these components throughout the community. These committees are comprised of STF members, city staff, representatives of institutions and utilities, and members of the general public.

City Measures that Address GHG Emissions by New Development

New development and redevelopment must adhere to a number of City policy documents, building code requirements, development standards, design guidelines, and standard practices that collectively further the goals and, in some cases, directly implement specific actions in the CAP. Below is a list of those measures which are applied on a project-by-project basis, and which aid in implementing the CAP:

- Consistency with key General Plan goals, policies, and actions that address sustainability, smart growth principles, multi-modal circulation improvements, and quality community design
- Compliance with California's Title 24 Building Energy Efficiency Standards for Residential and Non-Residential Buildings
- Compliance with the City's tree preservation ordinance
- Incorporation of street trees and landscaping consistent with the City's Municipal Code
- Consistency with the City's Design Guidelines Manual
- Consistency with the State's Water Efficient Landscape Ordinance (AB 1881)
- Compliance with the City's Residential Energy Conservation Ordinance, which requires energy and water efficiency upgrades at the point-of-sale, prior to transfer of ownership (e.g., attic insulation, programmable thermostats, water heater insulation, hot water pipe insulation, etc.)
- Provision of bicycle facilities and infrastructure as may be required by the City's Bicycle Master Plan
- Installation of bicycle and vehicle parking consistent with the City's Municipal Code
- Coordination with the Butte County Association of Governments to provide high quality transit service and infrastructure, where appropriate
- Consistency with the Butte County Air Quality Management District's CEQA Handbook
- Adherence to Butte County Air Quality Management District mitigation requirements for construction sites (e.g., dust suppression measures, reducing idling equipment, maintenance of equipment per manufacturer specs, etc.)
- Requirement for new employers of 100+ employees to submit a Transportation Demand Management Plan
- Diversion of fifty percent (50%) of construction waste
- Compliance with the City's Capital Improvement Plan, which identifies new multi-modal facilities and connections
- Option to incorporate solar arrays in parking areas in lieu of tree shading requirements
- Consistency with the City's Storm Drainage Master Plan

Adaptation Planning for the Chico Area

The State of California developed a plan for adapting to potential impacts of climate change entitled, "2009 California Climate Adaptation Strategy." The Plan summarizes the best known science on climate change impacts in the state and outlines possible solutions that can be implemented within and across state agencies to promote resiliency.

While it is important that the Chico community act quickly and boldly to reduce its contributions to GHG emissions, it is also necessary to simultaneously prepare for adaptation to regional changes that may result from climate change. Adaptation in this context means making long-term adjustments to maintain a level of community well-being, economic prosperity, and environmental quality in the face of changing circumstances. Effective adaptation will require local action that complements state initiatives, and early planning will significantly lessen the negative effects and costs of adaptation.

To plan for the potential impacts of climate change, the Sustainability Task Force's Adaptation and Resiliency Ad-Hoc Committee will develop a work plan consisting of three primary tasks:

1. Consider the range of potential impacts from climate change, and assess which will be the most prevalent in our local region.

2. Identify and engage key stakeholders, such as the local utilities and government agencies, within the City, Butte County, and the greater community in the process of addressing the impacts of climate change.

3. Develop a Climate Change Adaptation Plan for the Chico Area that outlines long-term strategies for mitigating anticipated local impacts of climate change. The Climate Change Adaptation Plan will be developed as a companion document to the Climate Action Plan.

CAP and CEQA

Creation of this CAP is called for by 2030 General Plan Goal SUS-6 (requiring reduction of citywide GHG emissions), and the implementation of this goal will rely on many other goals, policies, and actions throughout the General Plan.

The CAP does not change the level of development activity for Chico anticipated in the General Plan EIR. The actions in the CAP, in most cases, mirror adopted General Plan policies calling for energy efficiency, water conservation, waste minimization and diversion, reduction of vehicle miles traveled, and preservation of open space and sensitive habitat. As such, many of the potential effects of implementing the CAP were covered broadly by the General Plan EIR.

As discussed in the Climate Change Regulations section above, Senate Bill 97 established that GHG emissions and their effects are appropriate subjects for analysis under the California Environmental Quality Act (CEQA). One of the primary goals of the CAP, therefore, is to establish it as a qualified GHG emissions reduction plan for which future projects within the City can tier off of, thereby streamlining the environmental analysis necessary for CEQA.

SB 226, adopted in 2011, states that a project's greenhouse gas emissions shall not, in and of themselves, be deemed to cause an exemption to be inapplicable if the project complies with all applicable regulations or requirements adopted to implement statewide, regional, or local plans consistent with Section 15183.5(b)(1)A-G of Title 14 of the California Code of Regulations. This section of the Regulations was amended in March 2010 to state that a GHG Reduction Plan, or Climate Action Plan, may be used for tiering and streamlining the analysis of GHG emissions in subsequent CEQA project evaluation provided that the CAP does the following:

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

   The GHG Inventory, which was the basis for the CAP, fulfills this requirement.

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

C. The CAP establishes this level with its emissions reduction target of 25% below 2005 levels, which supports the AB 32 reduction target.

D. Identifies and analyzes the GHG emissions resulting from specific actions or categories of actions anticipated within the geographic area.

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

F. Establishes a mechanism to monitor the plan's progress toward meeting its GHG reduction goal.

G. Lastly, the CAP must be adopted in a public process following environmental review. Chico's CAP will be adopted in a public process following compliance with CEQA.

A GHG reduction plan, such as the CAP, which meets the above criteria may be used in the environmental impact analysis for individual projects and may be the basis for a determination that a project's incremental contribution to the cumulative effect of GHG emissions is not significant if the project complies with the requirements of the CAP. The environmental documents for later projects that rely on a cumulative analysis of a GHG reduction plan must identify those requirements specified in the CAP that apply to the project and, if they are not otherwise binding and enforceable, must incorporate them as mitigation measures. An Environmental Impact Report (EIR) may still be required for a project even though it does comply with the CAP if there is substantial evidence that the particular project may have cumulatively significant impacts (14CCR 15183.5).

GHG Emissions: Inventory, Future Projection, and Reduction Target

GHG Emissions Inventory

In 2008, the City of Chico, with the assistance of the California State University Chico Research Foundation, completed an inventory of the GHG emissions generated by both the City as an organization and the Chico community (GHG Inventory). The International Council for Local Environmental Initiatives (ICLEI) provides a five-milestone framework for reducing GHG emissions and addressing climate change (**Figure 1.2**) that served as a model for development of the GHG Inventory and the CAP.

The data collection and analysis for the GHG Inventory was conducted using ICLEI's Clean Air and Climate Protection, Version 1 (CACP) software and methodology. The CACP software allowed tracking and quantification of GHG emissions generated from electricity and natural gas consumption, vehicle miles traveled, and solid waste tonnages from both the City of Chico and the community during one year. The inventory measured emissions generated in the year 2005, making it the baseline year from which to measure emissions reductions. The inventory additionally allows the City to track and compare emissions with other California cities that use the same baseline year, as many do.

The GHG Inventory identified the 2005 baseline emissions level as **514,332 MtCO2e** and highlighted which sectors generated the greatest GHG emissions. As shown in **Figure 1.3** the inventory found 64.7% of the emissions came from the transportation sector, 16.4% from commercial energy consumption, 15.0% from residential energy consumption, 3.9% from solid waste sent to the landfill, and 0.8% from industrial energy consumption. A copy of the inventory is in **Appendix A**.

Future Emissions/"Business as Usual" Projection for 2020

The GHG inventory also projected emissions levels for the year 2020 in the five sectors of the Inventory: solid waste, transportation, and residential, commercial, and industrial energy use. Since this projection assumed that all emissions-producing activities would continue at their 2005 rates with no actions taken to reduce emissions, it is called the Business as Usual (BAU) emissions scenario.

The growth rates used in the BAU scenario were derived from multiple-year data measuring annual increases in population, residential and commercial growth, waste tonnage, and use of gasoline, diesel, natural gas, and electricity. The combined average growth rates for the five sectors was just over 2% per year, which is consistent with the historical trend of approximately 2% annual population growth for Chico. As shown in **Figure 1.4** below, the BAU scenario projects that emissions from the Chico area will increase beyond the baseline to **695,504 MtCO2e** for the year 2020 if no reductions are made to emissions rates. (For further details on the BAU scenario, see **Appendix B**.)

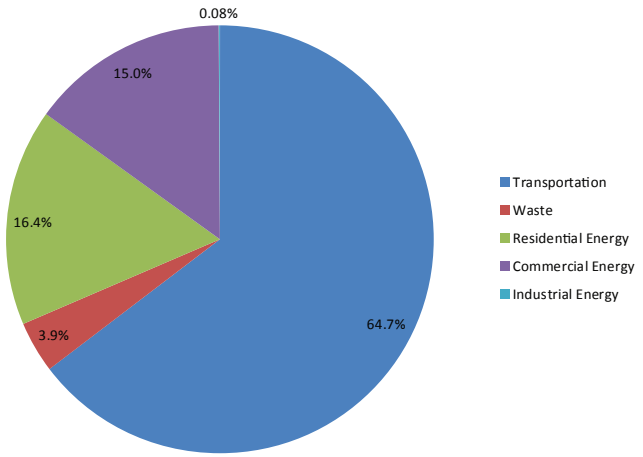
Emissions Reduction Target

Although AB 32 does not does not require that municipalities reduce current GHG emissions by 15%, the Scoping Plan sees local governments as "essential partners" in achieving this target. For the purposes of establishing a GHG emissions reduction target to meet the AB 32 requirements, the City is considering "current" emissions as the GHG emissions level identified in the inventory base year of 2005.

In 2008, the City Council established an overall GHG-reduction goal of 25% below 2005 base-year emissions levels to be achieved by December 2020. This target level is roughly equivalent to the Kyoto Protocol goal, and exceeds the 15% reduction goal of AB 32. Using the GHG inventory, this target emissions level was calculated to be **385,749 MtCO2e** generated in the year 2020. The BAU scenario described above shows that achieving the GHG emission reductions target of a 25% reduction from 2005 levels equates to a 44.5% reduction from the BAU scenario projected emissions for 2020.

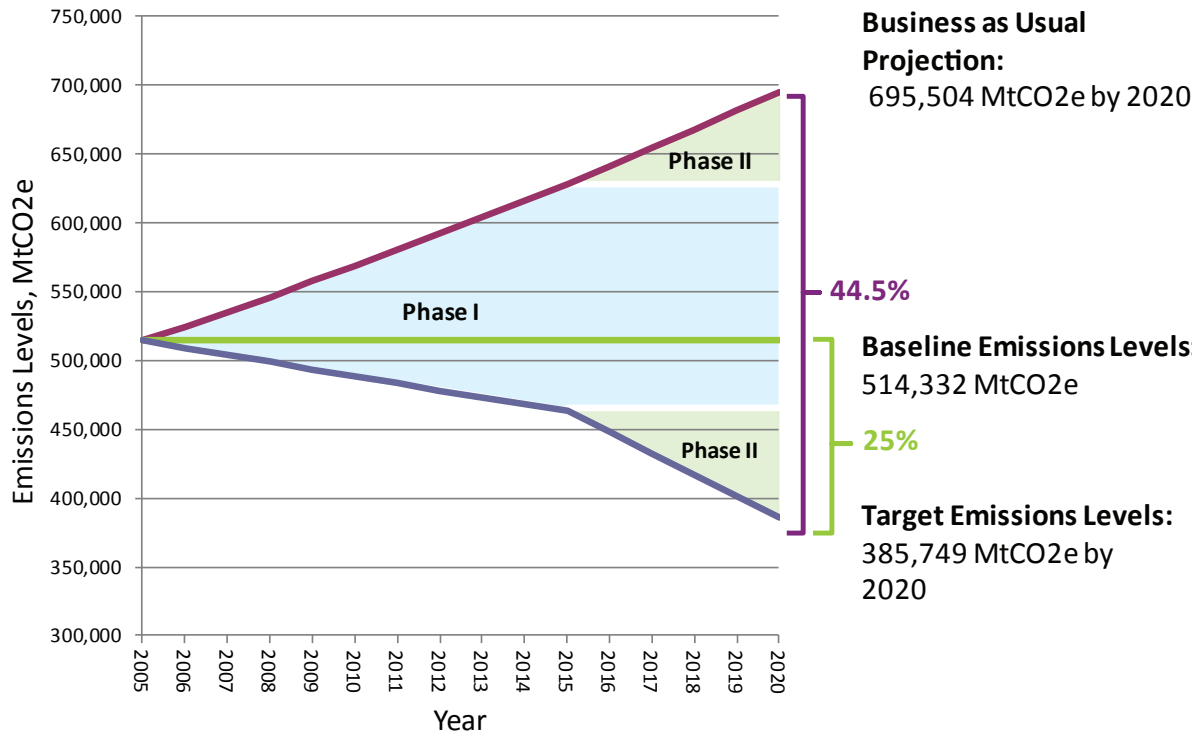
Baseline Emissions Inventory Breakdown by Sector

Figure 1.4



Business as Usual Projections

Figure 1.5



Chapter Two
Climate Action Goals

The ultimate goal of the Climate Action Plan (CAP) is to reduce emissions for the year 2020 to 385,749 MtCO2e, 25% below the base year (2005) levels.

The Plan is divided into two implementation phases, and specific emissions reduction targets have been established for both phases. Supporting these reductions targets are a range of sector goals for the five sectors identified in the GHG inventory: transportation, solid waste, and residential, commercial, and industrial energy use. Reductions are anticipated from actions taken locally and externally at the regional, state, federal, and international levels.

The focus of the first phase will be implementing broad community outreach measures, building public support for the Plan, and capitalizing on the most cost effective opportunities to reduce emissions. The actions begun during Phase I will continue to reduce emissions during Phase II.

Climate Action Plan Timeline & Targets

The CAP will be implemented in two phases, Phase I through 2015 and Phase II for the remaining five years to 2020.

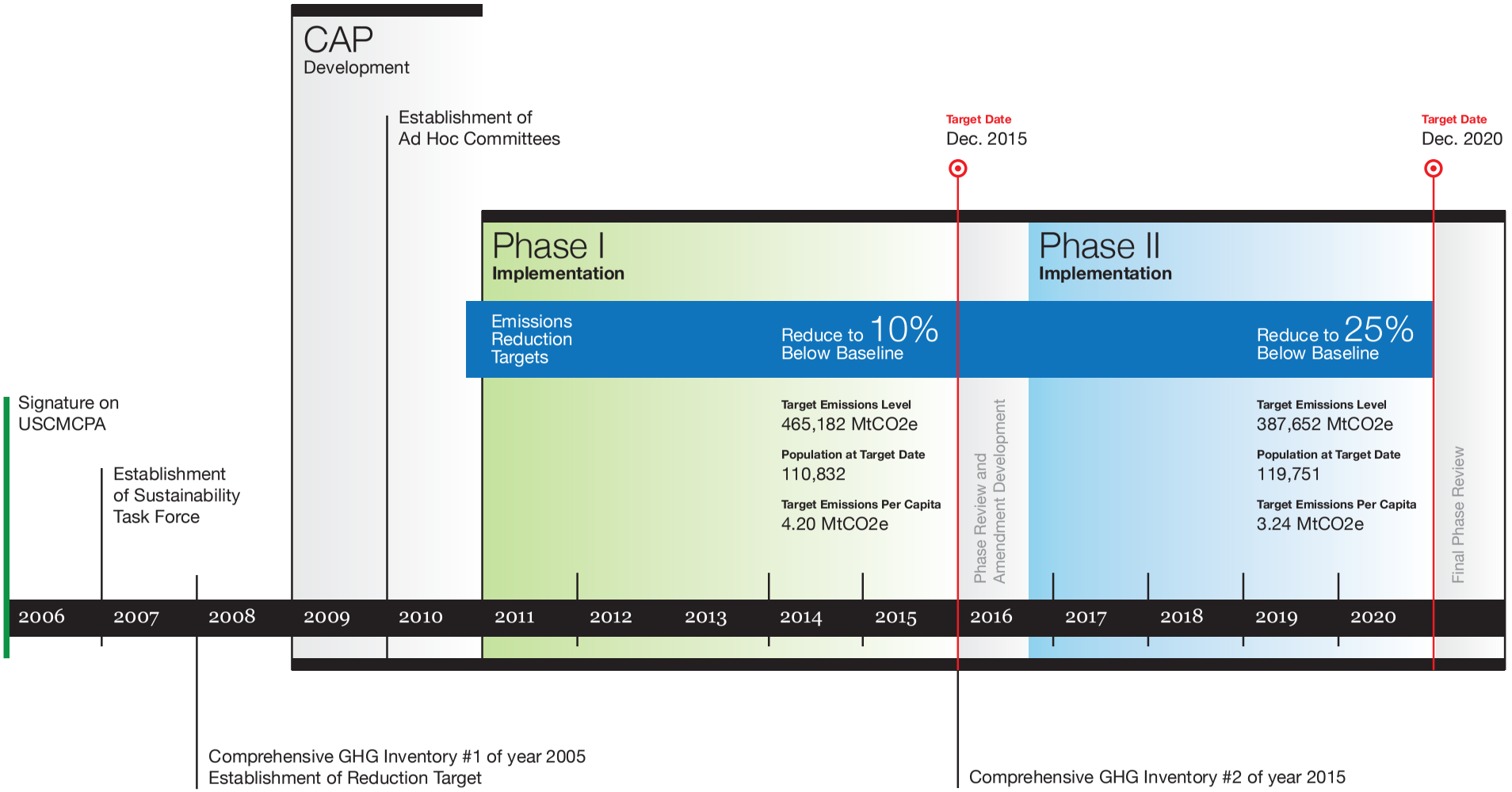
After Phase I, the CAP will be reviewed and amended to respond to changing technology, policies, and updated GHG emissions measurements in a subsequent GHG inventory. The target for Phase I is to reduce emissions by 10% below the 2005 base year level, or an emissions for the year 2015 that are 165,820 MtCO2e below those projected for 2015 in the BAU scenario.

The CAP schedule includes a review period between the two phases to evaluate the success of Phase I in achieving GHG emissions reductions. At that time, the CAP will likely be amended to revise Phase I actions and outline additional actions for Phase II (See **Chapter 4**).

Phase II will begin in 2016 and end in 2020. The target for Phase II is to further reduce emissions, ultimately achieving the overall CAP goal of 2020 emissions being 25% below the 2005 base year levels. The focus in the second phase will be building on successful Phase I actions, expanding community support for the Plan, and implementing additional Phase II actions. **Figure 2.1** depicts the timeline and the emission reduction targets for the two phases of the CAP.

Climate Action Plan Timeline

Figure 2.1



Sector Goals

Five emissions sectors were identified in the GHG Inventory: solid waste, transportation, and residential, commercial, and industrial energy use.

Each of the sectors has a considerably different contribution to overall emissions levels. Each emissions sector also has significantly different circumstances and opportunities for emissions reductions. Accordingly, the CAP establishes a goal for each of the five emissions sectors, which in combination will achieve the overall 2020 emissions reduction goal, as shown in **Table 2.1**. These goals were established by considering the potential emissions-reducing actions for each sector and the perceived ability of the City and the community to adjust related behaviors.

The percentage that each sector will contribute to emissions reductions to meet the 2020 goal is shown in the pie chart in **Figure 2.2**. Clearly, reductions in the transportation sector are critical for meeting the goal, and many of the actions are focused on reducing transportation-related emissions.

Business as Usual (BAU) projected emissions levels for each sector account for growth through 2020 and assume no reductions are made. BAU, therefore, acts as a reasonable benchmark against which emission reductions can be measured. Since the CAP identifies new actions that will reduce emissions, the sector goals are stated as a percentage of the BAU projected emissions for each sector. **Table 2.2** below, shows each sector goal as a percentage of the BAU emissions projected for 2020.

Emissions Comparison

Table 2.1

	Metric Tons of CO2e			
Sector	2005	BAU 2020	2020 Goal	Total Reduction
Energy	161,743	201,584	54,393	147,191
Transportation	332,602	468,485	318,401	150,084
Solid Waste	19,987	25,435	14,174	11,261
Community Outreach	N/A	N/A	N/A	1,219
Total	**514,332**	**695,504**	**386,968**	**309,755**

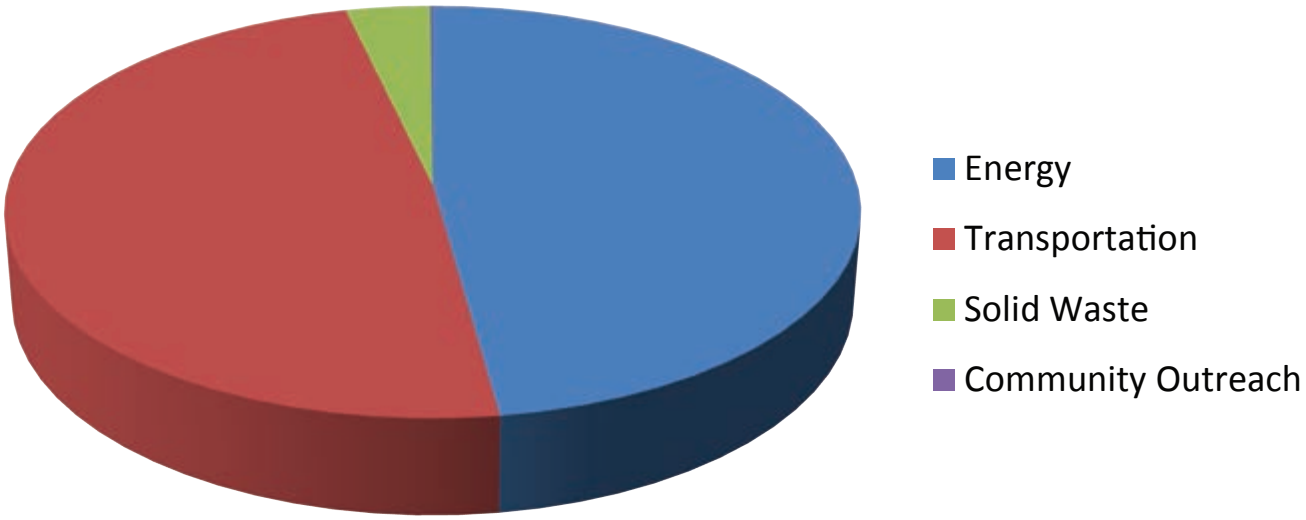
Sector Goals as Percentage (%) of Projected 2020 BAU Emissions

Table 2.2

	Target 2020 Emissions	
Sector	MtCO2e	% below BAU
Energy,	54,393	63
Transportation	318,401	32
Solid Waste	14,174	44
Total	**386,968**	

Sector Contribution to Overall Emissions Reduction

Figure 2.2



Local and External Emissions Reductions

The sector goals are 2020 target emissions levels set for each sector, and it is anticipated that these sector goals will be achieved through a combination of local actions and actions taken externally at the regional, state, federal, and international levels (external actions). For example, state and federal mandates for increased vehicle efficiency would represent an external action, while expanding bike lanes on City streets and increased use of bikes for local transportation would represent a local action. The local actions outlined in Chapters 3 and 4 include actions to be taken by the Chico community and the City. **Table 2.3** lists reduction targets, by sector, for local and for external actions.

2020 CAP Sector Goals

Table 2.3

	Reductions		
Sector	**Local Reductions (MtCO2e)**	**External Reductions (MtCO2e)**	**% of Reduction Target**
Energy	72,910	74,281	47.8%
Transportation	74,778	75,306	48.5%
Solid Waste	11,261	N/A	3.6%
Community Outreach	1,219	N/A	0.1%
Subtotal	**160,168**	**149,587**	**100%**
Total	**309,755**		

External Actions

The estimated emissions reductions from external actions for each sector are listed in **Table 2.3** (previous page). The estimates were prepared using information from the California Air Resources Board AB 32 Scoping Plan and from Pacific Gas & Electric staff.

An example of an external action is the expansion of the renewable (non-GHG-emitting) components in PG&E's grid mix, also known as the Renewable Portfolio Standard. As more renewable energy is used in the grid mix, fewer emissions will result from each unit of energy consumed. During Phase I, PG&E's expanded use of renewable energy is expected to be the greatest source of emissions reduction from external actions. As of January 2010, PG&E had already doubled the amount of energy it generates from renewable sources since the 2005 base year.

As discussed earlier, the AB32 Scoping Plan was also used in estimating reductions from external actions. The Scoping Plan sets specific targets and actions for reducing statewide GHG emissions from the burning of fossil fuels in both power plants and vehicles, and by setting state energy efficiency and renewable energy requirements. Although the Scoping Plan contains many measures that will directly or indirectly reduce emissions generated within the Chico area, only the actions that most directly impact the Chico area and have the potential to reduce emissions from activities that were measured in the baseline GHG Inventory were included in this CAP. Descriptions of the external actions chosen for inclusion in the CAP are described in the boxes on this page and discussed in **Chapters 3 and 4**.

Renewable Portfolio Standard (RPS)
Established in 2002 by Senate Bill 1078, the State of California Renewable Portfolio Standard (RPS) is one of the most ambitious renewable energy standards in the country, requiring electricity providers to increase the portion of energy from renewable sources to 20% by 2010 and by 33% by 2020. The California RPS is estimated to reduce statewide GHG emissions by approximately 12 million MtCO2e by 2020.

Assembly Bill 1493 (Pavley) I and II
Assembly Bill 1493, signed into law in 2002, required the Air Resources Board to adopt regulations that require carmakers to reduce GHG emissions from 2009 and later models of new passenger cars and light-duty trucks by 30% below 2002 levels by the year 2016. It is expected that the Pavley regulations will reduce GHG emissions from California passenger vehicles by about 22% in 2012 and about 30% in 2016. This measure is estimated to reduce statewide GHG emissions by 26.1 million

Low-Carbon Fuel Standard
The Low Carbon Fuel Standard (LCFS) is a flexible performance standard designed to accelerate the availability and diversity of low-carbon fuels by requiring fuels that contain less carbon with consideration of their full life-cycle. As part of the AB 32 Scoping Plan, the LCFS is estimated to reduce GHG emissions by 15.8 million MtCO2e by 2020.

Chapter Three: Phase I

Phase I of the Climate Action Plan considers the emissions-reducing actions taken since the greenhouse gas (GHG) inventory 2005 baseline year, and it includes additional actions to be undertaken by the City and throughout the community before 2015.

Achieving the City's GHG reduction target will require considerable changes within the community over the next decade. Chico will need to reduce both energy and water use, reduce waste, and improve the appeal of alternative transportation modes. To ensure this transformation occurs, the CAP contains actions that are ambitious, yet attainable. A list of potential actions was developed by:

1. Evaluating existing community conditions.
2. Identifying GHG reduction opportunities within the City, including those identified by the City's Sustainability Task Force.
3. Considering suggestions from the local community.
4. Reviewing policy direction in the Chico 2030 General Plan.
5. Reviewing best practices from leading cities and organizations.
6. Incorporating State and regional laws, guidelines, and recommendations.

Many of the potential actions were evaluated for their cost-effectiveness in terms of real costs and potential for reducing GHG emissions, and those actions deemed infeasible or cost-prohibitive were removed from the list. Beyond cost effectiveness, Phase I actions were also included for being particularly applicable to local circumstances, already being implemented or easy to implement, and due to special circumstances surrounding an action, such as projects that are "shovel-ready" or where funding opportunities presented themselves. This chapter presents the Phase I actions and then explains the cost-benefit analysis that informed selection of the actions.

The goal for Phase I of the CAP is to reduce the GHG emissions generated in the Chico area to 10% below 2005 baseline levels by 2015, which means offsetting annual emissions below the business as usual (BAU) projection for 2015 by **165,820 MtCO2e**. The City of Chico and other members of the community are already undertaking significant efforts to reduce GHG emissions. These actions range from transforming fleets to run on renewable fuels to promoting walking and bicycling to installing solar panels throughout the community. With leadership from the Sustainability Task Force, the City has worked closely with local utility companies, the county, state agencies, and local businesses to identify a range of actions for implementation in Phase I.

Phase I Actions

Phase I of the CAP contains a total of 55 actions. The City recognizes that several factors, including technology maturity and implementation challenges, may cause actual reductions from individual actions to be higher or lower than estimated. The inclusion of many different actions in the CAP will help ensure that the 2020 target is achieved.

Quantified Actions and Non-quantified Actions

The CAP estimates the GHG emissions reduction potential for 40 of the Phase I actions, known as "quantified actions". Documentation of how the GHG emission reduction estimates for the Phase I quantified actions were calculated is provided in **Appendix D** and the emissions factors used in the calculations are in **Appendix C**. The remaining "non-quantified actions" will also contribute to reaching the overall CAP reduction target, but their emissions reduction potential was not estimated for various reasons. Generally, either their GHG reduction potential could not be estimated at the time of Plan preparation or the action would reduce emissions for activities that were not measured by the baseline GHG Inventory. For those that could not be estimated for the CAP release, the omission was due to either: 1) insufficient data, such as unknown quantities of the units of measurements, to quantify GHG reduction potential, or 2) no reliable quantification methodology at present time to calculate these reductions. The City's high standard for quantification methodologies may have resulted in the exclusion of some emissions reductions, but the standard reflects the City's desire to not over estimate the reduction potential of the CAP actions. In the future, if reliable data or quantification methods are available, the City will include the reduction estimates.

As mentioned above, the emissions reduction potential of certain actions was also not quantified because those activities were not measured in the baseline GHG Inventory. These reductions, therefore, are not counted toward meeting the City's 2020 emissions reduction target, but remain in the CAP in recognition of their overall contribution to reducing GHG emissions and climate change.

As indicated in Chapter 2, the City also identified and estimated the potential GHG emission reductions that may be achieved within the Chico area as a result of the implementation of the AB32 Scoping Plan. The following actions were quantified and accounted for in this CAP because they most directly impact the Chico area, and have the potential to reduce emissions from activities that were measured in the baseline GHG Inventory:

1. Manufacture of more efficient vehicles (Pavley I and II and)
2. 33% renewable energy portfolio requirement for utilities by 2020 (RPS)
3. Low Carbon Fuel Standard

These external actions are estimated to reduce **84,874 MtCO2e** from the Business as Usual emissions scenario by the end of Phase I with additional reductions expected during Phase II (see **Appendix F**. for more details on how these actions were quantified).

Detailed Cost-Benefit Analysis of City-Implemented Actions

The City conducted an in-depth cost-benefit analysis on most of the actions to be implemented by the City in Phase I, taking into account the exact costs and circumstances surrounding those actions. The results, further explained and summarized in **Appendix E**, show a net present value (costs and savings over the action lifetime, in current dollars) of over $4 million in savings. As an example, the City's installation of LED streetlights is estimated to result in an annual savings of $73,796 to the City, and would represents a net savings of over $593,000 over the LED project 25-year lifetime.

Tables 3.1 thru **3.5** throughout this chapter list and summarize the Phase I actions that will be taken by the City and members of the community (local actions), or by other government agencies (external actions) in each sector: Transportation, Energy, and Solid Waste. The total estimated GHG emissions reduction from the all of the Phase I actions, by sector, by implementer and collectively, is shown in **Table 3.1** below.

Summary of Phase I Emissions Reductions

Table 3.1

	Total Identified Phase I Estimated Emissions Reductions (MtCO2e)		
SECTOR	City of Chico	Greater Community	Total
TRANSPORTATION ACTIONS	384	22,286	22,670
ENERGY ACTIONS	2,391	52,780	55,171
SOLID WASTE ACTIONS	63	203	266
COMMUNITY OUTREACH		542	542
TOTAL LOCAL ACTION REDUCTIONS:	2,838	75,811	78,649
TOTAL EXTERNAL ACTIONS REDUCTIONS:	84,874		84,874
		TOTAL ESTIMATED PHASE I REDUCTIONS:	**163,523**
		PHASE I TARGET REDUCTION GOAL:	**165,820**

Transportation Sector Actions

The baseline GHG Inventory identified transportation as the largest source of locally generated greenhouse gas emissions. It is also one of the most difficult sources of emissions to reduce because it can involve the installation of costly infrastructure as well as require a change in long established auto-related habits. If parking remains abundant and traffic is not congested, vehicle travel will continue to be a convenient option. Achieving the 2020 reduction target will, therefore, require significant changes to the transportation system in and around Chico. To reduce emissions in the transportation sector, changes need to occur in three areas: reducing vehicle miles traveled, improving vehicle efficiencies, and increasing the use of lower emission fuels. Phase I of the Climate Action Plan includes actions to capitalize on improvements in vehicle efficiency and public transportation, the use of alternative fuels, and strategies to decrease the amount of vehicle miles traveled.

Transportation Objective 1: Reduce Vehicle Miles Traveled

1.1 Car Share Programs: Car sharing programs like "Zip Car" allow participants to reserve vehicles online for a low hourly rate. Although users are still using vehicles, it has been found that car sharing can impact the travel behavior of its members. Once members give up their personal cars, the car is no longer the default mode of travel and is therefore used less than a personally owned vehicle. Additionally, car share vehicles are often newer, more efficient models or hybrid vehicles. In 2009, CSU, Chico implemented the "Zip Car" program in which five fuel efficient cars are available to students, faculty and staff 24 hours a day, seven days a week. It is estimated that **1,856 MtCO2e** of GHG emissions will be reduced from this effort by 2015.

1.2 Optimization of City Fleet: In 2009, the City underwent a fleet optimization effort in which the City analyzed its fleet needs and removed unnecessary vehicles and equipment from its inventory. The City also revised its vehicle use policy to reduce the amount of take-home vehicles by City staff. Vehicles driven home are now limited to only those living within the Chico area and are only allowed upon approval of the City Manager on an annual basis. The number of take-home vehicles was reduced from over 35 vehicles down to approximately 12. The City's new take home vehicle policy and its other fleet optimization efforts has resulted in an annual fuel savings of 32,731 gallons, which is estimated to reduce GHG emissions by **308 MtCO2e** per year.

1.3 Subsidize Employee Bus Ridership: The City and Butte County Association of Governments (BCAG), who administers the Butte Regional Transit System (B-Line), established a program to subsidize transit passes for employers and employees who work or live within the Central Business District of Chico. Bus passes are also provided to City of Chico employees and CSU, Chico staff and students. This action will continue this practice and will expand public education and promotion efforts to increase the use of the program by more downtown employers, employees, and students. An estimated **4,308 MtCO2e** of GHG emissions will be reduced from this Phase I action.

1.4 Flexible Work Schedules: In 2008, the City of Chico instituted a 9-80 flexible work schedule in which employees may choose to work nine 9-hour days with one day off over a two-week work period. This one day less of commuting by the current employees on a flex schedule results in an estimated GHG emissions reduction of **23 MtCO2e** annually. This action will also include encouraging other Chico employers to consider establishing flex schedules within the work place.

1.5 City Travel Demand Management Plan: Develop and implement a Travel Demand Management Plan that provides incentives for City employees to commute in modes other than single-occupant vehicles. An estimate of the GHG emissions that would be reduced by this action was not quantified because it is unknown at this time how many employees will participate (CIRC-9.1.1).

1.6 Carpooling Program: A core component of this action will be to consider developing or subscribing to a web-based carpooling website, such as "RideShare" or "Zimride", where people with similar commutes can find each other and create effective car pools. In addition to the ZipCar program, CSU, Chico also participates in the Zimride carpool program. The City will work with BCAG and other relevant agencies to further facilitate ridesharing in the community. Additionally, the City will pursue options to provide shade, weather protection, seating, lighting, and bike racks at carpool pick up areas to facilitate resident participation in casual carpools. The City will also explore the need for additional ride share stations. It is estimated that **288 MtCO2e** of GHG emissions will be reduced from this action.

1.7 Employer Vehicle Trip Reduction Programs: Through education and outreach, encourage existing employers to provide transit subsidies, bicycle facilities, alternative work schedules, ridesharing, telecommuting and work-at-home programs, and preferential parking for carpools/vanpools to reduce vehicle miles traveled. Also, consistent with the General Plan, require new non-residential projects that employ more than 100 people to submit a Travel Demand Management Plan that identifies strategies, including, but not limited to transit subsidies, bicycle facilities, alternative work schedules, ridesharing, telecommuting and work-at-home programs, to reduce single-occupancy vehicle trips. The estimated GHG emissions reduction for this action was not quantified because this is primarily an educational campaign and it is unknown at this time how many employers and employees may participate in a trip reduction program (CIRC-9.1.2, CIRC-9.1.3) .

1.8 Expanded and Improved Bus Service: In 2009/10, the Butte County Association of Governments conducted a Market Based Transit Study of the Butte Regional Transit System (B-Line) to determine user needs and to improve transit productivity. Based on the study's recommendations, regional and Chico routes were adjusted to improve on-time performance and to establish an express bus route providing service to Chico from the south end of the town, through the major points of destination every 15 minutes. Changes in hours of route operations, and identification of additional transfer locations were also achieved. Comparing ridership in a calendar month before and after the improvements (November 2009 to November 2011) reveals that

B-Line ridership in Chico has increased approximately 9% and that the increasing ridership trend is continuing. It was estimated that this increase bus ridership decreased annual GHG emissions by **4,846 MtCO2e**.

1.9 Regional Transportation Planning: SB375 requires Metropolitan Planning Organizations like Butte County Association of Governments (BCAG) to create a Sustainable Communities Strategy (SCS) in their regional transportation plans to reduce greenhouse gas emissions from passenger vehicle trips. The SCS aims to more closely coordinate land use and transportation planning and includes strategies to reduce vehicle miles traveled and therefore greenhouse gas emissions. The City and the Transportation Ad-Hoc Committee of the Sustainability Task Force will work with local and regional planning organizations, such as BCAG, to develop and implement long-term community transportation strategies.

Although SB 375 is expected to reduce vehicle miles traveled (VMT) and transportation-related emissions, this action is not separately quantified due to the overlap with the current transportation, land use, and transit-oriented development actions already included in the CAP. For instance, Chico's recently adopted 2030 General Plan directs infill, mixed-use, and compact urban development, promotes thoughtful urban design, and details multimodal circulation enhancements community-wide, making it a critical component of BCAG's SCS.

1.10 Sustainable Policy and Regulatory Framework: As mentioned in Chapter 1, the 2030 General Plan, adopted in April 2011, reinforces the City's compact urban form. Future development projects must be consistent with the General Plan, which guides infill and mixed-use development to areas contiguous to existing development, so it may be efficiently served by the extension of infrastructure and municipal services. The Plan further emphasizes a balanced, multimodal circulation system that is efficient and safe, connecting neighborhoods to jobs, shopping, schools, services, local attractions, and open space. Implementation of the 2030 General Plan policy framework, and the supporting comprehensive update of development standards in the City's Municipal Code, will result in increased densities and thoughtful mixed-use layouts that support the use of alternate modes of transportation, and therefore reduced VMT and GHG emissions.

As part of the General Plan EIR, a 4Ds (density, diversity, design, destination) analysis was performed comparing buildout of the 2030 General Plan Land Use Diagram to buildout of the 1994 General Plan Land Use Diagram (business as usual). The analysis showed that the 1994 General Plan Alternative had a VMT per household of 64 miles, while the 2030 General Plan Land Use Alternative had a VMT per household of 56 miles (11 percent reduction). The analysis concluded that this significant reduction is due to the 2030 General Plan Land Use Alternative being considerably denser, more diverse, having better pedestrian design, and having better access to regional destinations when compared to the 1994 General Plan. This action, which includes the following sub-actions, is estimated to reduce GHG emissions by **7,754 MtCO2e** by 2015.

1.10.1 Tiered City Fee Structure: The City will update and adopt a tiered development fee program that varies fees by development type and location in recognition of the different impacts that various types of development have on City services, infrastructure costs and efforts to reduce GHG emissions. This will be another incentive for infill development for which GHG emissions reductions were quantified elsewhere. (LU-4.1.2)

1.10.2 Pedestrian Connections for New Development: The City will amend the Municipal Code to require new subdivisions and large-scale developments to include safe pedestrian walkways that provide direct links between streets and major adjacent destinations such as transit stops, schools, parks, shopping centers, and jobs.

1.11 Expand and Enhance Bicycling and Pedestrian Infrastructure: Bike racks are essential to encourage bicycle ridership for commuting and daily shopping and errands. The City will identify commercial and public areas that lack appropriate levels of bicycle parking and install the needed facilities, as funding is available. The City also requires the provision of adequate bicycle parking for tenants, employees, and customers in new residential and non-residential development. To avoid double counting of GHG emissions reductions, the GHG reductions that may be attributed to this action is included in Action 1.10- "Sustainable Policy and Regulatory Framework" above .

1.12 "Complete Streets" Policy: As indicated in the 2030 General Plan, the City has a "complete streets" policy to facilitate all modes of travel (public transit, cars, bicyclists, pedestrians) as safely as possible on new, and as funding allows on existing streets. This action will help improve pedestrian infrastructure, such as ensuring that sidewalks are continuous and complete, and improving the Americans with Disabilities Act (ADA) access at intersections (CIRC-2.1.1). The GHG emissions reductions that could be attributed to this action are included in Action 1.10 above.

1.13 Corridor Management Measures & Traffic Calming: The City has an ongoing program of modifying major road corridors to enhance traffic flow and to reduce congestion and vehicle idling. Modifications include, but are not limited to, synchronization and optimization of signal timing, multi-modal roadway enhancements, intersection capacity improvements, and roundabouts. Since the 2005 base year, the following corridors have been enhanced:

- East Avenue/Manzanita/Bruce Road from Nord Avenue to SR 32,
- W. 8th Avenue between Nord and Esplanade,
- E. 5th Avenue between Esplanade and SR 99,
- Mangrove Avenue between SR 99 to E. 1st Ave,
- E. 1st Avenue between Esplanade and Downing Avenue.

As a result of the flow management enhancements, City Engineering staff estimates a reduction in vehicle emissions along these corridors of between 10 and 20 percent. In addition, the City continues to implement traffic calming measures such as landscape medians and street corner bulbouts to improve pedestrian safety and to reduce greenhouse gas emissions by lowering traffic speeds and improving the pedestrian and bicycle environment. Where practical and cost-effective, the City will continue to implement traffic calming and corridor flow management measures, such as evaluating the use of stop signs where not necessary for safety, along existing roadways and in new development. The GHG emissions reductions for this action has not been quantified as it relates to other transportation related actions.

Hwy 99 Corridor Bikeway Project

The City's award-winning Hwy 99 Bikeway Project consists of a 7-mile long contiguous bike path generally paralleling State Route 99. The project is being developed in two phases. Phase I was completed in 2011, and Phase II should be finished within three years. The bikeway commences at Eaton Road and traverses south to Southgate Avenue across a combination of Class I and Class II/III facilities, as well as bike bridges over creeks.

1.14 New Bike Paths: As funding allows and where feasible, the City will continue to enhance the existing network of bike paths, and require new bike paths as part of conditions for new development. Examples of new bike path opportunities are the recently constructed Hwy 99 Corridor Bikeway Project and the proposed 1st Street/2nd Street Couplet project (see side bars). The construction of these two projects alone is estimated to reduce GHG emissions by **1,455 MtCO2e** annually.

This action also includes the City updating its Bike Master Plan to include connections, crossings, and standards to support the new General Plan Land Use Diagram, enhance bicycle and pedestrian circulation community-wide, support safe routes to schools, and reduce reliance on the automobile

1.15 Pursue A Solid Waste Franchise System: Currently, the City has a solid waste permit system in which two waste haulers are allowed to provide waste service, curbside recycling, and yard waste recycling to Chico residents and businesses. Because the customer has a choice between either of these two haulers, six heavy diesel-powered solid waste vehicles can potentially traverse any given street in Chico every week. This action proposes to reduce vehicle miles traveled by establishing waste zones for residential collection services in which each hauler will be assigned a given area to serve, resulting in an estimated **683 MtCO2e** of GHG emissions reduced each year.

1.16 Safe Routes to Schools: A large number of children are driven to school each day in private automobiles. The City will ensure that essential infrastructure improvements are made to enable safe routes to schools to promote students' walking and bicycling. The City will also work with schools to create trip reduction programs that encourage walking, bicycling, carpooling, and public transit use. Specific attention will be placed on expanding the walking school bus programs throughout the community, where children walk to school in adult supervised and school coordinated groups. An estimate of the GHG emissions that would be reduced by this action was not quantified because it is unknown at this time how many students are affected by the safe routes to schools projects. This action will be monitored and the GHG emissions will be quantified as each "safe routes to schools" project is implemented.

1.17 Comprehensive Update of City Parking Standards: Policies in the General Plan direct amendments to the City's parking standards. Through the Title 19 Municipal Code Update, the City will adopt new parking standards for parking areas that facilitate carpooling and alternative transportation. New standards may include:

- Providing reserved preferential parking spaces for motorcycles, car-share, carpool, and ultra-low or zero emission vehicles.
- Minimum and maximum parking requirements that reduce surface parking area and ensure areas are not over-parked based on development intensity, proximity to transit, and availability of nearby on-street parking and parking facilities.
- Promoting shared parking among different land uses, where feasible.
- Requiring covered and uncovered bicycle parking at higher ratios.
- Providing employee facilities to support alternative modes of transportation, including showers and lockers.
- Providing convenient pedestrian pathways through parking areas.

An estimate of the GHG emissions that would be reduced by this action was not quantified, but will be monitored and determined during Phase I.

1.18 Anti-idling Policies: The City will enforce its policy to limit the idling time of City vehicles and equipment and, where applicable, will encourage other public and private entities, such as UPS and FedEx, to follow state mandates to reduce idling.

Transportation Objective 2: Expand the Use of Alternative Fuels

2.1 Community Use of Biodiesel: Biodiesel is alternative diesel fuel derived from biological sources (such as vegetable waste oils or tallow), which can be used in unmodified diesel-engine vehicles. Most commonly, these fuels are used in a blend with petroleum diesel. Some local residents and businesses are already using biodiesel fuel when it is available, and many others express interest. The GHG emissions that have been reduced by the local use of biodiesel is estimated at **11 MtCO2e**.

2.2 Hybrid Vehicles: Hybrids emit 80% fewer harmful pollutants and greenhouse gases than comparable gasoline cars.45. This action would expand upon the City's current efforts to replace traditional gas and diesel vehicles with hybrid or electric vehicles when a fleet vehicle is due for replacement. This action sets the goal to replace City vehicles, where applicable, with alternative fuel or hybrid technology by 2015. The City also attempted to identify the number of hybrids purchased by members of the Chico community. Using the CAPPA software, the City estimates that replacing 266 vehicles with hybrids copmmunitywide would decrease greenhouse gas emissions by **875 MtCO2e** annually.

2.3 Electric Vehicles: The City of Chico has several electric vehicles that it uses at its wastewater treatment plant and fleet maintenance yard. The City will be exploring the feasibility of using more electric vehicles for City operations, such as for Parks maintenance crews and as pool cars for employees. In addition during Phase I, the City will, to the best of its ability, quantify and account for GHG emission reductions achieved from the purchase of electric vehicles by local residents and businesses from 2005-2015. This action is estimated to reduce the GHG emissions by **74 MtCO2e**.

2.4 Electric Vehicle Charging Stations: In order for the City and the community to purchase more electric vehicles, it is imperative that electric charging stations be located in convenient and accessible locations throughout Chico. As called for by the 2030 General Plan and the update of Title 19 of the Municipal Code, the City will consider installing electric vehicle charging stations at City facilities and in municipal parking lots, and will encourage the installing of stations by businesses and large employers. This action is estimated to reduce the GHG emissions by **3 MtCO2e**.

2.5 Compressed Natural Gas (CNG) Conversion: Natural gas is a clean-burning alternative to gasoline or diesel for municipal and private fleet vehicles. While natural gas is a fossil fuel, it has lower carbon emissions per unit of energy than gasoline or diesel. Since the 2005 base year, the Butte Regional Transit System (B-Line) has been converting its regional and local buses to use CNG. The City will also consider the purchase of CNG vehicles and equipment where feasible. This action is estimated to reduce annual GHG emissions by **186 MtCO2e**.

The following **Table 3.2** lists each Phase I Transportation Sector action, identifies the anticipated implementer (City of Chico or the greater community), and provides the estimated annual GHG emissions reduction (if available).

Phase I: Transportation Sector Actions

Table 3.2

		Implementor		Estimated Emissions Reductions (MtCO2e)		
		City of Chico	Greater Community	City of Chico	Greater Community	Total Reduction
Objective 1: Reduce Vehicle Miles Traveled						
1.1	Promote Car Share Programs		x	TBD	1,856	1,856
1.2	City Fleet Optimization	x		308		308
1.3	Subsidize Employee Bus Ridership	x	x		4,308	4,308
1.4	Flexible Work Schedules	x	x	23		23
1.5	City Travel Demand Mgmt Plan	x		TBD		TBD
1.6	Carpooling Program		x		288	288
1.7	Employer Trip Reduction Programs	x	x		TBD	TBD
1.8	Expand/Improved Bus Service		x		4,846	4,846
1.9	Regional Transportation Planning	x		TBD		0
1.10	Sust. Policy/Regulatory Framework including:	x			7,754	7,754
	Tiered City Fee Structure	x				incl. in 1.10
	Pedestrian Connections for New Development	x				incl. in 1.10
1.11	Expand Bicycling/Pedestrian Infrastructure	x	x			incl. in 1.10
1.12	Complete Streets Policy	x				incl. in 1.10
1.13	Corridor Management/Traffic Calming	x		TBD	TBD	TBD
1.14	New Bike Paths	x	x	TBD	1,455	1,455
1.15	Solid Waste Franchise System	x		TBD	683	683
1.16	Safe Routes to Schools	x	x	TBD	TBD	TBD
1.17	Update of City Parking Standards	x			TBD	TBD
Objective 2: Expand Use of Alternative Fuels						
2.1	Community Use of Biodiesel (B20)		x		11	11
2.2	Hybrid Vehicles	x	x	53	822	875
2.3	Electric Vehicles		x		74	74
2.3	Electric Vehicle Charging Stations	x	x		3	3
2.5	Compressed Natural Gas (CNG) Conversion:		x		186	186
			TOTALS:	**384**	**22,286**	**22,670**

TBD: To be determined as part of the annual monitoring and evaluation of the implementation of the actions.

Energy Sector Actions

The energy sector , which includes the use of both electricity and gas, offers some of the most cost-effective opportunities to reduce GHG emissions, and Phase I capitalizes on these opportunities. Saving energy and saving money go hand in hand, and a significant number of community members have already reduced their energy consumption for one or both of these reasons. Three examples of these types of reductions include the installation of lighting occupancy sensors, large-scale commercial lighting upgrades, and building efficiency retrofits. The City has also taken significant steps to reduce energy consumption, including retrofitting over 1,200 streetlights with LED bulbs and installing a 1-megawatt solar panel array at the wastewater treatment facility.

Water conveyance is the highest use of energy in California. Conserving water, therefore, is a valuable way to save energy, and both the city and many community members have already taken water conservation steps such as installing low-maintenance landscaping and central irrigation control systems which irrigate based on weather and evapotranspiration (i.e. the amount of water that evaporates or transpirates from the plant's leaves) rates of plants.

To achieve GHG reductions from the Energy sector, the CAP includes 22 actions for implementation during Phase I:

Energy Objective 1: Upgrade and Tune-up Equipment

1.1 Upgrade equipment and appliances to ENERGY STAR: ENERGY STAR is a partnership between the U.S. Environmental Protection Agency and manufacturers to voluntarily label products, such as appliances, office and other equipment, and lighting fixtures, which meet certain energy efficiency criteria. It is estimated that **5,184 MtCO2e** emissions reduction has already been achieved from the purchase of Energy Star appliances and equipment by the City and the community. It is also assumed and calculated that GHG emissions will continue to be reduced by this action through 2020.

1.2 Personal Electronic Recycling and Power Management: The City seeks efficient information technology equipment and encourages sustainable practices throughout the equipment's life cycle. The City has been using power management programs for personal computers, strategically replacing inefficient equipment, and developing an internal reuse program for equipment that was once discarded. For example, since 2005, many of the personal computer monitors and televisions throughout the community have been switched from cathode ray tube (CRT) to more energy efficient liquid crystal display (LCD) and old computers and equipment are recycled where possible. An estimate of **31 MtCO2e** of emissions has been reduced from this program.

1.3 Heating Ventilation and Air Conditioning (HVAC) Retrofits: HVAC systems, which includes boilers and chillers, are one of the largest energy users in commercial buildings. Energy used to heat, cool, and ventilate contributes to the majority of energy used in buildings. Replacing older HVAC units with appropriately sized and more efficient units can reduce energy use by up to 30%.

The City has replaced and intends to continue to replace older HVAC units in City buildings with energy efficient models as needed. HVAC units have also been replaced since the 2005 base year by other agencies and businesses. The City will also provide

information to residents and businesses on the energy use, GHG emissions reductions, cost savings from rebates and reduced energy use, that can be achieved by retrofitting HVAC systems. This measure is estimated to reduce GHG emissions by **1,371 MtCO2e**.

Energy Objective 2: Green Building and Energy Efficiencies

Buildings account for 40% of total energy use and about 35% of GHG emissions in the United States. Design and construction of new buildings, or major renovation of existing ones, is the easiest time to implement energy saving measures that reduce GHG emissions. "Green Building" is defined as a whole-systems approach to the design, construction, and operation of buildings that helps mitigate the environmental, economic, and health impacts of buildings. Green building practices recognize the relationship between natural and built environments and seek to minimize the use of energy, water, and other natural resources and provide a healthy productive indoor environment.

2.1 California Green Building Standards Code (CALGreen): Under this GHG reduction measure, the City will enforce the mandatory CALGreen actions required for new development under its permitting process, and will provide resources and information to encourage the building industry to implement the voluntary actions. The City will also continue to provide information and support to developers and contractors on LEED and GreenPoint standards. An estimated 329 MtCO2e of GHG emissions will be reduced from this Phase I action.

2.2 Installation of Reflective or "Cool Roofs": A dark roof absorbs heat from the sun, creating higher urban temperatures and increasing the need for air conditioning. "Cool roofs" involve the installation of roofing materials with higher solar reflectivity to counter this heat island affect. California has required white colored material for flat roofs since 2005. The City will track "cool roof" installations and will implement a public information campaign

to encourage residents, contractors, and businesses to install "cool roofs" when replacing existing roofs. The square footage of "cool roofs" installed within the community, such as at the Chico Mall, is used to estimate the GHG emission reductions of **99 MtCO2e** from this action.

2.3 Low Income Weatherization Program: While low-income earners may have smaller houses and fewer appliances than higher-income earners, their homes are often older and poorly insulated. Low-income weatherization programs seal cracks around windows and doors, add insulation, and sometimes replace inefficient appliances, reducing energy use, related GHG emissions and lowering utility bills.

PG&E offers an Energy Savings Assistance Program to income-qualified renters and homeowners to make improvements to their dwellings. The improvements include compact fluorescent lights, caulking, showerheads, minor home repair, and other weatherization measures. Participants may also receive replacement of old refrigerators, furnaces, and/or water heaters. This program retrofits on average approximately 2,000 older homes in the Chico area each year. The City of Chico also offers low-income residents opportunity to improve the energy efficiency of their homes through its Low Income Housing Rehabilitation Program. An estimated **12,798 MtCO2e** of GHG emissions will be reduced from this action.

2.4 Home Energy Requirements Upon Resale (RECO): In 2011, the City updated its existing Residential Energy Conservation Ordinance (RECO), which requires energy and water efficiency upgrades at the point-of-sale, prior to transfer of ownership. Upgrades include items such as attic insulation, programmable thermostats, water heater insulation, hot water pipe insulation, and draft elimination through caulking and sealing. An estimated **38 MtCO2e** of GHG emissions will be reduced from this action.

2.5 PG&E Innovator Pilot Energy Efficiency Grant: Many homeowners are not aware of the energy and cost saving potential of relatively minor home improvements. The City received a grant from PG&E to implement the Innovators Pilot Program described later in the community outreach section. The program includes providing energy audits, weatherization retrofits, and personal energy efficiency consultations for 100 residents. This action includes continuing to seek funding to expand weatherization retrofits to older middle-income homes through the Energy Upgrade California program or other sources. It is estimated that **75 MtCO2e** of GHG emissions will be reduced from the Innovators Pilot program.

2.6 Financial Incentives for Energy Efficient Improvements: AB 811, passed in July of 2008, allows local governments to assess property owners who install renewable energy and energy efficiency improvements on their properties and want to pay for the cost of the projects over time through their property tax bills. If the property is sold, the outstanding loan balance is taken over by the new owner. AB811 allows property owners to avoid up-front installation costs.

These types of programs are typically called Property Accessed Clean Energy, or PACE, programs. The City will pursue joining a PACE program to seek financing to fund these types of improvements for both residential and non-residential property owners. The amount of GHG emissions that potentially can be reduced from this action will be determined and calculated based on the projects funded through the PACE program

Energy Objective 3: Improve Lighting Efficiency

3.1 Light Emitting Diode (LED) Streetlights: Replacing conventional high-pressure sodium and metal halide lamps in streetlights with LED lamps is a proven and cost-effective way to reduce both energy consumption and GHG emissions. In 2011, the City used a large portion of its allotment of Energy Efficiency & Conservation Block Grant funds from the American Resource and Recovery Act to replace 1,210 of the over 4,100 (25%) City-owned streetlight lamps with LEDs.

The City will continue to replace streetlights with LED lamps as funding becomes available and will require LED streetlights in all new development. In addition, over 1,500 of the streetlights in Chico are owned by PG&E, and the City will work with them to encourage the conversion of these utility-owned streetlights to LED. The total estimated emissions reductions from this action are estimated to be **160 MtCO2e**.

3.2 Commerical Lighting Upgrades: Most commercial buildings use fluorescent lighting, which is relatively efficient, but many buildings still have older fixtures with magnetic ballasts and T-12 size fluorescent tubes. New electronic ballasts with T-8 size tubes use 30% less energy. The City and many local businesses and manufacturers, such as Smuckers Natural Foods, have upgraded their commercial lighting to T-8 or in some cases T-4 fluorescent lighting. The City will continue to upgrade the lighting in municipal facilities and will work with PG&E to encourage other businesses to install lighting upgrades. It is estimated that lighting upgrades installed by the City and the community will reduce annual GHG emissions by **12,830 MtCO2e**.

3.3 Occupancy Sensors: Occupancy sensors detect motion, and if no motion is detected after a set period, the sensor turns off or dims lights. Sensors are a low-cost way to save energy on lighting, with a typical payback time of less than two years. The City has installed sensors in many of the City facilities, and will complete the installation of sensors in remaining city-owned buildings. The City will also provide information regarding the energy and GHG savings associated with and encourage the installation of occupancy sensors in local businesses, schools and other institutions. An estimated **106 MtCO2e** of GHG emissions will be reduced from this action.

3.4 LED Exit Signs: Older exit signs are lit by incandescent bulbs which use 40 watts per sign, while LED exit signs use 5 watts or fewer per sign, a savings of 87%. One simple measure that the City can take to reduce their GHG emissions and achieve energy savings is to install light emitting diode (LED) exit signs in its municipal buildings. In this action, the City proposes to replace 74 existing incandescent exit signs with LED signs, thereby reducing GHG emissions by **8 MtCO2e**.

3.5 Energy Fitness Commercial Lighting Upgrades: This program, funded by PG&E, provides free lighting retrofits, air conditioning tune-ups, vending machine misers, occupancy sensors, and energy saving services to small and very small businesses in the Northern California area. The City will encourage PG&E to continue to provide funding for this program. It is estimated that ultimately **4,224 MtCO2e** emissions will be reduced with this action.

Energy Objective 4: Renewable Energy Generation

4.1 Installation of Solar Photovoltaic (PV) Systems: This action includes the identification of the solar PV panels that have been installed by residents, businesses, the City, and other public agencies since the 2005 base year. These installations include a 1.1 megawatt PV array at the City's wastewater treatment plant, a nearly 2 megawatt PV solar system at the Sierra Nevada Brewing Company and PV arrays recently installed by the Chico Unified School District at the two high schools in Chico. This action also calls for the City to identify additional opportunities for solar panel installations on existing and new City facilities/properties. In addition, the City will continue to allow easier and quicker permit approval for the installation of solar panels by the private sector. An estimated **8,321 MtCO2e** of GHG emissions will be reduced annually from this action.

4.2 California State University, Chico Switching to PG&E: In 2005, CSU, Chico was obtaining its gas and electricity from an Arizona energy provider, whose primary source of energy was generated from coal. In 2009, the University switched to PG&E, which has a much greener energy grid mix than their previous provider. This change in energy service providers resulted in a reduction of **8,730 MtCO2e** of greenhouse gases emitted annually in the Chico area.

4.3 Methane Gas Recovery at the City's Wastewater Treatment Plant: It has been the past practice at the City's wastewater treatment plant to flare off the methane that is generated from the treatment of the wastewater produced from Chico residents and businesses. As part of recent expansion of the plant, a new co-generation system was installed to capture and convert the methane into reusable gas to replace a majority of the natural gas used to run the plant. It is estimated that the co-generation unit will reduce GHG emissions by **766 MtCO2e** by 2015.

Energy Objective 5: Promote a Healthy Urban Forest

The City has a robust urban forest, which encompasses over 30,000 City street trees, and as many or more privately owned trees. Trees reduce greenhouse gas emissions by removing CO2 from the atmosphere, and by shading our homes, office buildings and streets, thereby reducing air conditioning needs and the amount of fossil fuel burned to produce electricity.

5.1 Urban Forest Management Plan: The City will develop an Urban Forest Management Plan that will include the following:

- Maintain existing city trees through regular, scheduled service
- Planting new trees, preferably native species, to replace those that require removal and enhance the street tree canopy, where needed
- Require street and parking lot tree planting in new development
- Work with commercial parking lot owners to improve the shade canopy
- Implement the Municipal Code's tree protection regulations
- Use volunteer groups and property owners to plant new trees, care for newly planted trees, maintain young trees, and provide information and instructions regarding such care and maintenance (OS-6.1.1)

Due to many variables and because this plan has not yet been prepared, the amount of GHG emissions reductions associated with this action have not been quantified at this time.

Energy Objective 6: Water Conservation

6.1 Weather Based Central Irrigation Control System: Weather-based or evapotranspiration (ET) irrigation controller systems analyze soil moisture content and irrigate only when plants need water. These systems optimize irrigation efficiency and avoid over watering. The City installed an ET controller for most of its parks and public landscaped areas, and it will continue to identify additional public land that will be irrigated by this controller. The City will also develop a program to encourage the use of ET controllers in private landscapes. An estimated **10 MtCO2e** of GHG emissions has been reduced from the additional City's acreage irrigated by this controller since 2005. (SUS-4.2.1)

6.2 Water Efficient Public Landscaping: AB 1881, the Water Conservation in Landscaping Act of 2006, mandated increased water efficiency for both new and existing development statewide. The law required the Department of Water Resources to update the Model Water Efficient Landscape Ordinance (MWELO) in 2009, to take effect in 2010. Since January 1, 2010, the City has been implementing MWELO for every new commercial, multi-family, industrial, or tract home project containing 2,500 sq. ft. or more of landscaping installed by the developer. New landscapes installed by an individual homeowner that are more than 5,000 sq.ft. are also subject to the MWELO. An estimate of the GHG emissions that will be reduced annually from this action has not been quantified but will be tracked annually.

6.3 Low Maintenance Landscaping: As funding allows, the City will install drought tolerant landscaping in compliance with AB 1881 in existing and new City facilities, medians, and parkway strips to reduce water use and maintenance costs. (SUS-4.2.1). An estimated **93 MtCO2e** of GHG emissions will be reduced annually from this action.

6.4 Free Water Audit Program: Many of Chico's buildings are more than 30 years old, and water fixtures and appliances have improved considerably since that time. Replacing antiquated equipment will result in valuable water conservation. Leaking pipes and faucets account for approximately 8% of water consumption in older buildings. The local water purveyor, California Water Service, offers free water efficiency audits and the City will participate in promoting this opportunity to the community. This action is not quantified because it is unknown how many residents and businesses will request a free water audit and what water conservation measures, if any, will be installed as a result of the audit.

Table 3.3, on the next page, lists each Phase I Energy Sector action, identifies the anticipated implementer (City of Chico or the greater community), and when available, provides the estimated annual GHG emissions reduction.

Phase 1: Energy Sector Actions

Table 3.3

		Implementor		Estimated Emissions Reductions (MtCO2e)		
		City of Chico	Greater Community	City of Chico	Greater Community	Total Reduction
Objective 1: Upgrade and Tune-up Equipment						
1.1	Energy Star Appliances and Equipment		x		5,184	5,184
1.2	Computer Recycling/Power Mgmt.	x		31		31
1.3	HVAC Retrofits	x	x	744	627	1,371
Objective 2: Green Building and Energy Efficiencies						
2.1	CalGreen Building Standards	x			329	329
2.2	Reflective or Cool Roofs		x		99	99
2.3	Low Income Weatherization Program		x		12,798	12,798
2.4	Home Energy Requirement Upon Resale (RECO)	x			38	38
2.5	Innovator Pilot Energy Efficiency Program	x			75	75
2.6	Financial Incentives for Energy Efficiency (PACE)	x			TBD	TBD
Objective 3: Improve Lighting Efficiency						
3.1	LED Street Lights	x		160		160
3.2	Commercial Light Upgrades	x	x	42	12,788	12,830
3.3	Occupancy Sensors	x	x		106	106
3.4	LED Exit Signs	x		8		8
3.5	Energy Fitness Comm. Lighting Upgrades		x		4,224	4,224
Objective 4: Renewable Energy Generation						
4.1	Solar Photovoltaic Systems	x	x	635	7,686	8,321
4.2	CSU, Chico Switch in Energy Providers		x		8,730	8,730
4.3	Wastewater Treatment Methane Recovery	x		766		766
Objective 5: Promote a Healthy Urban Forest						
5.1	Urban Forest Management Plan	x		TBD	TBD	TBD
Objective 6: Water Conservation Strategies						
6.1	Weather Based Irrigation Controllers	x	x	6	4	10
6.2	Water Efficient Public Landscaping Ord.	x	x	TBD	TBD	TBD
6.3	Low Maintenance Landscaping	x	x	TBD	93	93
6.4	CA 20x2020 Water Conservation Plan		x	TBD	TBD	TBD
6.5	Free Water Audit Program	x	x	TBD	TBD	TBD
			TOTALS:	**2,391**	**52,780**	**55,171**

TBD: To be determined as part of the annual monitoring and evaluation of the implementation of the actions.

Solid Waste Sector Actions

Although waste-related emissions were a relatively small contributor (3.9%) to the overall baseline emissions generated in Chico, the solid waste sector remains a viable cost-effective option for reducing greenhouse gas emissions. Actions taken to reduce waste-related emissions can also produce coincidental environmental and economic benefits of keeping waste out of the landfill. Recycling and composting efforts have been established practices throughout the community for decades. Phase I of the Climate Action Plan includes actions to expand many of these existing efforts, as well as to develop a methane gas-to-energy generation facility at the Butte County Neal Road Waste and Recycling Facility.

Solid Waste Objective 1: Expand Recycling Efforts

1.1 Expand Residential and Multifamily Recycling: Recycling at multifamily residences can be challenging, especially in a college town where many of the tenants are students who move often. There is a need for consistent outreach to tenants on what can be recycled, and to property managers and landlords about the cost-savings and environmental benefits of waste diversion. Expanded outreach to the multifamily residents in Chico is underway. The City will expand its multifamily public outreach and educational campaign to increase the amount of recycling from multifamily complexes by 5% from the 2005 base year. The campaign will include "move-in" information packets, a reusable tote bag for tenants to store and transport their recyclables, and modified recycling containers to reduce contamination and illegal disposal in the recycling bins. It is also assumed in this action that as the City's residential and commercial base grows, that there will be additional materials recycled through the curbside recycling programs. An estimate of the GHG emissions to be reduced from this action is included in the "Commercial and Industrial Recycling" action 1.3 below.

1.2 Expand the City's Municipal Recycling Program: Increase the use of recycling bins at municipal facilities, public parks, and recreational spaces, and as necessary, increase the size, durability, and number of recycling bins as well as the range of materials accepted (SUS-3.3.1). The amount of GHG emissions that will be reduced from this action cannot be quantified at this time, but will be monitored and quantified at the end of Phase I.

1.3 Commercial and Industrial Recycling: AB 341 (Chesbro), which was passed in October 2011, establishes a statewide commercial recycling mandate. The purpose of the program is to reduce greenhouse gas emissions by diverting recyclable materials generated by commercial and industrial businesses from the landfill. According to the law, on or after July 1, 2012, a business that generates more than four cubic yards of commercial solid waste per week or a multifamily residential dwelling of five units or more shall arrange for recycling services. Because many of Chico's businesses are already recycling, it is difficult at this time to determine the amount of additional GHG emissions that may be achieved through this new mandatory program. However, AB 341 requires the City to conduct a public outreach campaign, monitor the implementation of the mandate, and to report to the State on the progress each year. The estimated GHG emissions reductions achieved from this program is estimated at **12 MtCO2e** per year by 2015 (PPFS–8.1.7).

1.4 Environmentally Preferable Purchasing Program: As called for by the General Plan (SUS-3.1.1), the City will develop and implement an Environmentally Preferable Purchasing Program that directs the purchase of products and services for municipal operations that are environmentally preferable (e.g., renewable, recyclable, non-toxic) and sold locally to the maximum extent economically and legally feasible. The amount of GHG emissions that will be reduced from this action cannot be quantified at this time, but will be monitored and quantified at the end of Phase I.

Solid Waste Objective 2: Expand Composting Efforts

2.1 Expand Yard Waste and Other Organic Composting: Curbside yard waste recycling is available to Chico residents and businesses. In addition, the City operates a compost facility that provides a convenient yard waste drop-off location for residents, landscapers, tree trimmers, and other businesses. As the population expands and the existing trees grow, it is assumed that more yard waste will be generated and composted within the Chico area. As part of its review of franchise waste zones, the City will also look to provide education and financial incentives to encourage more residents and businesses to participate in the yard waste recycling and composting programs. An estimated **168 MtCO2e** of GHG emissions will be reduced from this action.

Solid Waste Objective 3: Green Building

3.1 CALGreen Waste Diversion Requirement: The 2008 California Green Building Code ("CALGreen") requires building contractors to recycle 50% of Construction and Demolition (C&D) debris from all 1) new construction projects, 2) full structure demolitions, and 3) alterations/tenant improvements with a contracted construction value of $250,000 or more. Due to the economic downturn and the slow growth in new development, it is difficult to determine the potential GHG emissions from this action. However, contractors are required to submit waste management plans to the City for each project subject to the CALGreen standards. The City will track the tons of C&D waste recycled and annually calculate the associated GHG emission reductions resulting from this waste diversion mandate.

Solid Waste Objective 4: Renewable Energy Generation

4.1 **Generate Energy from Landfill Methane Capture:** During the 2005 base year, the methane that was produced at the Butte County Neal Road Landfill, which holds the majority of Chico's waste, was flared off rather than captured as energy. Starting in 2012, the County plans to capture and utilize the methane to generate up to 2.2 megawatts (enough power for approximately 1,383 homes), The amount of energy produced from Chico's proportionate share of waste at the landfill is estimated to reduce GHG emissions by **86 MtCO2e** per year during Phase I.

The following **Table 3.4** (next page) lists each Phase I Solid Waste Sector action, identifies the anticipated implementer (City of Chico or the greater community), and provides the estimated annual GHG emissions reduction (if available).

Phase I: Solid Waste Sector Actions Table 3.4

		Implementor		Estimated Emissions Reductions (MtCO2e)		
		City of Chico	Greater Community	City of Chico	Greater Community	Total Reduction
Objective 1: Expand Recycling Efforts						
1.1	Residential/Multifamily Recycling		x		TBD	TBD
1.2	City Municipal Recycling Program	x		TBD		TBD
1.3	Commercial/Industrial Recycling				12	12
1.4	Environmentally Preferable Purchasing	x		TBD		TBD
Objective 2: Expand Composting						
2.1	Yard Waste/Other Organic Composting	x	x	63	105	168
Objective 3: Green Building						
3.1	CALGreen 50% C&D Diversion		x		TBD	TBD
Objective 4: Renewable Energy Generation						
4.1	Landfill Methane Gas Recovery		x		86	86
			TOTALS:	63	203	266

Community-Wide Education and Recognition Efforts

In addition to the specific actions described above, there are additional educational and collaborative efforts that can be taken by the City and the community to reduce GHG emissions. While it may not be possible to directly quantify these efforts, they are no less important in achieving the City's GHG reduction goal. These actions, described below, are intended to inform Chico residents about the need to reduce GHG emissions and foster a sense of involvement in and ownership of climate action in the community.

1) School Outreach & Education Program:

The City Sustainability Task Force established an Education and Outreach Ad-Hoc Committee to promote the CAP throughout the community and to develop and implement educational campaigns on climate action. The committee has already partnered with representatives from CSU, Chico, Chico Unified School District, and the Gateway Science Museum to develop a school educational outreach strategy. This strategy includes two main components: one targeted at 4th and 5th grade elementary school students, and the other at 9th and 10th grade high school students.

The aim of these educational outreach campaigns is to educate students about the science of climate change, focusing on causes and consequences, and to engage participants in taking action to combat climate change. For the younger students, outreach will include simple games and activities that teach how to reduce one's environmental impacts. For the older students, outreach will include service-lea rning projects, such as assisting directly in implementation of CAP actions. By educating and empowering students, Chico will develop a vital resource in the long-term effort to curb GHG emissions and climate change.

2) Sustainability Website:

The City will create a webpage that describes the City's sustainability efforts, identifies partnerships, and provides educational resources and opportunities for community members. The site will also serve as a clearinghouse for information on Chico's climate action program. (SUS-1.5.1)

Phase I: Community Outreach Actions

Table 3.5

		Implementor		Estimated Emissions Reductions (MtCO2e)		
		City of Chico	Greater Community	City of Chico	Greater Community	Total Reduction
Objective 1: Community Outreach						
1.1	Sustainable Business Recognition	x			542	542

PG&E Innovator's Pilot Program

In 2010, the City of Chico was awarded the "Innovators' Pilot Grant" from PG&E to work with local residents to reduce their home energy consumption. The Sustainability Task Force established an Innovators' Pilot & Residential Outreach Ad-Hoc Committee to oversee the implementation of this program. Through this grant, the City will offer "whole house" Building Professional Institutes (BPI) energy assessments, basic weatherization measures as required by the City's Residential Energy Conservation Ordinance (RECO), and personalized home energy consultations to 100 residents who own and reside in older homes. This program is estimated to reduce GHG emissions by **75 MtCO2e**.

3) Air Quality Mitigation:

The City is collaborating with the Butte County Air Quality Management District (BCAQMD) as they update their California Environmental Quality Act (CEQA) Air Quality Handbook. The Handbook will include recommendations and mitigation measures for projects to avoid having a significant impact through contributions to GHG emissions. The City and BCAQMD will employ locally appropriate environmental review guidelines to further help mitigate increases in GHG emissions.

4) Sustainable Business Recognition Program:

The City will implement a sustainable business program to recognize and encourage businesses to voluntarily go beyond minimum requirements to conduct environmentally-friendly business operations. By implementing a combination of required and optional measures, businesses may receive recognition in one or more of the following sustainability categories; transportation, energy efficiency, water conservation, waste prevention, pollution prevention, and social equity. Although this is a public outreach program, the City did calculate that this program has the potential to reduce GHG emissions by **542 MtCO2e** per year. (SUS-1.5.3)

Chapter Four: Phase II

By the end of Phase I in 2015, locally generated GHG emissions are projected to be reduced by 165,820 MtCO2e from business as usual, to a level 10% below the 2005 base-year.

Achieving the CAP's overall 2020 goal will require Phase II emissions reductions that go significantly beyond Phase I levels. The Phase I actions will continue to reduce emissions during Phase II, and additional actions will be implemented to accelerate emissions reductions during this second Phase of the CAP. The Phase II reduction target is to further reduce emissions by an additional 15% or by **143,935 MtCO2e** per year to achieve the overall CAP goal of reducing emissions to 385,749 MtCO2e, which is 25% below baseline levels and 44.5% below BAU projections for 2020.

The CAP represents the City's best attempt to create an organized, community-wide response to the threat of climate change. The field of climate action planning is rapidly evolving. Over the next decade, new information about climate change science and risk is likely to emerge, new GHG reduction technologies and infrastructure will be developed, innovative municipal strategies will be identified, and State and federal legislation are likely to advance. In order to remain relevant and to be as effective as possible the CAP must evolve over time.

At the end of Phase I, the CAP will be reviewed and, if necessary, amended to include new actions to ensure the City meets its 2020 GHG reduction goal. The review will also consider advancements in climate science, new opportunities for GHG emissions reduction, and changes in climate policy. This chapter describes actions to be implemented in Phase II, but the list of actions to be implemented in Phase II may be revised in 2015 in response to:

- The results of the second comprehensive GHG Inventory;
- Reviewing the performance of Phase I actions;
- Changes to local circumstances surrounding emissions-generation;
- Updated reduction estimates for external and local actions.
- Any additional unanticipated local and external actions.

Second Comprehensive GHG Inventory

At the end of Phase I, the City will conduct a second comprehensive GHG emissions inventory, quantifying the emissions generated by City operations and those generated by the community, with a detailed breakdown of emissions generated by sector. The second inventory will measure the same sectors and geographic area used in the first GHG Inventory to accurately compare emissions levels and assess the impact of Phase I actions.

CAP Review and Amendment

Review of Phase I

Prior to the end of 2015, a review and evaluation of Phase I actions will be conducted so that, if necessary, a CAP amendment can be completed prior to the beginning of Phase II in 2016.

The CAP review will assess the successes and/or shortcomings of implementing Phase I actions. Using the results of the second GHG Inventory, the review will evaluate the degree to which external and local actions influenced emissions levels compared with the estimates originally made in the CAP. Any actions taken independently of the CAP by individuals and businesses during Phase I that were not accounted for in the CAP will also be identified and quantified if possible.

The review will also analyze the dynamic circumstances surrounding the CAP, and consider how they affected the implementation of Phase I. These circumstances may include: the condition of the local economy; input price levels (ranging from gasoline and kWh of energy to efficient technologies); relevant and available technologies; and funding sources for implementation. A careful evaluation of the Phase I results and the circumstances impacting them will help ensure that any adjustments made to the CAP for Phase II are most relevant and likely to steer the CAP toward meeting its 2020 goal.

Preparing for Phase II and CAP Amendment

Depending upon the Phase I outcome as determined by the second GHG Inventory and the CAP review, it may be necessary to adjust the amount of emissions reductions needed during Phase II to reach the targeted 2020 GHG emissions level of **385,749 MtCO2e**. If changes to the Phase II emissions reductions goals are needed for external and/or local actions, they will be established through the CAP amendment.

Estimation of Potential External Impacts in Phase II

To determine the level of local GHG reduction needed for the amendment, the City will first need to estimate the reductions from external actions in Phase II. Similar to Phase I, the reductions from external actions are anticipated to be primarily from changes in PG&E's grid mix, increases in automobile fuel efficiency, the diversion rates of locally generated waste, and other measures implemented through California's AB32 Scoping Plan.

Selection of Additional Actions

Many of the Phase I actions will continue to reduce GHG emissions during Phase II. It is projected that the continuation and/or expansion of all of the Phase I actions will collectively reduce GHG emissions by an estimated additional **26,590 MtCO2e** per year by 2020.

The following **Table 4.1** lists those Phase I actions for each sector that were projected to be expanded due to growth or other factors and the estimates of the additional projected annual GHG emissions reduction to be achieved between 2015 and 2020.

Projection of Emissions Reductions from Applicable Phase I Actions by 2020 Table 4.1

SECTOR	Projected 2020 Phase I Emissions Reductions (MtCO2e)
Transportation	
Hybrid Vehicles	411
GP Sustainability Policy/Framework	7,754
Energy	
Energy Star Rebates	3,015
Low-Income Home Weatherization	6,997
Weatherization Retrofits Upon Resale (RECO)	38
Energy Fitness Lighting Efficiency Upgrades	2,183
CSU, Chico Energy Provider Switch	909
Solar PV Installations	4,597
Waste	
Landfill Methane Gas Recovery	9
Sustainable Business Program	677
ESTIMATED TOTAL EXPANDED PHASE I REDUCTIONS:	**26,590**

However, to meet the 2020 goal additional Phase II actions will be needed. Many are already included in this chapter, but others will likely be added through the CAP amendment process. New actions for Phase II may be selected by considering several of the following factors:

- Newly identified GHG reduction opportunities,
- Suggestions from the local community through public meetings,
- Policy direction in the Chico 2030 General Plan,
- Best practices from leading cities and organizations, and
- State and regional laws, guidelines, and recommendations.

The analysis of potential new Phase II actions will include determining the degree to which the action can be implemented, calculating an estimate of the potential emissions reduction, estimating the action's related costs and savings, and identifying the likely implementer or implementers.

CAP Amendment

The amendment should be presented to the City Council and ready to implement by the beginning of Phase II in 2016. The amendment may require additional environmental review and will be adopted by the City Council through a public process.

Phase II Actions

The CAP includes 27 Phase II actions described below and depicted in ***Tables 4.2*** *through* ***4.5*** *for each sector: Transportation, Energy, and Solid Waste.*

There are fewer actions in Phase II than Phase I because many of the Phase I actions will still reduce emissions during Phase II and because the list of Phase II actions will be reviewed and likely expanded before Phase II begins. For many of the reasons stated above, the GHG emissions reductions for these potential actions have not been quantified at this time, but will be estimated if and when chosen for implementation during Phase II.

Transportation Sector Actions

Objective 1: Reduce Vehicle Miles Traveled

1.1 Require Large Employers to Provide Facilities to Encourage Bicycle Commuting: A large barrier to cycling as a means of commuting to work is a lack of facilities for changing into work clothes and protecting bicycles from the rain. Shower facilities encourage people who live further away to cycle to work. Covered and indoor bicycle parking increase security and prevent bikes from getting wet during the winter. The new action will establish a standard for large employers to provide showers and covered bicycle storage facilities where feasible.

1.2 Design Guidelines Manual Update: With direction from the 2030 General Plan, the City will amend its Design Guidelines Manual to address residential infill conflicts, detail how to incorporate passive solar design into buildings, and include provisions for remaking older auto-centric transit corridors as pedestrian-friendly, multi-modal seams within the community. Renewed corridors support infill and redevelopment, and promote non-auto transportation modes. Passive solar design solutions support energy efficiency and renewable energy. The reductions from this action are not quantified to avoid possible double-counting with other quantified actions related to infill development and solar photovoltaic installations.

1.3 Residential Transportation Education and Challenge: The City will partner with BCAG to expand its public education and outreach campaigns to encourage residents to use alternative transportation and reduce their individual annual vehicle miles traveled by 8%. The amount of GHG emissions reductions from this challenge will be determined in the future based on the number of participants who obtain this goal and the vehicle miles saved.

Objective 2: Expand the Use of Alternative Fuels

2.1 Preferential Street Parking for Alternative fueled vehicles: The City will provide preferential parking spaces for car share, carpool, and ultra-low or zero emission vehicles such as electric vehicles that will encourage residents to carpool or purchase low or zero emission vehicles. Preferential street parking spaces for eligible vehicle types will be located throughout the community's commercial districts.

2.2 Use of Biodiesel: Biodiesel is alternative diesel fuel derived from biological sources, which can be used in unmodified diesel-engine vehicles. If readily available locally and if it does not impact local food resources, the City will convert a portion of its fleet to use B20 biodiesel (80% diesel/20% biodiesel),

2.3 Expand Conversions to Compressed or Liquid Natural Gas (CNG or LNG) or Propane: The City will continue to pursue converting the City's equipment and vehicles to those that use CNG, LNG or propane where possible. The City will also continue to encourage BCAG, the solid waste haulers, and other local diesel fleets to consider converting their vehicles to CNG or LNG where feasible.

2.4 Encourage Alternative Fuel Stations in Certain New Development: The City will require that master plans and planned developments projects in new growth areas include the siting of alternative fueling stations and electrical vehicle charging stations.

The following **Table 4.2** lists potential Phase II Transportation Sector actions, identifies the anticipated implementer (City of Chico or the greater community), and provides the unit of measurement and emission factors that will be used to calculate the annual 2020 GHG emissions reductions for each action (if available).

Phase II Transportation Sector Actions

Table 4.2

		Implementor		GHG Emissions Estimates	
		City of Chico	Greater Community	Unit of Measurement	Emission Reduction/ Unit (MtCO2e)
Objective 1: Reduce Vehicle Miles Traveled					
1.1	Large Employer Bicycle Facility Requirement	x	x	TBD	TBD
1.2	Design Guidelines Manual Update	x		TBD	TBD
1.3	Residential Transportation Education/Challenge	x		# residents @ 8% VMT reduced	0.00941
Objective 3: Expand Use of Alternative Fuels					
2.1	Preferential Parking for Alternative Fuel Vehicles	x	x	TBD	TBD
2.2	Use of Biodiesel (B20)	x	x	# vehicles converted	1.36
2.3	Expand Vehicle Conversion to CNG/LNG/Propane	x	x	# vehicles converted	15.5
2.4	Encourage Alter. Fuel Station in New Development	x	x	# of stations installed	1.697

Energy Sector Actions

Objective 1: Upgrade and Tune-Up Equipment

1.1 Building Commissioning and Retro-commishing: Before 2005, several City buildings received energy audits and lighting upgrades to improve their energy efficiency. Based on the results of further energy audits of City facilities, the City will continue to prioritize and complete energy efficiency upgrades on its municipal buildings, where feasible.

1.2 Encourage Solar Hot Water Heaters in New Development: Solar hot water systems offer a simple and reliable way to harness the sun's energy to provide hot water. The City will work with PG&E and other agencies to promote financial incentives for the installation of solar hot water systems. In addition, the City may amend the Municipal Code to require certain new residential and commercial development projects to install solar hot water systems.

1.3 Variable Speed Pool Pumps and Solar Water Heating Systems for Swimming Pools: Swimming pools can account for up to 20% of a residence's energy consumption. Through an education and outreach campaign, the City will encourage residents to install variable speed swimming pool pumps and solar water heating systems. In Phase II, the City will amend the Municipal Code to require variable speed pumps and solar water heating systems in new swimming pools, where applicable.

1.4 Solar Irrigation and Groundwater Pumps: The City will work with Cal Water, the Chico Area Recreation District, and other public agencies to determine whether irrigation and groundwater pumps can be converted to use solar generated electricity or other alternative energy sources.

Objective 2: Green Building and Energy Efficiencies

2.1 Consider Adoption of Additional Building Standards for Energy Efficiency: The City will consider amending the Chico Muncipal Code to require and verify that all new construction exceed the Title 24 energy efficiency requirements by 15% by 2020 (Tier 1 Standard).

2.2 City of Chico Green Facilities Commitment: Consistent with the General Plan, new significant City facilities will be constructed to achieve at least the Silver baseline certification level of Leadership in Energy and Environmental Design (LEED), or equivalent.

2.3 Residential Energy Efficiency Challenge: The City will partner with PG&E to expand its public education and outreach campaigns to promote energy efficiency improvements within the community, including information on rebates and incentives. An energy efficiency challenge is also an effective way to motivate people to save energy. The City will challenge residents to reduce their energy use by 10%. The amount of GHG emissions reductions from this challenge will be determined in the future based on the number of participants who obtain this goal.

Objective 3: Improve Lighting Efficiencies

3.1 Encourage/Require Bi-Level Parking Lot/ Structure Lights: Many parking garage structures or parking lots in commercial and institutional facilities are currently illuminated with high pressure sodium and metal Halide ceiling mounted fixtures. Because it is common for parking lots and garages to have lights on all day or all night, regardless of the occupancy or lighting need, these facilities are excellent candidates for an upgrade to bi-level lighting. Bi-level fixtures, such as induction, ceramic metal halide, and LED, which are also controlled by motion sensors, present an opportunity to use 30-75% less energy by dimming light levels when parking areas are unoccupied. Bi-level lighting controls can also turn off perimeter light fixtures for much of the day in areas that receive sufficient daylight to meet lighting needs.

As funding allows, the City will convert its existing parking garage and parking lots to use these bi-level lights. Through the PACE program identified in Phase I, the City will also encourage the retrofit of lighting for existing large parking lots and garages, such as at the Chico Mall and Enloe Hospital, and will require the use of these fixtures in new large commercial and industrial developments.

Objective 4: Renewable Energy Generation

4.1 Building Fee Incentives for Alternative Energy Installations (Solar/Wind): When economic conditions are more favorable , the City will consider reducing or waiving building permit and/or plan review fees for photovoltaic solar or other renewable energy systems on existing residential and commercial buildings. This type of financial incentive encourages the proliferation of solar projects and is consistent with a number of initiatives at the local, State and Federal level.

4.2 Increase the City's Municipal Use of Renewable Energy: The City will investigate the potential to increase its purchase of renewable energy sources for it's municipal buildings and facilities by at least 10% above the PG&E's 33% renewable grid mix required under the AB32 Scoping Plan.

4.3 Power Purchase Agreements: Renewable energy has become increasingly more accessible and cost-effective due to Power Purchase Agreements (PPAs). In a PPA, a private company or third party installs a renewable energy technology, often solar panels, at no cost to the consumer and maintains ownership of the installed panels, selling customers the power produced on a per kilowatt-hour basis at a contractually established rate. The rate is often lower than what customers pay to PG&E, and the rate increases at a fixed percentage annually. In addition to installing the panels, the third party owns, monitors, and maintains the systems to ensure that they keep working. These agreements are ideal for either projects implemented by the City, or for residents or businesses with interests in reducing the energy consumptions in their homes and businesses. The City will pursue the installation of renewable energy projects on City property at the Chico Municpal Airport Industrial Area and may offer this renewable energy source and incentive to commercial and industrial businesses located within this industrial area.

Objective 5: Carbon Reduction

5.1 Low Carbon Projects: The City will develop a policy encouraging the implementation and construction of low carbon impact public works and infrastructure projects. This will include reducing transportation needs during construction, reducing waste, reusing asphalt and other materials, and other activities to reduce GHG emissions generated from projects constructed by the City directly, or through its contractors.

5.2 Purchase Carbon Offsets: To help meet its 2030 overall greenhouse gas reduction goal, the City will explore investing in carbon offsets and retiring the associated credits. The City could also encourage residents, businesses, governments, schools, and institutions to invest in greenhouse gas-reducing projects to offset their personal or corporate greenhouse gas emissions. In addition, the City will explore ways to create offset programs which provide revenues for local climate change projects, such as development impact fees, requiring offsite tree planting, or other measures to offset project-related emissions.

Objective 6: Water Conservation

6.1 Encourage the use of Grey Water and Rainwater Systems: Grey water systems save water by reusing untreated household wastewater from bathtubs, showers, bathroom washbasins, and clothes washing machines. Rainwater may be collected from roofs and other impermeable surfaces and stored in cisterns or barrels for use in dry weather sub-surface or surface irrigation. Current California law permits use of grey water systems for subsurface irrigation if compliant with Title 24, Part 5 of the California Plumbing Code. In 2008, the adoption of Senate Bill 1258 made grey water systems more feasible in the California. The City will provide information to residents and businesses about the opportunities to construct such systems on their properties, and may require grey water systems where appropriate for new development.

6.2 Require Weather-based Irrigation Controllers: The City will require the use of weather-based, Evapotranspiration (ET) controllers for new development and landscape projects over 2,500 square feet. This action is estimated to achieve 0.2201 MtCO2e of GHG emissions reductions for each acre irrigated by these controllers.

6.3 California 20 x 2020 Water Conservation Plan: In February 2008, a comprehensive program was introduced to reduce statewide per capita urban water use by 20% by the year 2020. The 20 x 2020 Water Conservation Plan requires that Chico's local water purveyor, Cal Water, through a series of strategies, programs, incentives, and enforcement achieve the 20% per capita reduction. Benefits associated with this significant reduction in water use include a commensurate reduction in energy use for pumping, treating, and storage of water.

The following **Table 4.3** lists potential Phase II Energy Sector actions, identifies the anticipated implementer (City of Chico or the greater community), and provides the unit of measurement and emission factors that will be used to calculate the annual 2020 GHG emissions reductions for each action (if available).

Phase II Energy Sector Actions

Table 4.3

		Implementor		GHG Emissions Estimates	
		City of Chico	Greater Community	Unit of Measurement	Emission Reduction/ Unit (MtCO2e)
Objective 1: Upgrade and Tune-up Equipment					
1.1	Building Retrocommissioning		x	sq ft commissioned	0.0004
1.2	Solar Hot Water Heater Requirement	x		# homes installed	0.6746
1.3	Variable Speed Pool Pumps/Solar Heaters	x	x	# of pump/heaters	TBD
1.4	Solar Irrigation/Groundwater pumps	x	x	# of pump installed	104
Objective 2: Green Building and Energy Efficiencies					
2.1	Additional CalGreen Building Standards	x		sq. ft. "green" buildings	0.00065
2.2	Green Facilities Commitment/Policy	x		sq. ft. "green" buildings	0.00065
2.3	Residential Energy Efficiency Challenge	x		# Kwh/therms saved	0.00029/ 0.0056
Objective 3: Improve Lighting Efficiencies					
3.1	Bi-level Parking Garage/Lot Lights	x	x	# Kwh saved	0.00029
Objective 4: Renewable Energy Generation					
4.1	Permit Fee Incentives for Alternative Energy Projects		x	# of kwh/therms generated	0.00029/ 0.0056
4.2	Increase City Use of Renewable Energy	x		# of kwh/therms generated	0.000.29/ 0.0056
4.3	Purchase Power Agreements (PPA's)	x	x	# of kwh/therms generated	0.00029
Objective 5: Carbon Reduction					
5.1	Low Carbon Infrastructure Projects	x		TBD	TBD
5.2	Purchase Carbon Offsets	x	x	MtCO2e Offset	1.00
Objective 6: Water Conservation Strategies					
6.1	Encourage Grey Water/Rain Water Systems	x	x	# gallons (per 1,000 gal)	
0.22013					
6.2	Require Weather Based Irrigation Controllers	x		# acres irrigated	0.00350
6.3	CA 20 by 2020 Water Conservation Plan	x	x	# of gallons reduced	0.00350

Solid Waste Sector Actions

Objective 1: Expand Recycling Efforts

1.1 **City Waste Policy:** The City will consider establishing a waste-reduction program for municipal operations by designing and managing goods and products to allow for the reduction, reuse, and recycling of waste, where feasible. Specifically, the City would establish a detailed recycling, composting, and Staff education program that would establish a goal that on a per capita basis that at least 75% of materials are reused, recycled, or composted.

1.2 **Increase Construction and Demolition (C&D) Recycling:** If feasible and if local recycling opportunities are available, the City will amend the Chico Muncipal Code to require all new construction to exceed the CALGreen 50% C&D waste diversion requirement by 25% to achieve a 75% diversion rate by 2020.

Objective 2: Expand Composting Efforts

2.1 **Composting of Food Waste:** Currently, the City's compost facility does not have the capacity nor is it permitted to compost food waste. The City will work with the local waste haulers, Butte County, and other agencies to develop a facility or program to compost food waste from commercial and residential sectors.

Solid Waste Objective 3: Renewable Energy Generation

3.1 **Expand Landfill Methane Capture:** During Phase I, Butte County began capturing methane out of the landfill that was estimated to generate up to 2.2 megawatts. The County intends to expand the methane capture program, which is estimated to generate up to 4.3 megawatts per year.

The following **Table 4.4** lists potential Phase II Energy Sector actions, identifies the anticipated implementer (City of Chico or the greater community), and provides the unit of measurement and emission factors that will be used to calculate the annual 2020 GHG emissions reductions for each action (if available).

Phase II Solid Waste Sector Actions

Table 4.4

		Implementor		GHG Emissions Estimates	
		City of Chico	Greater Community	Unit of Measurement	Emission Reduction/ Unit (MtCO2e)
Objective 1: Expand Recycling Efforts					
1.1	City Waste Reduction Policy	x		Tons Diverted	0.026
1.2	Construction/Demolition Recycling	x	x	Tons Diverted	0.011
Objective 2: Expand Composting Efforts					
2.1	Compost Food Waste	x	x	Tons Diverted	0.024
Objective 3: Renewable Energy Generation					
3.1	Expand Landfill Methane Gas Recovery		x	Additional Kw generated	0.6965

Summary of CAP Emissions Reductions

Table 4.5 below demonstrates how the estimated GHG emissions reductions from all of the actions in Phase I and Phase II combined will reduce the 2020 emissions by **309,755 MtCO2e** for the Chico area to an annual emissions level of **385,749 MtCO2e**, which is 25% below baseline levels and 44.5% below BAU projections for 2020. The Chico CAP outlines a path to meet the City's aggressive GHG emissions reduction goal.

It provides an opportunity to evaluate the success of its implementation and make mid-course corrections if necessary to meet the goal. The City of Chico is committed to achieving the 2020 CAP goal, honoring the Mayor's Climate Protection Agreement, supporting California's Global Warming Solutions Act (AB 32), and being a regional leader in climate action.

Summary of 2020 Emissions Reductions Estimates

Table 4.5

	Total Estimated Emissions Reductions (MtCO2e)		
SECTOR	Phase I	Phase II	Total
TOTAL ESTIMATED LOCAL ACTIONS REDUCTIONS:	78,649	26,590	105,239
TOTAL ESTIMATED EXTERNAL ACTIONS REDUCTIONS:	84,874	64,713	149,587
TARGETED REDUCTIONS FOR UNQUANTIFIED ACTIONS:	2,297	52,632	54,929
TOTAL 2020 EMISSION REDUCTIONS:	165,820	143,935	309,755

Beyond 2020

Although AB 32 does not formally establish a GHG reduction target beyond 2020, the Governor's Executive Order S-3-05 signed in 2005 created a statewide goal to reduce GHG emissions to 80% below 1990 levels by 2050. The City will evaluate whether to establish a more aggressive GHG reduction target as part of its ongoing monitoring of the implementation of this CAP and its review of whether the 2020 reduction goal was attained.

A

Appendices

Appendix A-1: Community and Municipal Greenhouse Gas And Criteria Air Pollutant Emissions Inventory

Introduction and Addendum

Inventory & Projection Methodology

The inventory was calculated using the Clean Air and Climate Protection (CACP) software developed by ICLEI. The CACP software is an emissions-management tool that allows the user to track electricity and natural gas consumption, vehicle miles traveled, and solid waste tonnages. The software then converts the data into quantified GHG emissions.

Generating this emissions inventory required the collection of information from a variety of sources, including the Pacific Gas and Electric Company (PG&E), the California Public Road Data—Highway Performance Monitoring System, the California Integrated Waste Management Board, the City of Chico, and Butte County Solid Waste Management.

Once the inventory baseline was established, it became possible to project future emissions levels. That forecast, known as a "Business as Usual" Emissions Scenario, represents a critical tool for gauging the extent of actions necessary to reduce emissions to target levels. The scenario assumes that all emissionsproducing activities continue at the same level as in 2005, with no action taken to mitigate emissions. It also takes into account population growth and the associated increase of GHG emissions.

Chico's community-wide emissions levels were projected through the year 2020 based on growth rates for five emissions sectors:

- Transportation
- Waste
- Commercial Energy Consumption
- Residential Energy Consumption
- Industrial Energy Consumption

Each sector has a different relative overall contribution to emissions levels, and each has a slightly different growth rate.

A copy of the complete Inventory is attached to this document.

Adjustments to Original Inventory and Projections

Revised 2005 Baseline Emissions:

After making the necessary emissions-factor adjustments, the baseline emission level was revised to 516,869 MtCO2e. The inventory found 64% of the emissions came from the transportation sector, 16% from commercial energy consumption, 14% from residential energy consumption, 5% from solid waste sent to the landfill, and less than 1% from industrial energy consumption. Given a population of 94,887 in 2005, the annual per capita emissions generated during the base year translated to approximately 5.45 $MtCO_2e$ per person.

Energy Emission Factor Revision:

The basic process of an emissions inventory comprises identifying the activities that generate emissions, quantifying the scale on which they are occurring, and converting those aggregated impacts into a measurement of GHG emissions. That final conversion is made using what is known as an emissions factor: a coefficient that represents the per-unit emissions generated by an activity.

The emissions factor for energy consumption that had been used in the original inventory was based on an average of several utility companies in the Pacific Northwest region; this was the default calculation in the CACP software. The Chico community, however, is primarily served by only one energy utility, Pacific Gas and Electric (PG&E). Many of the other utilities included in the default average had "dirtier" grid mixes than PG&E in terms of GHG emissions, due in part to PG&E's expansive hydroelectric generation.

Using the default average resulted in an over-inflated emissions impact from the consumption of energy by the Chico community. Subsequently, City staff received energy-generation figures from PG&E and calculated an emissions factor specific to the Chico area. City staff adjusted the baseline emissions levels accordingly.

Growth Projection Revisions:

Part of the inventory process involved projecting future growth by looking at five growth factors, one for each sector — solid waste, transportation and residential, commercial and industrial energy use. The original GHG Emissions Inventory used the best available default growth averages available at that time to project the "Business as Usual" 2020 emissions.

Shortly after the inventory was completed, the city began updating its General Plan. The Climate Action Plan is a companion document to the General Plan Update (GPU); thus, the future emissions projections were recast based on the residential, commercial and industrial growth rates used in the GPU, rather than the default averages initially in the inventory.

The results that follow are projections in line with the GPU. The five adjusted growth rates used to project future emissions levels average out to an overall growth rate of just over 2% per year. This is consistent with the historical trend of roughly 2% annual population growth for Chico. At this rate, emissions for the community of the Greater Chico urban area are projected to increase to a level of 698,006 MtCO2e by the year 2020. The emission and growth adjustment factors used to revise the GHG inventory are depicted in the following tables:

Appendix A-2 : Emissions Factor Adjustments

All unlabeled values are Metric Tons of CO_2 Equivalent

Original Emissions Inventory Results

Emissions Sector	Base Year Emissions
Transportation	332,602
Waste	19,987
Residential Energy	119,135
Commercial Energy	138,527
Industrial Energy	700
TOTAL	610,951

SOURCE: GHG Inventory table 3.1

Emissions Sector	Percent of Energy Emissions from Electricity
Residential Energy	44%
Commercial Energy	66%
Industrial Energy	66%

SOURCE: GHG Inventory sections 3.2.4.1 & 3.2.5.1

Assumption: % Emissions from Electricity for Industrial set same as Commercial

Adjusted Electricity Consumption Emissions Factor

E.F. Source	Factor (MtCO2e/ gWh)
Original - Regional	675
Adjusted- PG&E Specific	223
Variance:	67%

SOURCES: Pacific Gas & Electric; ICLEI's Clean Air & Climate Protection Software

Adjusted Base Year Emissions from Electricity Consumption

Sector	Original Base Year Emissions	Adjusted Base Year Emissions
Residential Electricity	52,419	17,323
Commercial Electricity	91,428	30,214
Industrial Electricity	462	153

Adjusted Base Year Emissions from Energy Consumption (Electricity & Natural Gas)

Sector	Adjusted Electricity Emissions	Additional Sector Emissions	Adjusted Aggregate Base Year Energy
Residential Energy	17,323	66,716	84,039
Commercial Energy	30,214	47,099	77,313
Industrial Energy	153	238	391

Adjusted Aggregate Base Year Emissions

Sector	Base Year Emissions
Transportation	332,602
Waste	19,987
Residential Energy	84,039
Commercial Energy	77,313
Industrial Energy	391
TOTAL	**514,331**

Appendix A-3 : Derivation of Growth Rates for Adjustment to 'BAU' Emissions Projections

Population (Residential Sector) Growth Rate

Pop. Sphere of Influence, 2008:	99,451
Projected Increase 2008-2030:	40,262
Pop. 2030 Projection:	139,713
Annual Growth Rate, 2008-2030:	1.56%

SOURCE: City of Chico General Plan 2030 Update LU 3-2

Transportation Sector Growth Rate

Year:	2001	2002	2003	2004	2005	2006	2007
Daily Vehicle Miles Traveled:	1,267,500	1,326,370	1,308,000	1,352,300	1,527,900	1,523,800	1,440,070
Annual VMT:	462,637,500	484,125,050	477,420,000	493,589,500	557,683,500	556,187,000	525,625,550
% Change from Previous Year:		4.64%	-1.38%	3.39%	12.99%	-0.27%	-5.49%
Avg. Annual Growth Rate, 2001-2007:	2.31%						

SOURCE: *California Public Road Data* Highway Performance Monitoring System- CDOT. http://www.dot.ca.gov/hq/tsip/hpms/datalibrary.php

Commercial / Industrial Sector Growth Rate

Job Sector	# Employees		Increase	Growth Rate 2008–2030
	2008	**2030**		
Retail:	13,936	18,879	4,943	1.39%
Office:	11,095	15,030	3,935	1.39%
Industrial:	9,506	12,877	3,371	1.39%

SOURCE: *BAE Market Opportunities and Land Absorption ProjectionsTables #6, #7*

Waste Sector Growth Rate

Average Annual Growth Rate:	1.62%

SOURCE: *Original GHG Inventory CACP Software*

Appendix B: Business As Usual Emissions Projections

All unlabeled values are Metric Tons of CO_2 Equivalent

	Year	Population	Emissions Sector					Aggregate Emissions
			Transportation	Waste	Residential Energy	Commercial Energy	Industrial Energy	
Growth Rate:		1.56%	2.31%	1.62%	1.56%	1.39%	1.39%	2.03%
	2005	94,869	332,602	19,987	84,039	77,313	391	**514,332**
	2006	96,372	340,285	20,311	85,350	78,388	396	524,730
	2007	97,900	348,146	20,640	86,681	79,477	402	535,346
	2008	99,451	356,188	20,974	88,034	80,582	408	546,185
	2009	101,002	364,416	21,314	89,407	81,702	413	557,252
	2010	102,578	372,834	21,659	90,802	82,838	419	568,551
	2011	104,178	381,446	22,010	92,218	83,989	425	580,089
	2012	105,803	390,258	22,367	93,657	85,157	431	591,869
	2013	107,454	399,273	22,729	95,118	86,340	437	603,897
	2014	109,130	408,496	23,097	96,602	87,540	443	616,178
	2015	110,833	417,932	23,471	98,109	88,757	449	**628,718**
	2016	112,562	427,586	23,852	99,639	89,991	455	641,523
	2017	114,318	437,464	24,238	101,194	91,242	461	654,599
	2018	116,101	447,569	24,631	102,772	92,510	468	667,950
	2019	117,912	457,908	25,030	104,375	93,796	474	681,583
	2020	119,752	468,485	25,435	106,004	95,100	481	**695,505**
% Total, 2020:			67.36%	3.66%	15.24%	13.67%	0.07%	100%

Appendix C-1: Emissions Factors & Cost Calculations for Cost Benefit Analysis

Emissions Factors

Electricity

Emissions/kWh PG&E Grid Mix 2008

	CO2	CH4	N2O
lbs/ megawatt per hour (mWh)	641.35	0.0302	0.0081
Metric Tons/ mWh	0.290911812	1.36985E-05	3.6741E-06
Metric Tons/ kilowatt per hour (kWh)	0.000290912	1.36985E-08	3.6741E-09
mtCO2e/ kWh	0.000290912	3.15066E-07	1.08753E-06

mtCO2e/ gigawatt per hour (gWh)	292.3144125

mtCO2e/ kWh	0.00029

Sources: CO2: PG&E CCAR Reporting Year 2008
CH4/ N2O: EPA eGRID WECC Calif. Subregion Data Year 2005

Natural Gas

Emissions/Therm Natural Gas (National Average)

	CO2e
Metric Tons/ Therm	0.00560219

mtCO2e/ therm	0.00560

Source: ICLEI's CAPPA V1.0

Gasoline

Emissions/Gallon Gasoline (Nat'l Avg.)

	CO2	CH4	N2O
Metric Tons/ Gallon	0.00941273		

mtCO2e/g	0.00941

Source: ICLEI's CAPPA V1.0
Emission factors for gas exclude CH4 and N2O 'due to the difficulty of combining technology dependent emissions factors with thos for CO2, which rely on volume of fuel consumed only. The effect of this omission is small relative to CO2 emissions.

Diesel

Emissions/ Gallon Diesel Fuel (Nat'l Avg.)

	CO2	CH4	N2O
Metric Tons/ Gallon	0.00953091		

mtCO2e/g	0.00953

Source: ICLEI's CAPPA V1.0

Emission factor for gas exclude CH4 and N2O 'due to the difficulty of combining technology dependent emissions factors with thos for CO2, which rely on volume of fuel consumed only. The effect of this omission is small relative to CO2 emissions.

Compressed Natural Gas

Emissions/ Standard Cubic Foot CNG (Nat'l Avg.)

	CO2	CH4	N2O
Metric Tons/ SCF	0.000054		

mtCO2e/SCF	0.00005

Source: ICLEI's CAPPA V1.0

Emission factors for gas exclude CH4 and N2O 'due to the difficulty of combining technology dependent emissions factors with thos for CO2, which rely on volume of fuel consumed only. The effect of this omission is small relative to CO2 emissions.

Costs

Price of Energy

Electricity	Natural Gas
$0.12 per kWh	$1.12 per Therm

Source: Pacific Gas & Electric

Price of Water

	Units	Conversions
$0.88	per 100 cu. ft.	
$0.0088	per 1 cu. ft.	7.48 gallons/cu. ft.
$0.0012	per gallon	0.13368984 cu. ft./gallon

Source: California Water Service Co. Schedule NO. CH-1-NR (July 2010)

Price of Fuel

		Units	Conversions
CNG:	$1.93	per gge	1.14 therms/ gge
	$1.74	per therm	100 cu. ft./ therm
	$0.02	per cubic foot	
Gasoline:	$3.69	per gallon	
Diesel:	$3.62	per gallon	
B20 Biodiesel:	$3.69	per gallon	

Source: DOE "Clean Cities Alternative Fuel Price Report" 2010

Appendix C-2: Cost Benefit Analysis of Energy, Water, and Transportation Sector Actions

Energy & Water Actions

	Energy and Water Actions	Up-Front Costs/ Unit	Simple Payback (Years)	Net Cost/ MteCO2 Mitigated
1	Low Maintenance Landscaping	$0	0.0	-$793
2	Central Irrigation Control System	$1,500	4.4	-$784
3	Energy Star Printers	$10	0.2	-$362
4	Occupancy Sensors	$0	0.2	-$354
5	Energy Star Copiers	$50	0.6	-$338
6	PC Power Mgmt Software	$20	0.6	-$329
7	Energy Star Clothes Washers	$150	4.4	-$318
8	Energy Star Vending Machines	$200	1.0	-$310
9	Energy Star Window AC	$10	0.9	-$302
10	LED Exit Signs	$57	1.7	-$282
11	Decrease Street Light Hours (2 hrs/day)	$0	0.0	-$260
12	Torchiere Exchange	$46	2.3	-$260
13	Install Low Flow Showerheads	$29	0.8	-$250
14	Lights Out at Night Policy	$0	0.0	-$227
15	Energy Star Refrigerators	$200	3.6	-$226
16	Landfill Gas Energy Generation	$1,400	4.9	-$193
17	Energy Star Water Coolers	$100	4.1	-$186
18	Building Retro-commissioning	$1	3.5	-$184
19	Green Business Program Participation	$100	0.1	-$172
20	Green Building to Code	$2	2.7	-$169
21	Low Income Weatherization	$0	0.0	-$155
22	Commercial Efficiency Retrofits	$1	4.4	-$154
23	Commercial Lighting Upgrades	$85	7.9	-$151
24	Energy Fitness Program: Lighting	$1	7.9	-$150
25	Use Wind Energy	$1,540	8.4	-$141
26	Energy Star Dishwashers	$90	4.2	-$138
27	Reflective Roofing	$0	8.7	-$137
28	Plant Trees to Shade Buildings	$224	9.2	-$135
29	Energy Star Water Heaters	$1,049	5.4	-$131
30	Efficient/ Affordable New Housing	$3,000	6.4	-$129
31	Energy Star Computers	$100	4.1	-$128
32	Water Pump Efficiency	$80	7.5	-$122
33	Residential Efficiency Campaign	$500	1.2	-$120
34	LED Street Lights	$688	10.7	-$118
35	Home Weatherization Retrofit at Sale	$750	4.7	-$105
36	Wastewater Gas Energy Generation	$7,612	8.0	-$23
37	Purchase Carbon Offsets	$10	N/A	$10
38	Solar Hot Water Heaters	$3,000	15.4	$67
39	Chiller Retrofits	$18	21.4	$71
40	Install Solar PV	$7,800	29.7	$207
41	HVAC Control Retrofits	$7	31.5	$238
42	Energy Star Computer Monitors	$100	13.7	$430
43	Geothermal Heat Pump	$12,380	(None)	$1,033

Transportation Actions

	Transportation Actions	Up-Front Costs/ Unit	Simple Payback (Years)	Net Cost/ MteCO2 Mitigated
1	**Provide Bikes for Daily Trips**	$250	(None)	-$338
2	**Compressed Natural Gas Vehicle Conversion**	$3,000	3.2	-$324
3	**Electric Vehicle Charging Stations**	$1,500	2.3	-$240
4	**Telecommuting (Once a Month)**	$0	0.0	-$217
5	**Parking Cashout Program**	$0	0.0	-$217
6	**Limit Heavy Truck Idling**	$0	0.0	-$210
7	**Limit Transit Bus Idling**	$0	0.0	-$210
8	**Franchise Waste Zones**	$0	0.0	-$210
9	**Limit School Bus Idling**	$0	0.0	-$210
10	**Safe Routes to School Program**	$0	0.0	-$187
11	**Fuel Efficient (EV) Parking Enforcement**	$8,000	4.1	-$183
12	**Transit-Oriented Development**	$8,000	4.1	-$183
13	**Subsidize Employee Bus Ridership**	$242	(None)	-$168
14	**Transportation Ed. (8% VMT reduction)**	$29	(None)	-$151
15	**Hybrid Vehicles**	$7,000	5.4	-$125
16	**Electric Vehicles**	$7,000	4.4	-$118
17	**Flex Scheduling (9/10 days)**	$0	0.0	-$84
18	**Carpooling Program**	$8,500	(None)	-$72
19	**Carshare Program**	$0	0.0	-$42
20	**Expand Bus Service**	$186	1.0	-$11
21	**B20 Biodiesel Conversion**	$2,033	(None)	$181
22	**New Bike Paths**	N/A	N/A	N/A
23	**Transportation & Circulation Planning Committee**	N/A	N/A	N/A
24	**Support Local Businesses**	N/A	N/A	N/A

Appendix D-1: Calculation Of GHG Emissions Reductions for Phase I Transportation Actions

		Implementation Unit of Measurement	Units Measured or Estimated	Annual Emissions Reduction/ Unit	Estimated Emissions Reductions (MtCO2e)		
TRANSPORTATION SECTOR ACTIONS"					**City of Chico**	**Greater Community**	**Total Reduction**
Objective 1: Reduce Vehicle Miles Traveled							
1.1	Promote Car Share Programs	# participants	850	2.18342		1,856	1,856
1.2	City Fleet Optimization	# of gallons of gas reduced	32,731	0.00941	308		308
1.3	Subsidize Employee Bus Ridership	# employees offered	2,000	2.15394		4,308	4,308
1.4	Flexible Work Schedules	# employees offered	148	0.15529	23		23
1.5	City Travel Demand Management Plan		TBD		TBD		TBD
1.6	Carpooling Program	# groups of 150 members	10	28.77000		288	288
1.7	Employer Trip Reduction Programs	# employees offered	TBD			TBD	TBD
1.8	Expanded and Improved Bus Service	# additional daily riders	2,250	2.15394		4,846	4,846
1.9	Regional Transportation Planning					TBD	0
1.10	Sustainable Policy/Regulatory Framework including:	# of gallons of gas reduced	823,981	0.00941		7,754	7,754
	1 Tiered City Fee Structure						Included in Action 1.10
	2 Pedestrian Connections for New Development						Included in Action 1.10
1.11	Expand Bicycling/Pedestrian Infrastructure						Included in Action 1.10
1.12	Complete Streets Policy						Included in Action 1.10
1.13	Corridor Management/Traffic Calming		TBD			TBD	TBD
1.14	New Bike Paths	# of gallons of gas reduced	154,644	0.00941		1,455	1,455
1.15	Solid Waste Franchise System	# of gallons of diesel reduced	71,636	0.00953		683	683
1.16	Safe Routes to Schools	# students offered	TBD	0.07000		TBD	TBD
1.17	Update of City Parking Standards		TBD			TBD	TBD
Objective 2: Expand Use of Alternative Fuels							
2.1	Community Use of Biodiesel (B20)	# vehicles converted	8	1.36156		11	11
2.2	Hybrid Vehicles	# vehicles switched	266	3.28962	53	822	875
2.3	Electric Vehicles	# vehicles switched	13	5.71651		74	74
2.3	Electric Vehicle Charging Stations	# stations installed	2	1.69702		3	3
2.5	Compressed Natural Gas (CNG) Conversion:	# B-Line buses converted	12	15.50000		186	186
				TOTAL:	**384**	**22,286**	**22,670**

Appendix D-2: Calculation Of GHG Emissions Reductions for Phase I Energy Sector Actions

		Implementation Unit of Measurement	Units Measured or Esti-mated	Annual Emissions Reduction/ Unit	Estimated Emissions Reductions (MtCO2e)		
PHASE I: ENERGY SECTOR ACTIONS					**City of Chico**	**Greater Community**	**Total Reduction**
Objective 1: Upgrade and Tune-up Equipment							
1.1	Energy Star Appliances and Equipment	# of Kwh saved	17,213,218	0.00029		4,992	4,992
		# of Therms saved	34,331	0.00560		192	192
1.2	Personal Computer Recycling and Power Mgmt.	# of Kwh saved	106,020	0.00029	31		31
1.3	HVAC/Boiler Retrofits	sq. ft. of facilities-HVAC	228,000	0.00056		128	128
		sq. ft. of facilities-Boiler	530,097	0.00209	717	391	1,108
		# of Kwh saved	374,000	0.00029	27	108	135
Objective 2: Green Building and Energy Efficiencies							
2.1	CalGreen Building Standards	sq. ft .'green' construction	506,918	0.00065		329	329
2.2	Reflective or Cool Roofs	sq. ft. reflective roofing installed	397,500	0.00025		99	99
2.3	Low Income Weatherization Program	# homes weatherized	12,736	1.00483		12,798	12,798
2.4	Home Energy Requirement Upon Resale (RECO)	# homes weatherized	50	0.75362		38	38
2.5	Innovator Pilot Energy Efficiency Program	# homes participating	100	0.75362		75	75
2.6	Financial Incentives for Energy Efficiency (PACE)	types of improvements installed	TBD	TBD		TBD	TBD
Objective 3: Improve Lighting Efficiency							
3.1	LED Street Lights	# streetlights replaced	1,141	0.1402	160		160
3.2	Commercial Light Upgrades	sq. ft. of facilities	488,263	0.02619		12,788	12,788
		# of Kwh saved	145,529	0.00029	42		42
3.3	Occupancy Sensors	sq. ft. facilities with sensors	150,988	0.0007		106	106
3.4	LED Exit Signs	# exit signs replaced	100	0.0795	8		8
3.5	Energy Fitness Commercial Lighting Upgrades	# of Kwh saved	14,564,058	0.00029		4,224	4,224
Objective 4: Renewable Energy Generation							
4.1	Solar Photovoltaic Systems	Kw produced	12,005	0.64020		7,686	7,686
		kWh produced	2,190,000	0.00029	635		635
4.2	CSU, Chico Switch in Energy Providers	MtCO2e saved	8,730	n/a direct		8,730	8,730
4.3	Wastewater Treatment Plant Methane Recovery	kWh produced	2,641,140	0.00029	766		766
Objective 5: Promote a Healthy Urban Forest							
5.1	Urban Forest Management Plan	number of trees planted	TBD			TBD	TBD
Objective 6: Water Conservation Strategies							
6.1	Weather Based Irrigation Controllers	# acres on central controller	41	0.22013	6	4	10
6.2	Water Efficient Public Landscaping (AB 1881)	# gallons of water saved	TBD	0.00350	TBD	TBD	TBD
6.3	Low Maintenance Landscaping	acres of low maint. landscaping	251	0.37118		93	93
6.4	CA 20 by 2020 Water Conservation Plan	# gallons of water saved	TBD	0.00350	TBD	TBD	TBD
6.5	Free Water Audit Program	# gallons of water saved	TBD	0.00350	TBD	TBD	TBD
				TOTAL:	**2,391**	**52,780**	**55,171**

Appendix D-3: Calculation Of GHG Emissions Reductions for Phase II Energy Sector Actions

		Implementer		GHG Emissions Estimates	
PHASE II ENERGY SECTOR ACTIONS		City of Chico	Greater Community	Unit of Measurement	Emission Reduction/ Unit (MtCO2e)
Objective 1: Upgrade and Tune-up Equipment					
1.1	Building Commissioning/Retrocommissioning		x	sq ft commissioned	0.0004
1.2	Solar Hot Water Heater Requirement	x		# homes installed	0.6746
1.3	Variable Speed Pool Pumps/Solar Heaters	x	x	# of pump/heaters	TBD
1.4	Solar Irrigation/Groundwater pumps	x	x	# of pump installed	104
Objective 2: Green Building and Energy Efficiencies					
2.1	Additional CalGreen Building Standards	x		sq. ft. “green” buildings	0.0016
2.2	Green Facilities Commitment/Policy	x		sq. ft. “green” buildings	0.0016
2.3	Residential Energy Efficiency Challenge	x		# of residents participating	1.22
Objective 3: Improve Lighting Efficiencies					
3.1	Bi-level Parking Garage/Lot Lights	x	x	# of lights installed/Kwh	TBD
Objective 4: Renewable Energy Generation					
4.1	Permit Fee Incentives for Alternative Energy Projects		x	# of kwh/therms generated	0.0003/.0056
4.2	Increase City Use of Renewable Energy	x		# of kwh/therms generated	0.0003/.0056
4.3	Purchase Power Agreements (PPA’s)	x	x	# of kwh/therms generated	0.0003
Objective 5: Carbon Reduction					
5.1	Low Carbon Infrastructure Projects	x		TBD	TBD
5.2	Purchase Carbon Offsets	x	x	MtCO2e Offset	1.00
Objective 6: Water Conservation Strategies					
6.1	Encourage Grey Water/Rain Water Systems	x	x	# gallons saved (per 1,000 gal)	0.0019
6.2	Require Weather Based Irrigation Controllers	x		# acres irrigated	0.2201

Appendix D-4: Calculation Of GHG Emissions Reductions for Phase I Waste & Community Outreach Actions

		Implementation Unit of Measurement	Units Measured or Estimated	Annual Emissions Reduction/ Unit	Estimated Emissions Reductions (MtCO2e)		
PHASE I SOLID WASTE SECTOR ACTIONS					**City of Chico**	**Greater Community**	**Total Reduction**
Objective 1: Expand Recycling Efforts							
1.1	Residential/Multifamily Recycling	Tons Diverted	TBD	0.0140		TBD	TBD
1.2	Commercial/Industrial Recycling	Tons Diverted	857	0.0140		12	12
1.3	City Municipal Recycling Program	Tons Diverted	TBD	0.0140	TBD		TBD
1.4	Environmentally Preferable Purchasing				TBD		TBD
Objective 2: Expanded Composting							
2.1	Yard Waste and Other Organic Composting	Tons Diverted	12,756	0.0132	63	105	168
Objective 3: Green Building							
3.1	CalGreen Building Standards (50% C&D Diversion)	Tons Diverted	TBD	0.0140		TBD	TBD
Objective 4: Renewable Energy Generation							
4.1	Landfill Methane Gas Recovery	Landfill Gas Emissions Rate	1018	0.0841		86	86
				TOTALS:	**63**	**203**	**266**

		Implementation Unit of Measurement	Units Measured or Estimated	Annual Emissions Reduction/ Unit	Estimated Emissions Reductions (MtCO2e)		
PHASE I COMMUNITY OUTREACH ACTIONS					**City of Chico**	**Greater Community**	**Total Reduction**
Objective 1: Community Outreach							
1.1	Sustainable Business Recognition Program	# of businesses participating	100	5.41762		542	542

Appendix E: Cost-Benefit Analysis of City-Implemented Projects in Phase I

Project	Upfront Costs	Rebates	Net Up-Front Costs	Additional Annual Operating Costs	Annual Fuel Savings		Annual $ Savings	Project Lifetime	Internal Simple Payback	Annual Emissions Reduction	Additional/ External Annual Savings	Net Present Value
										(MtCO2e)		
Transportation	**(City)**				**g Gasoline**		**(City)**			**(Total)**	**(Community)**	
Flex Schedule	$0	$0	$0	$0	2,458		$9,070	2	N/A	23	$0	$17,834
New Bike Path- 99	$3,425,000	$0	$3,425,000	$13,500	75,417		$0	15	(None)	710	$278,289	-$255,082
New Bike Path- 2nd Street	$904,944	$0	$904,944	$0	79,227		$0	15	(None)	746	$292,348	$2,668,999
Police on Bikes	$6,000	$0	$6,000	$200	4,516		$63,462	5	0.1	43	$0	$278,241
Franchise Waste Zones	$0	$0	$0	$0	71,636		$0	40	N/A	683	$0	$0
Additional Hybrid Vehicles	$112,000	$0	$112,000	$0	5,592		$20,634	10	5.4	53	$0	$65,608
Energy Conservation					**kWh**	**Therms**						
PC Power Mgmt	$7,500	$5,700	$1,800	$0	106,020		$12,722	10	0.1	31	$0	$107,710
HVAC Control Retrofits	$348,792	$0	$348,792	$0	92,142		$11,057	25	31.5	27	$0	-$160,177
CH/CC Chillers	$880,014	$61,945	$818,069	$0	343,097		$41,172	25	19.9	100	$0	-$115,748
LED Street Lights	$786,528	$120,850	$665,678	$0	548,295		$73,796	25	9.0	160	$0	$593,168
Lighting Upgrades	$68,772	$8,458	$60,314	$0	145,529		$17,463	25	3.5	43	$0	$237,584
Weatherization/ Energy Audits- Pilots	$0	$0	$0	$0	128,500	4,250	$0	2	N/A	61	$20,180	$39,678
Solar PV	$8,400,000	$4,200,000	$4,200,000	$0	2,190,000		$262,800	25	16.0	640	$0	$282,939
Wastewater Gas Capture	$2,550,000	$0	$2,550,000	$0	2,641,140		$316,937	10	8.0	772	$0	$178,093
Water Conservation					**kWh**	**g Water**						
Additional Acreage CIC	$37,500	$0	$37,500	$0	18,827	5,379,000	$8,577	15	4.4	6	$0	$64,746
Waste Management					**tons Waste**							
Additional City Composting	$0	$0	$0	$0	4,776		$0	10	N/A	63	$0	$0
									TOTALS:	**4,160**		**$4,003,594**

Appendix F: GHG Emissions Reductions from External Actions

PG&E Grid Mix Change

	2005	2015	2020
Grid Mix Makeup			
Natural Gas:	39%	32%	27%
Nuclear:	22%	22%	22%
Large Hydro:	16%	16%	16%
Renewable:	14%	26%	33%
Coal:	9%	4%	2%
Other:	(1%, accounted from 'coal')		
Total:	**100%**	**100%**	**100%**

Projected kWh consumption:		591,680,443	636,298,665

Emissions/yr Using 2005 Mix (MtCO2e):		156,241	
Emissions/yr Using 2015 Mix (MtCO2e):		108,734	116,934
Emissions/yr Using 2020 Mix (MtCO2e):			90,160
Total Estimated Reduction:		**47,507**	**26,774**

Fuel Efficient Vehicles (Pavley)

	2008 (2005)	2015	2020
Projected VMT gasoline Use		651,705,808	730,536,660
Projected VMT diesel Use		49,053,126	54,986,632

Emissions/gal gasoline	0.00941		
Emissions/gal diesel	0.00953		

Average Vehicle Fuel Efficiency (MPG)			
Gasoline	19.70	21.75	24.01
Diesel	5.50	6.07	6.70

(Assumed 2% incease/yr)

Emissions/yr With 2005 Levels (MtCO2e):			
Gasoline		311,387	316,148
Diesel		85,004	86,303

Emissions/yr at Expected New Levels (MtCO2e):			
Gasoline		282,033	286,345
Diesel		76,991	78,168

Estimated GHG Reduction (gasoline):		29,354	29,803
Estimate GHG Reduction (diesel):		8,013	8,136
	Total Estimated Reductions:	37,367	37,939

Summary of Total Emissions Reductions from External Actions by 2020	**Phase I MtCO2e**	**Phase II MtCO2e**
Estimated Total GHG Reductions :	**84,874**	**64,713**

ATTACHMENT "1" TO THE
CITY OF CHICO 2020 CLIMATE ACTION PLAN

City of Chico Greenhouse Gas & Criteria Air Pollutant Emissions Inventory

Summer 2008

CITY OF CHICO
INC. 1872

City of Chico
COMMUNITY AND MUNICIPAL GREENHOUSE GAS AND CRITERIA AIR POLLUTANT EMISSIONS INVENTORY

April 2008

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The first step to reduce our carbon footprint.

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1. Introduction

1.1. Climate Change

Over the past 20 years, the extent, cause and impacts of global climate change have been debated with some uncertainty. However, more than 21,500 of the world's top climate scientists have reached consensus that global climate change is a human-created environmental and economic challenge of significant scope. According to the report *Climate Change 2007: The Physical Science Basis* prepared by more than 1,500 scientists of the Intergovernmental Panel on Climate Change (IPCC):

> *"Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level" (IPCC, 2007).*
>
> *"Most of the observed increase in globally average temperatures since the mid-20th century is* very likely[1] *due to the observed increase in anthropogenic greenhouse gas concentrations"(IPCC, 2007).*
>
> *"Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would* very likely *be larger than those observed during the 20th century" (IPCC, 2007).*

While the effects of global climate change may be difficult to perceive in Chico, scientists have observed significant changes in seasonal timing, or phenology. In a recent article published by the Associated Press and printed in the *Chico Enterprise-Record*, science writer Seth Borenstein wrote that "The fingerprints of man-made climate change are evident in seasonal timing changes for thousands of species on Earth."[2] This phenomenon is coupled with early warm storms that threaten the snow pack of the Sierra Nevada on which Californians are dependent for drinking water, agriculture, and power production. Other broader indicators of climate change include[3]:

- The six hottest years of recorded history (looking at average global temperatures) have all occurred in the last eight years (see Figure 1.1).
- The year 2005 was the hottest on record for the global climate. The average global surface temperature of 14.77 degrees Celsius (58.6 degrees Fahrenheit) was the highest since recordkeeping began in 1880.

[1] The IPCC defines "very likely" as greater than 90 percent.
[2] "Global warming rushes timing of spring." Seth Borenstein, Associated Press Science Writer. Article launched: 03/22/2008.
[3] "2005 Hottest Year on Record." Joseph Florence. http://www.earth-policy.org/Indicators/Temp/2006.htm

- Using records stored in ice, tree rings, and fossils, scientists have estimated that the Northern Hemisphere is warmer now than at any time in the past 1,200 years.
- Another study reported that atmospheric levels of CO_2 and methane, another greenhouse gas, are higher today than at any time in the last 650,000 years.
- The rise in sea surface temperature has also contributed to a record-breaking Atlantic hurricane season, with 27 named storms and 15 hurricanes in 2005.

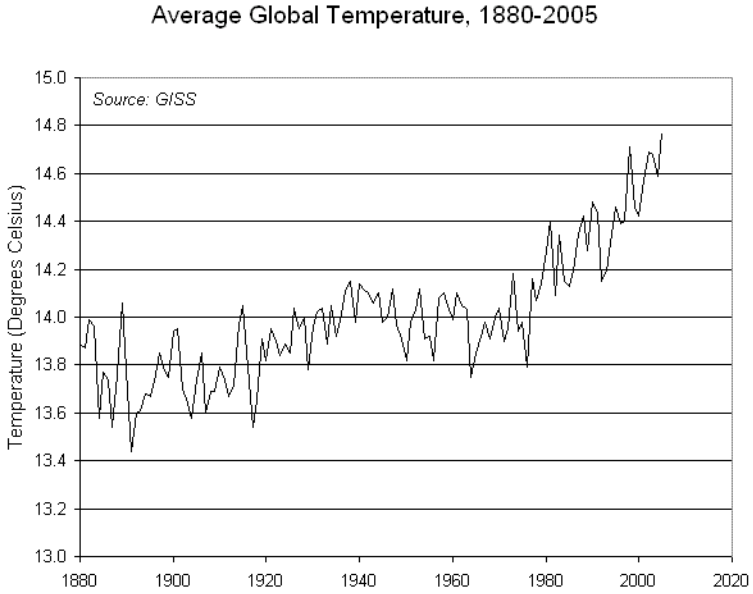

Figure 1.1 Average Global Temperature Change (1880-2005)

Chico is the largest city in Butte County, with more than 70,000 people living within the city limits and more than 100,000 people residing in the Greater Chico Area. Greenhouse gas (GHG) emissions are generated in this locale and contribute to global warming.

The City government and, to a greater extent, the local community are primary contributors of GHG emissions and air pollutants generated in the northern portion of the Central Valley.

An emissions inventory of the Chico community and government is timely. Initiating one of the first emissions inventories in the region makes it likely that similar studies will follow. Additional studies in the region will provide a more comprehensive understanding of Chico as an emissions generator.

1.2. Carbon Footprints and Greenhouse Gas Inventories

The GHG inventory process is relatively new. GHG inventories originated as an international response to mitigating global climate change. Fundamentally, a GHG inventory measures the amount of heat-trapping gases that an entity contributes to the atmosphere. By quantifying

emissions, GHG generators can estimate their "carbon footprint" and benchmark their status against other emissions producers.

Each year, the U.S. Environmental Protection Agency (EPA) prepares a national greenhouse gas inventory report. The 2008 report, which presents estimates of U.S. greenhouse gas emissions and sinks for the years 1990-2006, defines a GHG inventory as:

> *"A greenhouse gas inventory is an accounting of the amount of greenhouse gases emitted to or removed from the atmosphere over a specific period of time (e.g., one year). A greenhouse gas inventory also provides information on the activities that cause emissions and removals, as well as background on the methods used to make the calculations. Policy makers use greenhouse gas inventories to track emission trends, develop strategies and policies and assess progress. Scientists use greenhouse gas inventories as inputs to atmospheric and economic models" (EPA, 2008).*

1.3. Local Solutions for a Global Problem

While international and national efforts to mitigate global climate change have stalled, many cities and locales across the country and around the world have initiated local GHG emissions studies and programs to reduce GHG emissions. Bottom-up initiatives are taking root and growing rapidly in local communities. Actions to abate GHG emissions are rarely global or national. Lasting reductions in GHG emissions are possible only when individuals and organizations change their behavior and activities, and employ different technologies.

Monitoring GHG emissions is the critical first step to setting a goal for emissions reductions, developing polices and programs to achieve that goal, and measuring progress toward reductions. This work represents the first comprehensive effort to quantify GHG emissions generated by the City of Chico municipal government and the Chico community.

1.4. Nine Reasons to Take Action

1. **Reduce our Contribution to Global Climate Change.** The number one reason to create a greenhouse gas action plan is to reduce the quantity of CO_2 produced by the Greater Chico Area and thereby slow our contribution to climate change.

2. **Improve Service Delivery.** Energy efficiency initiatives will enable the City to offer services more efficiently and economically.

3. **Reduce Cost**. By reducing energy consumption, the City and local citizens will save money on energy bills. While energy efficiency initiatives may require an initial capital investment, paybacks within about four to seven years can be expected in many cases and savings will continue beyond the payback period. Furthermore, by reducing energy consumption, the City and its citizens will be less vulnerable to fluctuations in the market price of energy.

4. **Increase Energy Independence.** By generating our own energy through the utilization of local energy resources (e.g., solar, wind, small hydro), Chico can reduce its dependence on remote and centralized sources that are susceptible to fluctuations in market price and reliability.

5. **Improve Air Quality and Public Health**. Air quality in Chico has been identified as the third worst in California.[4] Combustion of fuel wood and fossil fuels used to produce electricity, heat buildings, and power vehicles emit a variety of pollutants known to have negative health impacts and reduce local air quality. Less energy consumption means fewer local air pollutants.[5] Additionally, climate change may lead to an increase in the spread of vector-borne and heat-related diseases, so taking steps to reduce GHG emissions reduces the likelihood of climate-related health problems.

6. **Improve Asset Management.** Asset management is a proactive approach to facility management that includes a systematic review of the state of facility operations and implementation of a logical repair/upgrade schedule. Preventative maintenance improves the value of the City's assets by reducing operating cost, modernizing equipment, and decreasing deferred maintenance. Furthermore, increasing the efficiency of facilities and operations leads to better-run operations and greater client satisfaction, along with increased energy efficiency and the resulting cost savings and emission reductions.

7. **Provide Community Leadership**. By taking concrete steps to address climate change, the City of Chico will provide a solid example for the community, county, and Northern California.

8. **Improve Quality of Life for Citizens/Healthy Cities.** The City can use savings generated by improved efficiency to improve critical community services. Programs that reduce emissions, such as bike paths, public transit, and smart growth, also increase the quality of life by improving air quality, promoting active lifestyles, and creating a more beautiful community. Together, these measures help build a healthier, more sustainable community.

9. **Create Jobs.** The transition to a low emissions society will require innovation and effort. As homes and businesses are retrofitted, new jobs will be created. The transition to a "climate-friendly economy" will also require new educational programs, new technologies, and new businesses, which will create new jobs in our community.

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[4] *Chico Enterprise-Record*. Jan. 26, 2008. Section: Local. Steve Schoonover. Article ID: 8084706.

[5] See Section 2.3.3: "Understanding Analysis Results" for a complete list of criteria air pollutants.

2. Project Background and Purpose

2.1. Project Background

2.1.1. U.S. Mayors Climate Protection Agreement

In October 2006, City of Chico Mayor Scott Gruendl signed the U.S. Mayors Climate Protection Agreement. To date more than 600 mayors have signed the agreement, including more than 115 California cities.[6] Under the U.S. Mayors Climate Protection Agreement, Chico has committed to taking the following three actions:

- Strive to meet or beat the Kyoto Protocol targets, through such actions as anti-sprawl land-use policies, urban forest restoration projects, and public information campaigns.
- Urge state and federal governments to enact policies and programs to meet or beat the greenhouse gas emission reduction target suggested for the United States in the Kyoto Protocol—7 percent below 1990 levels by 2012.
- Urge the U.S. Congress to pass the bipartisan greenhouse gas reduction legislation, which would establish a national emission trading system.

2.1.2. ICLEI's Cities for Climate Protection Campaign

In 1993, at the invitation of ICLEI – Local Governments for Sustainability, municipal leaders met at the United Nations in New York and adopted a declaration that called for the establishment of a worldwide movement of local governments to reduce greenhouse gas emissions, improve air quality, and enhance urban sustainability. The result was the Cities for Climate Protection (CCP) Campaign.

The CCP Campaign has proven that cumulative local actions have a positive impact on global climate change.

Since its inception, the CCP Campaign has grown to involve more than 650 local governments worldwide that are integrating climate change mitigation into their decision making processes. Based on recent analysis, CCP participants account for about 15 percent of global anthropogenic greenhouse gas emissions.[7] Cumulative nationwide CCP members have reported a reduction of more than 23 million $MTCO_2E$ (metric tons of carbon dioxide equivalent) greenhouse gas emissions.[8]

[6] For a complete list of cities that have signed the U.S. Mayors Climate Protection Agreement or more information about the agreement, please visit http://www.ci.seattle.wa.us/mayor/climate/default.htm - who

[7] http://www.iclei.org/index.php?id=811

[8] Because CCP member cities only voluntarily report emission reductions to ICLEI, the total number of reductions associated with the CCP campaign likely far exceeds the 23 million $MTCO_2E$ mentioned above. Source: Personal communication with Ayrin Zahner, program associate, ICLEI USA.

As part of Chico's participation in the CCP Campaign, the City has voluntarily committed to completing the following milestones:

I. Conduct a baseline emissions inventory and forecast.
II. Set an emissions reduction target.
III. Develop an action plan to meet the emissions reduction target.
IV. Implement the action plan.
V. Monitor and verify progress and results.

This report completes milestone I. Milestones II—V are explained in detail in Chapter 5: Next Steps.

2.2. Purpose of the Study

Completion of the GHG inventory represents the first milestone of ICLEI's CCP Campaign. The purpose of this study is to inventory GHG and criteria air pollutant (CAP) emissions produced by the City of Chico's government and the larger community of residents and businesses in the Greater Chico Area. Reporting the City's emissions will aid policy makers in forecasting emission trends, identifying the point sources of emissions generated, and setting goals for future reductions and mitigation.

If you don't measure it, you can't manage it.

The underlying purpose of this study is to move the Chico community toward a sustainable future. A sustainable future requires a shift from valuing what we measure to measuring what we value. By measuring what we value, we can produce meaningful indicators that can influence our current and future behaviors. A good indicator should be resonant, valid, and motivational.

- **Resonant**—Within the user's sphere of understanding and relevance.
- **Valid**—Data from which the indicator is drawn need to be as comprehensive and credible as possible, and the method used to develop the indicator must be as transparent as possible.
- **Motivational**—Reflect issues that are within the user's sphere of influence, provoking and inspiring change.

This project also aspires to assist in identifying and developing information that can improve and complete our understanding of GHG emissions. This includes the gap between knowledge of how emissions are generated locally and how those emissions contribute to global climate change. This investigation also aims to assist in finding common ground between operations and policy makers. The ultimate purpose of this study is to provide a starting point for the City government and greater community to lower their emissions.

2.3. Methodology and Organization

2.3.1. Software

This project was completed using Clean Air and Climate Protection (CACP) Software developed by Torrie Smith Associates (2003) in conjunction with State and Territorial Air Pollution Program Administrators (STAPPA), Association of Local Air Pollution Control Officials (ALAPCO), and International Council for Local Environmental Initiatives (ICLEI). CACP

software is an emissions management tool that allows the user to track emissions and reductions of GHG and CAP emissions associated with electricity, fuel use and waste disposal.[9] The software contains thousands of emission factors that are used to calculate emissions based on simple fuel and energy use data, or by using information on waste disposal. This flexible tool allows the user to enter data in a number of different forms, utilize information collected through other inventory tools, customize emission coefficients, and create new fuel and vehicle types.[10]

2.3.2. Project Organization and Baseline Year

CACP Software is divided into two distinct analyses: a government analysis and a community analysis. The community analysis creates an inventory of the GHG and CAP emissions produced in the Greater Chico Area. The government analysis creates an inventory of the GHG and CAP emissions produced by all municipal government operations. **All GHG and CAP emissions detailed in the government analysis are included in, and not in addition to, the community analysis (Figure 2.1)**. In both analyses, emissions are quantified on data derived from fuel use, electrical use, and waste.

Figure 2.1 Basic project organization

For both the government and community analyses, 2005 was chosen as the baseline year.

ICLEI recommended choosing 2005 as the baseline year because many Californian ICLEI members already decided to use the same year. By conforming to this regional consensus, the City of Chico Community and Municipal Greenhouse Gas and Criteria Air Pollutant Emissions Inventory will more easily be compared with similar analysis from other cities in the region. In addition to 2005, information for adjacent years has been compiled in this analysis in order to establish trend lines.

[9] See section 2.3.3 Understanding Analysis Results for a complete list of GHGs and CAPs.
[10] For more information about CACP Software, visit http://www.cacpsoftware.org/

2.3.3. Understanding Analysis Results

There are six greenhouses gases that are typically measured and monitored in GHG inventories. They are: carbon dioxide (CO_2), nitrous oxide (NO_2), methane (CH_4), sulfur hexafluoride (SF_6), and hydrofluorocarbons (HFCs). CACP software does not, however, quantify the amounts of these individual gases. Instead, the software quantifies all GHG emissions in CO_2 equivalency (CO_2E). This is a convenient way to compare separate gases with distinct global warming properties on the same playing field. Due to the scale of this project, all results are conveyed in metric tons of carbon dioxide equivalency ($MTCO_2E$). A metric ton is equivalent to 2,205 pounds, and one pound of CO_2 can fill about 120 party balloons. This means that one $MTCO_2E$ could fill more than 260,000 party balloons.

There are five criteria air pollutant (CAP) emissions inventoried in this project. These pollutants harm both human health and the environment, but they do not contribute directly to global climate change. They are: carbon monoxide, sulfur dioxide, nitrogen oxides, volatile organic compounds, and particulate matter smaller than 10mm.

1. **Carbon monoxide (CO)—**Can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues.
2. **Sulfur dioxide (SO_2)—**Contributes to respiratory illness, particularly in children and the elderly, and aggravates existing heart and lung diseases. SO_2 contributes to the formation of acid rain, which damages trees, crops, historic buildings, and monuments; and makes soils, lakes, and streams acidic. SO_2 also contributes to the formation of atmospheric particles that cause visibility impairment, most noticeably in national parks.
3. **Nitrogen oxides (NO_x)**—Cause a wide variety of health and environmental impacts because of various compounds and derivatives in the family of nitrogen oxides, including nitrogen dioxide, nitric acid, nitrous oxide, nitrates, and nitric oxide.
4. **Volatile organic compounds (VOCs)—**Include a variety of chemicals associated with short- and long-term adverse health effects. VOCs also participate in photochemical reactions.
5. **Particulate matter (PM_{10})**—Fine particles that contain microscopic solids or liquid droplets so small that they can get deep into the lungs. Particulate matter can cause respiratory health problems such as decreased lung function, aggravated asthma, development of chronic bronchitis, irregular heartbeat, non-fatal heart attacks, and premature death in people with heart or lung disease.[11]

Results concerning the listed CAP emissions will be conveyed in pounds (lbs.) and will be listed separately because there is currently no way to combine these distinct air pollutants for analysis.

[11] U.S. EPA, http://www.epa.gov/air/urbanair/

3. Community Analysis

3.1. Community Analysis Scope

The community analysis provides an estimate of all of the GHG and CAP emissions produced within the "Greater Chico Area" by residents, businesses, and agencies. Five primary sectors are included in the community analysis: Residential, Commercial, Industrial, Transportation, and Waste. Each of the five sectors may be broken down further into source subsectors as indicated in Figure 3.1.

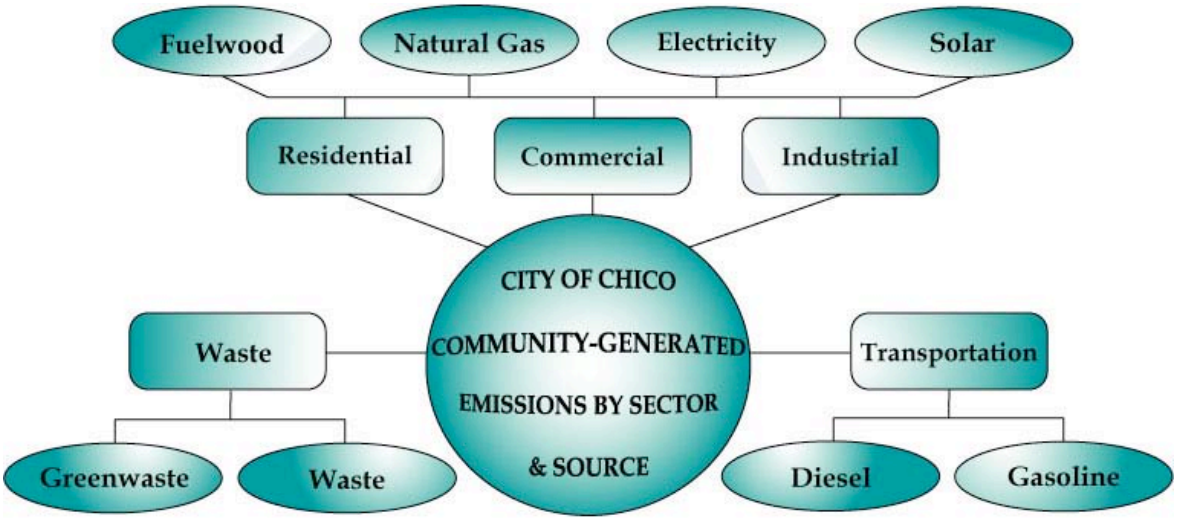

Figure 3.1 Community analysis design flowchart

3.1.1. Community Analysis Data Sources

The primary data used to determine the amount of emissions for the residential, commercial, and industrial sectors was obtained through the local utility—Pacific Gas and Electric (PG&E). Data provided by PG&E included four years (2003-2006) of electrical and natural gas information. Data for the transportation sector was obtained from the *California Public Road Data—Highway Performance Monitoring System*. This annual report provides daily vehicle miles traveled for the Greater Chico Area.[12] Transportation data included three years (2004-2006). Data for the waste sector was provided by City of Chico Management Analyst Linda Herman and Butte County Solid Waste Manager Bill Mannel. Additional information was also gathered from the California Integrated Waste Management Board Web site.[13] Waste sector data includes three years (2005-2007). Obtaineing multiyear data sets allowed for a more comprehensive analysis and aided in the forecasting/backcasting process.

Boundaries for this study were an issue from the beginning. Most inventories include only emissions generated within city limits. Nonetheless, after reviewing the nature of the data

[12] Source: http://www.dot.ca.gov/hq/tsip/hpms/datalibrary.php
[13] http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile2.asp?RG=C&JURID=80&JUR=Chico

available and listening to the aspirations of the City of Chico Sustainability Task Force to include the Greater Chico Area, the geographic boundaries of the project were expanded. Data provided by PG&E includes what they refer to as Chico's "Town and Territory." Despite multiple requests, PG&E was unable to define the exact geographical parameters of what they refer to as the "Town and Territory." In this section, it is assumed that the "Town and Territory" roughly equates to the "Greater Chico Area."

3.2. Community Analysis Results

3.2.1. Overview

In 2005, the Chico community generated 610,951 $MTCO_2E$. Fifty-four percent of those emissions were produced by the transportation sector. The commercial sector was the second largest contributor, accounting for 23 percent, followed by the residential sector (19%), the waste sector (4%), and the industrial sector (less than 1%) (Figure 3.2).

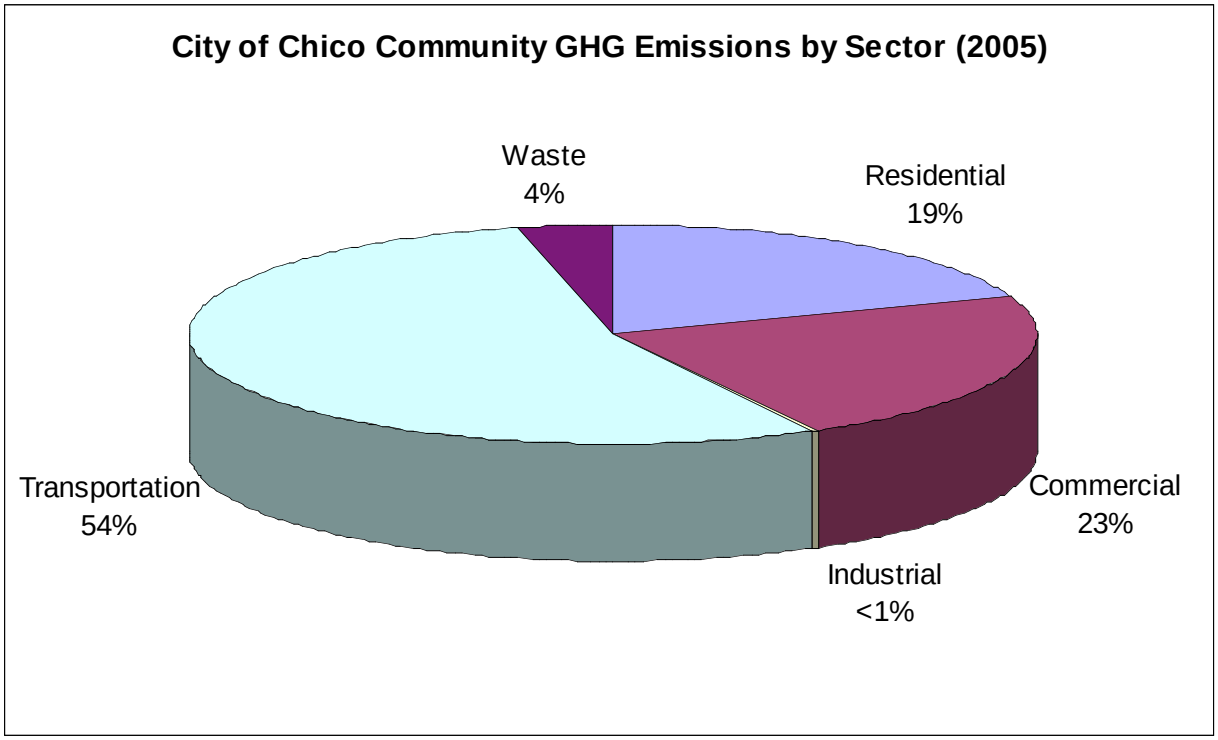

Figure 3.2 Community greenhouse gas emissions by sector (2005)

Table 3.1 provides a summary of energy use, CAP and GHG emissions produced by each sector. The number in the last column of Table 3.1 represents the amount of energy (MMbtu) per amount of GHG emissions ($MTCO_2E$). This ratio provides an indicator demonstrating the efficiency of each sector in terms of GHG emissions (a lower number indicates lower efficiency). The transportation sectors scored the lowest rating primarily because the burning of fossil fuels (especially gasoline and diesel) emits large amounts of CO_2 per unit of energy combined with the relatively low efficiency of today's automobile.

SECTOR (unit)	Energy (MMBtu)	NO_x (lbs.)	SO_x (lbs.)	CO (lbs.)	VOC (lbs.)	PM_{10} (lbs.)	Emissions ($MTCO_2E$)	MMBtu/ $MTCO_2E$
Residential	2,256,421	438,266	143,300	2,359,050	427,344	399,233	119,135	**18.9**
Commercial	1,895,994	485,605	241,336	213,915	27,934	156,997	138,527	**13.6**
Industrial	13,158	3,869	1,853	1,097	194	137	700	**18.8**
Transportation	4,273,595	**2,519,382**	135,290	**19,363,257**	**2,018,542**	73,106	332,602	**12.8**
Waste	N/A	N/A	N/A	N/A	N/A	N/A	19,987	**N/A**
TOTAL	**8,439,168**	**3,447,122**	**521,779**	**21,937,319**	**2,474,014**	**629,473**	**610,951**	**16.03 AVG**

Table 3.1 Energy, Air Pollutants, GHG emissions, and MMBtu per $MTCO_2E$ by sector

Per capita comparative analysis can be a useful metric for progress made in reducing GHG emissions and for comparing one community's emissions with other communities or against regional and national averages.

Currently it is difficult to make meaningful comparisons between cities because of variation in the scope of inventories conducted and data collection methods.

Region	Per Capita $MTCO_2E$
Chico Community (2005)	5.8
Sonoma County (2000)	8.2
Menlo Park (2005)	14.7
City of Durham, NC (2005)	28.2
State of California	12.0
National (2004)	24.1

Table 3.2 Per capita GHG emissions of different regions

In the near future, a universal reporting standard will be developed and adopted through a process being driven by ICLEI.

Per capita GHG emissions in Chico are considerably lower than the national average. During 2005, Chico generated approximately 5.8 $MTCO_2E$ per capita.[14] This is enough GHG emissions for every Chico citizen to fill 1.5 million party balloons in one year. In 2004, per capita GHG emissions in the U.S. were approximately 24.1 $MTCO_2E$.[15] However, total U.S. emissions include some sources not included in this CCP inventory (e.g., agricultural soil management, air transportation, and industrial emissions not related to energy use). If these additional remote sources of GHG emissions had been included in this inventory, the per capita emissions in Chico would be higher.

When examined by end-use sector, 21 percent of the national energy related emissions are residential, 18 percent are commercial, 28 percent are industrial, and 33 percent are transportation related. By comparison, the transportation sector

Sector	Nat. Avg.	Chico
Residential	21%	19%
Commercial	18%	23%
Industrial	28%	<1%
Transportation	33%	54%
Waste	N/A	4%

Table 3.3 End-use sector (national vs. Chico)

[14] Greater Chico Area population calculated by the percent increase from Chico's population in 2004 to 2005. Percent increase calculated to 2004 Greater Chico Area numbers. Source: Chico Chamber of Commerce.

[15] Source: Based on 2004 population estimates published by U.S. Census Bureau and total GHG emissions produced in the U.S. in 2004 as published by U.S. EPA.

(54%) and commercial sector (23%) are considerably higher in Chico than the national average. The residential (19%) and industrial (<1%) sectors are lower than the national average. It is worth noting that national end use data excludes GHG emissions derived from waste, so comparing other sectors can be misleading. Furthermore, because Chico's industry sector is so small, it is difficult to make meaningful comparisons to national averages, where industry plays a large role in GHG emissions.

3.2.2. Source of Community Greenhouse Gas Emissions

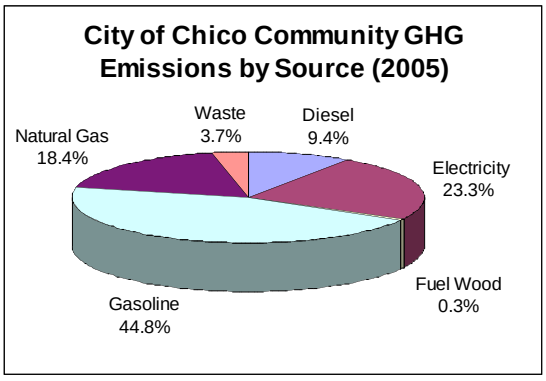

Figure 3.3 Community GHG emissions by source (2005)

This section provides an analysis of GHG emissions by fuel type. The majority of GHG emissions generated by the Chico community originate from gasoline, which generated nearly half of all GHG emissions. The second largest source of GHG emissions was electricity (23.3%), followed by natural gas (18.4%), diesel (9.4%), waste (3.7%), and fuel wood (0.3%) (Figure 3.3).

3.2.3. Community-Generated Air Pollutants

According to the EPA, the airshed Chico belongs to recently ranked third worst in California. A recent article in the *Chico Enterprise-Record* claimed that Chico was the only city in the airshed that was out of compliance with recently adopted standards for particulate matter.[16]

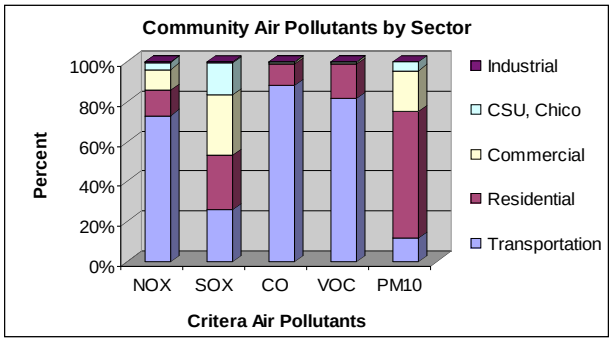

Figure 3.4 Community air pollutants by sector

In 2005, the Chico community generated 629,473 lbs of particulate matter smaller than 10mm, 521,779 lbs of sulfur dioxide, 2,474,014 lbs of volatile organic compounds, 3,447,123 lbs of nitrogen oxides, and 21,937,320 lbs. of carbon monoxide. The transportation sector produced about 80% of all community-generated nitrogen oxides, carbon monoxide, and volatile organic compounds. The residential sector was the largest emitter of particulate matter, generating roughly 60 percent (Figure 3.4).

[16] *Chico Enterprise-Record*. Jan. 26, 2008. Section: Local. Steve Schoonover. Article ID: 8084706.

3.2.4. Residential Sector

3.2.4.1. Residential Emissions

In 2005, the residential sector generated 119,135 $MTCO_2E$, representing over 19 percent of community-generated GHG emissions (Figure 3.2). On average, each household[17] produced roughly 2.3 $MTCO_2E$. Comparatively, the national average for GHG emissions per household is 12.5 $MTCO_2E$.[18] Despite the residential sector having low per household scores, residential GHG emissions have undergone a 15.6 percent increase from 2003 to 2007. The majority of this increase occurred from 2004 to 2005 (Figure 3.5). The primary sources of residential emissions were generated from electricity (44%), natural gas (54%), and fuel wood (2%).

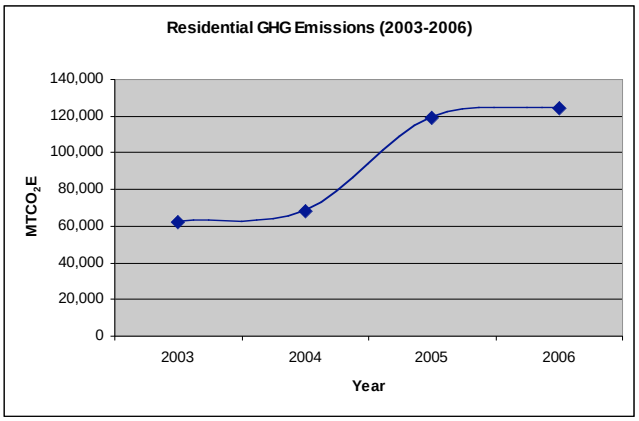

Figure 3.5 Residential sector GHG emissions (2003-2006)

Residential Emission Sources	Energy (MMBtu)	NO_x (lbs.)	SO_x (lbs.)	CO (lbs.)	VOC (lbs.)	PM_{10} (lbs.)	Emissions ($MTCO_2E$)	MMBtu / $MTCO_2E$
Electricity	758,148	196,929	131,378	124,697	14,012	108,424	51,980	**14.6**
Natural Gas	1,222,404	214,621	8,182	53,028	11,311	6,279	65,024	**18.8**
Fuelwood	268,334	26,716	3,740	2,181,325	402,021	284,530	2,131	**126**
Solar	7,536	0	0	0	0	0	0	**∞**
Total	**2,256,422**	**438,266**	**143,300**	**2,359,050**	**427,344**	**399,233**	**119,135**	**N/A**

Table 3.4 Residential sector GHG and CAP emissions, energy, and MMBtu/$MTCO_2E$ by source

On a per household basis, the residential sector in Chico is substantially <u>below</u> the national average in GHG emissions.

Fuel wood generated the smallest amount of GHG emissions, with about 2 percent of GHG emissions for the residential sector. Despite fuel wood being the smallest contributing source of GHG emissions, fuel

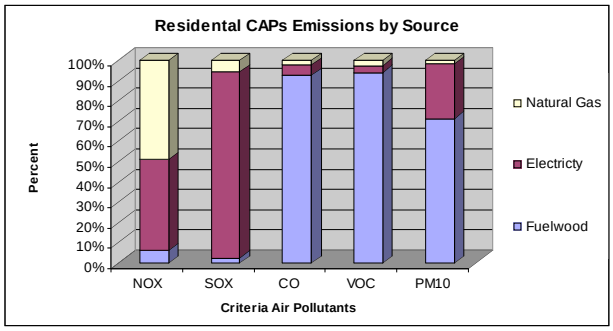

Figure 3.6 Residential criteria air pollutants by source

[17] Number of households calculated by percentage increase of population from the City of Chico to the Greater Chico Area, multiplied by the number of households in the City of Chico. Source: Chico Chamber of Commerce.

[18] Source: Calculated using the national per capita GHG emissions average of 24.1 tons and the end-use residential sector emissions (21%) included in the U.S. EPA GHG Inventory, and the average people/household (2.47) sector emissions (21%) included in the U.S. EPA GHG Inventory, and the average people/household (2.47).

wood does produce an enormous amount of air pollution. For example, fuel wood only generated 12 percent of total residential energy yet it generated 71 percent of particulate matter, 94 percent of volatile organic compounds, and 92 percent of carbon monoxide. Residential criteria air pollutants are illustrated in Figure 3.6.

Chico Residential Solar

There are more than 200 residential grid-tied solar projects in the Greater Chico Area possessing an inverter capacity of 1.1 megawatts. These solar projects have the potential to produce roughly 2,000 MWh annually. By producing this electricity with energy from the sun rather than from the local utility, the residential sector achieves over a 450 $MTCO_2E$ reduction. In addition to this considerable GHG emissions reduction, the solar projects also decrease air pollution and are impervious to electricity price increases.

3.2.5. Commercial Sector

3.2.5.1. Commercial Emissions

The commercial sector generated 138,527 $MTCO_2E$, representing 23 percent of community-generated GHG emissions (Figure 3.2). In comparison, the commercial sector produces 17 percent of the total national fossil fuel-derived GHG emissions or 4.1 $MTCO_2E$ per capita.[19] On average, each employee the in Greater Chico Area produced 2.9 $MTCO_2E$, or 1.3 $MTCO_2E$ per capita, which is lower than the national average.

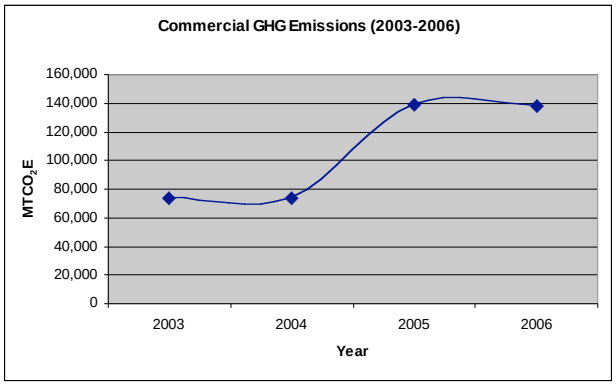

Figure 3.7 Commercial GHG emissions (2003-2006)

[19] Source: EPA National GHG Inventory.

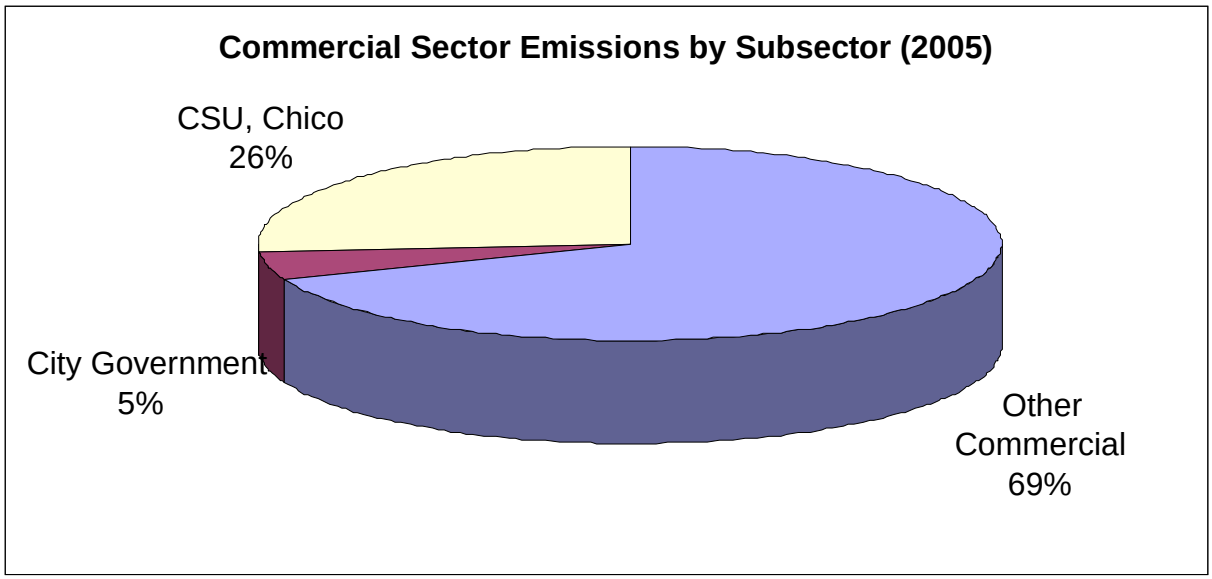

Figure 3.8 Commercial sector GHG emissions by subsector (2005)

Analyzing commercial sector GHG emissions by end-use subsectors reveals that only 5 percent were generated by the City of Chico municipal government. Sixty-nine percent were produced by other businesses, and roughly one-quarter of all commercial GHG emissions were produced by CSU, Chico.

Commercial Subsector	Energy (MMBtu)	GHG ($MTCO_2E$)	MMBtu $MTCO_2E$
Municipal Government	94,004	6,678	14.0
CSU, Chico	216,488	36,599	5.9
Other Commercial	1,585,542	95,250	17.1
TOTAL	1,895,994	138,527	AVG 12.3

Table 3.5 Commercial subsector energy use and GHG emissions

CSU, Chico generated GHG emissions that were higher than all other subsectors in terms of energy per $MTCO_2E$ (Table 3.5). The University's low energy-to-GHG-emissions ratio results from the source of electricity it purchases. CSU, Chico buys its electricity from Arizona Power Supply (APS). APS generates electricity from a variety of sources, as do most utilities. What differentiates APS from PG&E and nearly all West Coast utilities is that more than 40 percent of its "grid-mix" originates from coal and coal-generated electricity, which produces large amounts of GHG and CAP emissions.

GHG emissions from the commercial sector originated from two sources: electricity and natural gas. The majority of commercial sector emissions were produced from electricity (66%), with the remainder originating from natural gas (34%). Solar-generated electricity was responsible for producing only 2 percent of electrical energy (MMBtu) but resulted in no GHG or CAP emissions.

Fuel Type	Energy (MMBtu)	NO_x (lbs.)	SO_x (lbs.)	CO (lbs.)	VOC (lbs.)	PM_{10} (lbs.)	GHG ($MTCO_2E$)
Electricity	988,054	32,465	22,113	20,201	2,260	16,844	**91,178**
Natural Gas	890,127	10,259	0	1,392	366	293	**47,349**
Solar	17,812	0	0	0	0	0	**0**
Total	**1,895,993**	**45,155**	**29,688**	**22,085**	**2,709**	**17,427**	**138,527**

Table 3.6 Commercial sector: 2005 energy use, CAP and GHG emissions by fuel type

Chico Commercial Solar

There are about 20 commercial grid-tied solar projects in Chico with an inverter capacity of 2.6 megawatts. These projects have the potential to produce more than 5,000 MWh annually. By producing this electricity with energy from the sun rather than from the local utility, the residential sector achieves over a 1,200 $MTCO_2E$ reduction. In addition to this considerable GHG emissions reduction, the solar projects also decrease air pollution and are impervious to electricity price increases.

3.2.6. Transportation Sector

3.2.6.1. Background

Chico's transportation network is characterized by two state highways. California State Highway 99 runs north/south and California State Highway 32 runs east/west. Arterial streets provide regional and local access. The majority of Chico residents reside in the City of Chico limits. Compared with other cities, mobility within the City is generally good, with an average commute time of 17.4 minutes. The low commute time results from the City's compact form and the availability of commercial centers, educational institutions, medical facilities, and recreational sites within city limits. Despite efforts to create a balanced transportation system that serves bicyclists and pedestrians, roughly 70 percent of commuters commute in single-occupancy vehicles (Table 3.7).[20]

Commuter Behavior	Percent
Drive Alone	**70**
Carpool/Vanpool	**12.6**
Public Transportation	**1.9**
Walk	**5.5**
Other	**6.2**
Work From Home	**3.8**

Table 3.7 Chico commuter behavior

The transportation sector includes GHG emissions generated from privately and publicly owned passenger vehicles, transport trucks, public transit vehicles, and all other on-road vehicles associated with personal, commercial, industrial, and government activities. Information for this sector was obtained from the California Public Road Data—Highway Performance Monitoring System. This annual report provides daily vehicle miles traveled for the the Greater Chico Area.[21]

[20] U.S. Census for Chico, CA.
[21] Source: http://www.dot.ca.gov/hq/tsip/hpms/datalibrary.php

3.2.6.2. Transportation Sector Emissions

Overall, the transportation sector produced 332,602 $MTCO_2E$, representing about 54 percent of all community GHG emissions (Figure 3.9). Eighty-three percent of transportation sector emissions were generated from gasoline combustion, while the remaining 17 percent originated from diesel combustion.

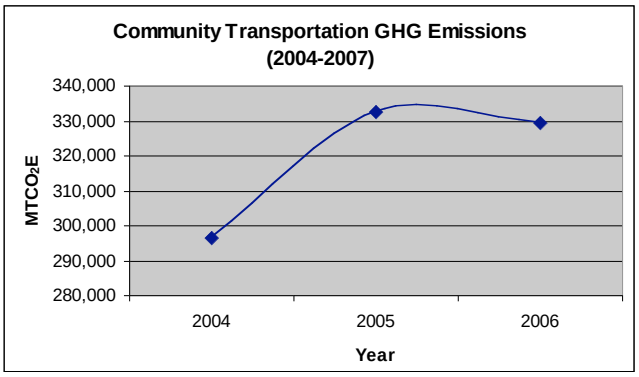

Figure 3.9 Transportation sector greenhouse gas emissions (2004-2006)

The transportation sector generates more GHG and CAP emissions than all other community sectors combined.

In addition, the transportation sector is responsible for roughly 83 percent of all community CAP emissions—claiming 73 percent of the nitrous oxides, 26 percent of sulfur dioxide, 88 percent of carbon monoxide, 81 percent of volatile organic compounds, and 11 percent of particulate matter smaller than 10 millimeters (Figure 3.4). For a complete breakdown of transportation-generated energy, CAP, and GHG emissions, refer to Table 3.8.

Fuel Type	Energy (MMBtu)	NO_x (lbs.)	SO_x (lbs.)	CO (lbs.)	VOC (lbs.)	PM_{10} (lbs.)	GHGs ($MTCO_2E$)
Gasoline	3,542,877	1,669,183	100,012	18,704,657	1,928,989	36,774	**275,066**
Diesel	730,718	850,199	35,278	658,600	89,553	36,332	**57,537**
Total	**4,273,595**	**2,519,382**	**135,290**	**19,363,257**	**2,018,542**	**73,106**	**332,603**

Table 3.8 Transportation Sector: 2005 energy use, CAP and GHG emissions by fuel type

3.2.7. Solid Waste Sector

3.2.7.1. Background

Currently, two waste disposal companies serve the Chico urban area: NorCal Waste Systems and North Valley Waste Management. Each company disposes the majority of collected waste in two separate landfills.[22] North Valley Waste Management transports waste to the Neal Road Landfill, while NorCal Waste Systems transports waste to Ostrum Road Landfill in Sutter County.

Both landfills use similar waste-handling methods. Daily operations consist of covering waste with a minimum of six inches of soil[23] and/or tarps. Eventually, modules are closed and covered with 12 inches of soil and capped with a 40 mil geo-membrane, followed by 12 inches of soil

[22] Roughly 1.3 percent of Chico waste goes to the following landfills: Altamont L.F. (Alameda), Bakersfield S.L.F. (Kern), Azusa L.R. (Los Angeles), Sacramento County L.F., and North County L.F (San Joaquin).
[23] It is also common to use wastewater sludge/cake as an alternative to soil.

added on top of the geo-membrane and seeded to promote vegetative growth. These closed modules generate methane as the waste decomposes under anaerobic conditions.

The Landfill Gas Collection and Control System at Neal Road uses a series of 36 gas collection wells and seven vadose zone wells that are under vacuum to extract the landfill gas, which is captured and then flared. A similar system exists at the Ostrum Road Landfill, and the landfill managers at both facilities says that 100 percent of the methane is captured and flared. By flaring (igniting) methane gas, the landfills greatly reduce their global warming potential by converting it to carbon dioxide. Since methane is 21 times more potent than CO_2 as a GHG, flaring the gas reduces its global warming potential by 21 times.[24] The methane gas captured at landfills, however, can be used as an alternative fuel source. According to Neal Road Landfill Manager Bill Mannel, the facility has plans for a sustainable energy project to utilize a methane recovery system in 2009.

Solid waste data was collected from City of Chico Management Analyst Linda Herman and Butte County Solid Waste Manager Bill Mannel. Additional information was also gathered from the California Integrated Waste Management Board Web site.[25] These sources have provided the necessary information concerning community waste and landfill technology to complete this report. There is, however, no complete and accurate information of the compositional breakdown of the community's waste stream, therefore percentage breakdowns that are represented in this report were provided by ICLEI.

3.2.7.2. Solid Waste Emissions

In the 2005 calendar year, the City of Chico sent 88,307 tons of waste to the landfill. This amount of waste emitted 19,987 $MTCO_2E$, representing 4 percent of total community-generated GHG emissions. The majority of GHG emissions generated by the solid waste sector originated from the decomposition of paper (81%) and food waste (16%) (Table 3.9).

On average, each person living in the Chico urban area generates roughly 0.2 $MTCO_2E$ of waste-related emissions a year. There were no CAP emissions in the solid waste sector because decomposing waste produces only methane gas. GHG and CAP emissions resulting from the transportation of solid waste are included in the transportation sector of the community inventory.

Waste Type	Materials	GHGs ($MTCO_2E$)
Solid Waste	Paper Products	**16,273**
	Food Waste	**3,152**
	Plant Debris	**77**
	Wood/Textiles	**485**
Total		**19,987**

Table 3.9 Solid waste emissions breakdown

3.3. Community Analysis Forecast and Backcast

The CACP software allows users to estimate future GHG emissions that will be generated if the community implements no further reduction measures. In 2005, the community produced 610,951 $MTCO_2E$. In a "business as usual" scenario, GHG emissions are projected to increase

[24] Source: Intergovernmental Panel on Climate Change Third Assessment Report, 2001.
[25] http://www.ciwmb.ca.gov/Profiles/Juris/JurProfile2.asp?RG=C&JURID=80&JUR=Chico

more than 64 percent, or to 1,004,161 $MTCO_2E$ by the year 2020. This projection is based off annual percent increases in population, households, commercial establishments, waste tonnage, gasoline, diesel, natural gas, and electricity. In most cases, growth rates were derived from multiple-year data sets gathered for this report.

In addition to the future projection, Figure 3.10 includes a reverse projection, or backcast. In order to find 1990 GHG emissions levels, ICLEI recommended using 25 percent below 2005 levels to find the Kyoto Protocol target. Seven percent above Kyoto levels represents the amount of GHG emissions generated by the Chico community in 1990, or 490,287 $MTCO_2E$.[26]

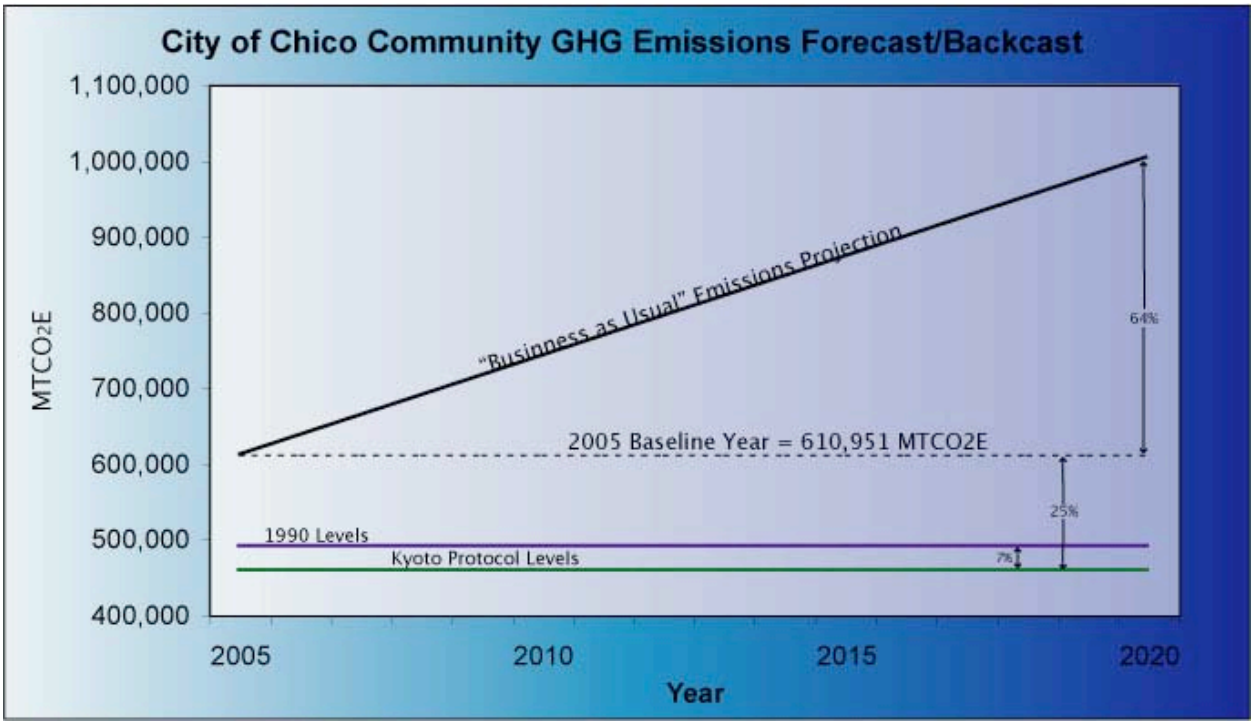

Figure 3.10 City of Chico GHG emissions projection (2005-2020)

[26] ICLEI USA

4. Government Analysis

4.1. Government Analysis Scope

The government analysis covers all buildings and facilities, operations, programs, the employee commute, and vehicles owned and operated directly by the City of Chico municipal government. Data acquisition and results have been divided into the following sectors: buildings, vehicle fleet, employee commute, streetlights, water/sewage, and waste (Figure 4.1). The baseline year for the government analysis is 2005. Energy, fuel, and waste data were collected for 2005. Data for adjacent years were also collected based on availability. The government analysis is more detailed than the community analysis because the data is more refined; it includes detail for more sectors and identifies specific point sources of emissions and air pollutants.

Figure 4.1 City of Chico government emissions analysis by sector

4.2. Government Analysis Results

4.2.1. Overview

In 2005, the City of Chico Government operations generated 6,678 $MTCO_2E$ and consumed approximately 94,000 MMBtu of energy. Cost associated with this energy use was near $1.9 million.

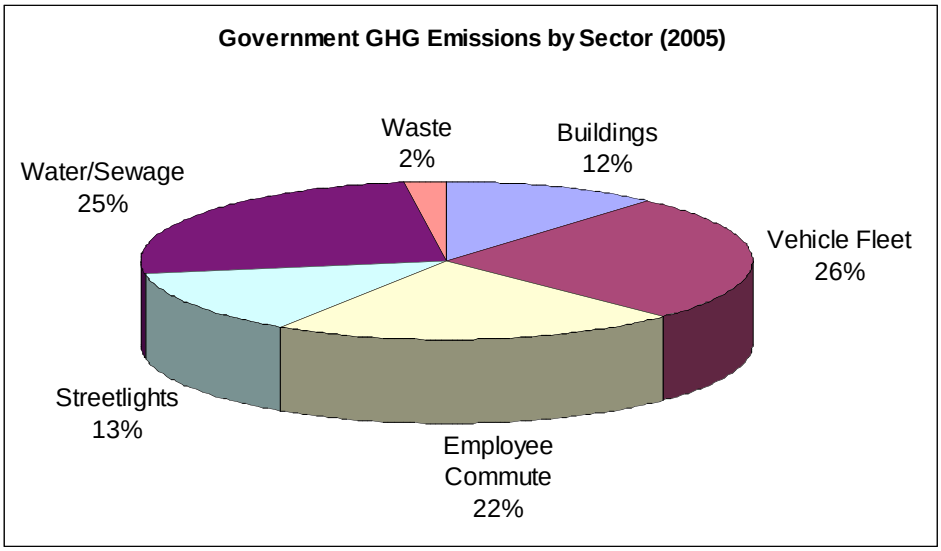

Figure 4.2 Government-generated GHG emissions by sector

Figure 4.2 shows the percentage of GHG emissions emitted from each sector. GHG emissions associated with the vehicle fleet and the Water Pollution Control Plant account for roughly half of all government-generated GHG emissions. The third largest GHG emissions generating sector was the employee commute, accounting for 22 percent, followed by the streetlights sector (13%), the buildings sector (12%), and the waste sector, accounting for only 2 percent of all government-generated emissions.

4.2.2. Source of Government Greenhouse Gas Emissions

GHG emissions generated by the City of Chico government originate from five primary sources. Figure 4.3 shows that the majority of GHG emissions were generated from gasoline (38%), followed by purchased electricity (37%), natural gas (13%), diesel (10%), and waste (2%). Combined gasoline and diesel fuel emissions represent nearly half of all government-generated emissions.

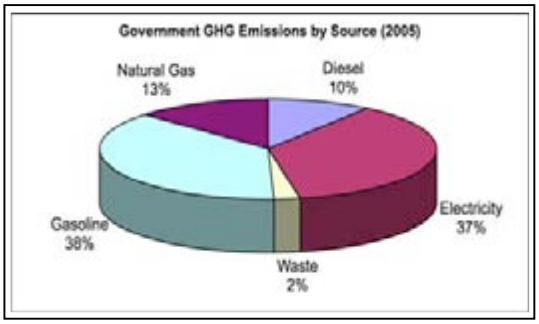

Figure 4.3 Government GHG emissions by source

GHG emissions resulting from the combustion of gasoline and diesel fuels are exclusively from the vehicle fleet and employee commute sectors. GHG emissions resulting from natural gas originate from the heating of government buildings and the heating of the digesters at the Water Pollution Control Plant (WPCP). GHG emissions resulting from electricity originate from the electrical use in government buildings and from electrical pump stations associated with the WPCP.

4.2.3. Government-Generated Air Pollutants

In 2005, the most abundant criteria air pollutant (CAP) emission generated from government operations was carbon monoxide. The second most emitted criteria air pollutant emissions were nitrogen oxides, followed by volatile organic compounds, sulfur dioxide, and particulate matter. Nearly all of the carbon monoxide and volatile organic compounds were emitted from the vehicle fleet and employee commute sector as a result of gasoline and diesel combustion (Figure 4.4).

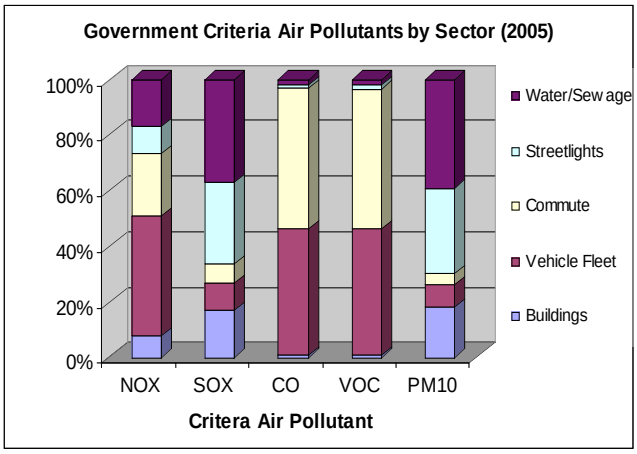

Figure 4.4 City of Chico government-generated criteria air pollutants by sector

CAP emissions nitrogen oxides, sulfur dioxide, and particulate matter were more evenly distributed throughout the government sectors. For a complete breakdown of government-generated criteria air pollutants, refer to Table 4.1.

SECTOR	NO_X (lbs.)	SO_X (lbs.)	CO (lbs.)	VOC (lbs.)	PM10 (lbs.)
Buildings	2,740	1,301	1,420	181	1,072
Vehicle Fleet	15,210	734	78,077	8,224	500
Commute	7,848	517	87,273	9,168	224
Streetlights	3,352	2,236	2,123	239	1,846
Water/Sewage	6,028	2,832	3,106	398	2,332
TOTAL	**35,178**	**7,620**	**171,999**	**18,210**	**5,974**

Table 4.1 Criteria air pollutants by sector

4.2.4. Vehicle Fleet Sector Analysis

The vehicle fleet sector contributed 1,737 $MTC0_2E$, representing approximately 26 percent of total government-generated emissions (Figure 4.2). GHG emissions generated from this sector originate from the burning of gasoline and diesel in city owned/operated vehicles.

In 2005, the city purchased approximately 120,600 gallons of gasoline costing $252,730. Additionally, the City purchased 59,588 gallons of diesel costing $139,458. Combined, the City purchased 180,188 gallons of transportation fuel costing $392,188.

Source	$MTCO_2E$	MMBtu	Gallons	Cost
Gasoline	1,163	15,019	120,600	$252,730
Diesel	574	7293	59,588	$139,458
TOTAL	**1,737**	**22,312**	**180,188**	**$392,188**

Table 4.2 Vehicle fleet GHG emissions, energy, gallons, and cost

The 2005 City of Chico fleet consisted of more than 360 gasoline- and diesel-combusting vehicles and equipment that may be divided into subfleets as indicated in Figure 4.5. In addition to gasoline- and diesel-powered vehicles, at least one WPCP vehicle has flexible-fuel capability. This vehicle has the capacity to run on either gasoline or compressed natural gas (CNG). Because the amount of CNG is negligible, it has been omitted in this report.

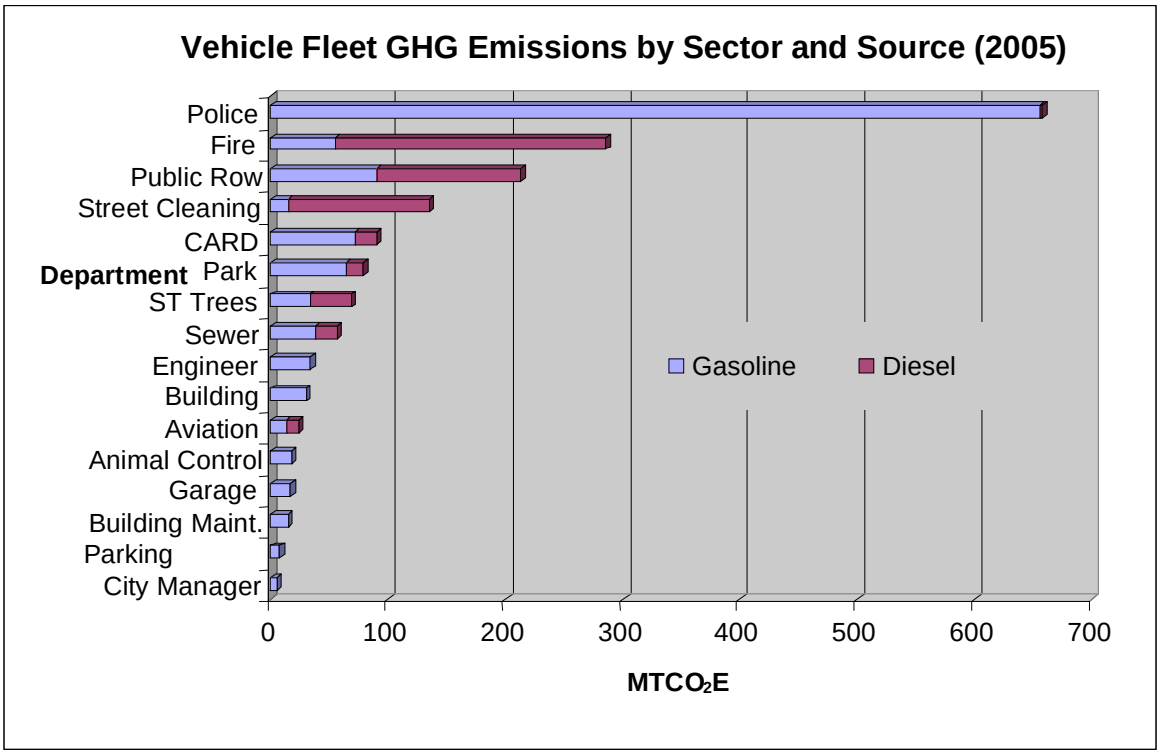

Figure 4.5 Fleet sector GHG emissions by fleet and source (2005)

Figure 4.5 shows that of the 16 subfleets, GHG emissions generated by the police department far exceeded those of other departments. The police department represents 37 percent of all vehicle fleet emissions and originated almost entirely from gasoline. The fire department ranked second, claiming 13 percent of all vehicle fleet sector emissions and more than 40 percent of all diesel-generated emissions within the sector.

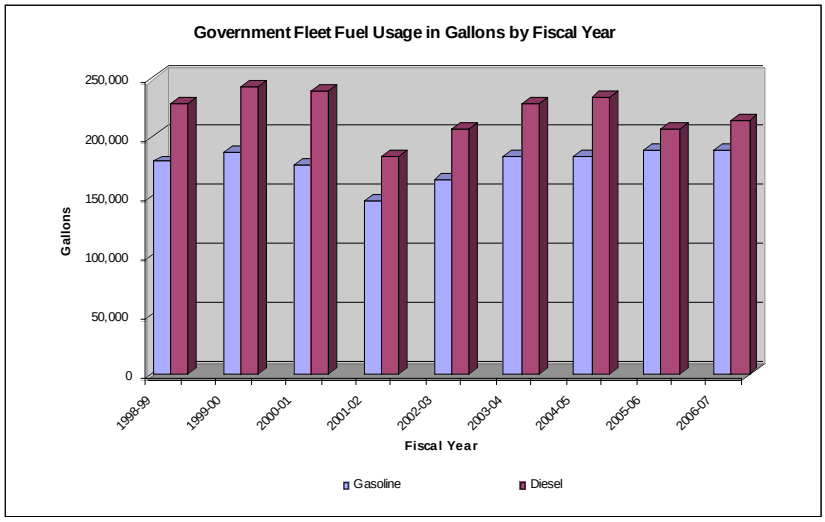

Figure 4.6 Government fleet fuel usage in gallons by fiscal year

Greening the City Fleet

The City has made efforts to improve the efficiency of its fleet by purchasing 10 hybrid vehicles. Of the 10 hybrids, four were purchased in 2005 or prior and have been included in the 2005 analysis. The remaining six were purchased after 2005 and were not included in the 2005 analysis.

4.2.5. Building Sector Analysis

In 2005, the building sector generated 768 $MTC0_2E$, representing about 11.5 percent of total government-generated emissions (Figure 4.2). GHG emissions generated from this sector originate from purchased electricity and natural gas.

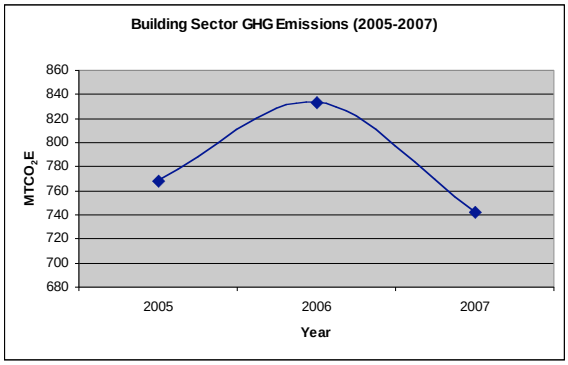

Figure 4.7 Building sector GHG emissions (2005-2007)

Electricity is primarily used in City buildings for lighting and office equipment. In 2005, the City purchased $300,590 of electricity, which averages to $12,024 of electricity for each building. In addition, the City purchased $63,909 of natural gas, which averages to $2,556 of natural gas per building. Natural gas is primarily used to heat water and air in the buildings.

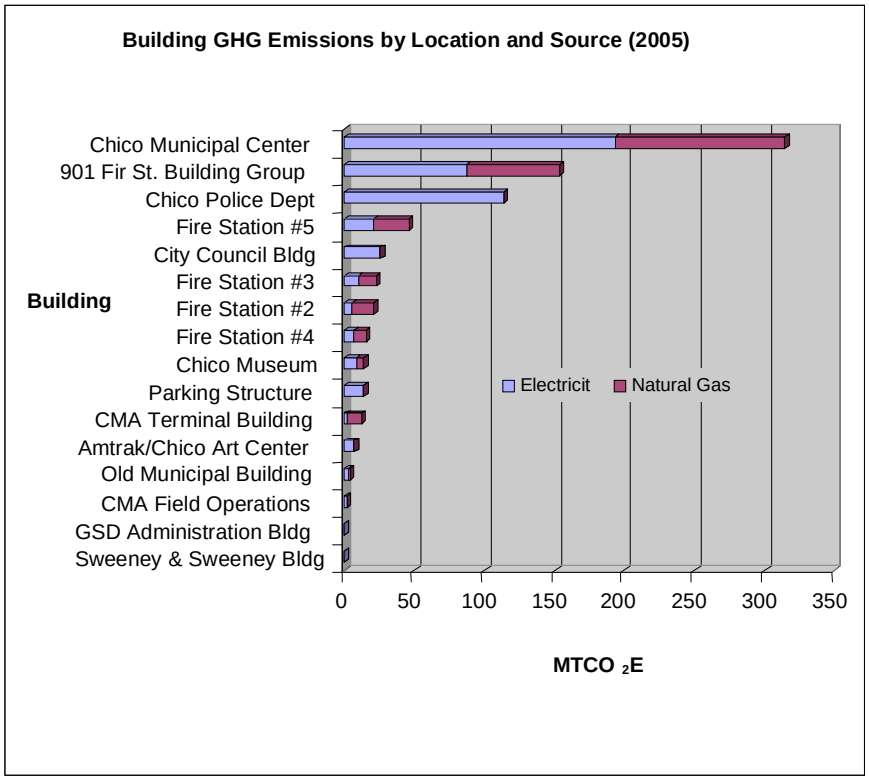

Figure 4.8 City of Chico government GHG emissions by building and source (2005)

The Chico Municipal Center generated the most GHG emissions of any City building. The 901 Fir St. Building Group contributed the second largest amount of GHG emissions, followed by the Police Department. The 901 Fir St. Building Group includes GSD/Field Supervisor Office, Central Garage, Carpenter/Sign Shop, GSD Warehouse, Fire Training Center, Fire Training Tower, Crime Lab Storage, and the Coverage Storage Shelters. All these building are grouped because there is no sub-metering for any of these facilities.

4.2.6. Waste Sector Analysis

In 2005, the government produced 644 tons of waste, which in turn generated 155 $MTCO_2E$, representing only 2 percent of total government GHG emissions (Figure 4.2). Emissions from this sector include waste that was generated by local government operations. More specifically, this sector includes all waste generated from government operations, employee waste, and waste generated at municipal government facilities including parks and buildings.

The majority of emissions generated in the waste sector originated from the decomposition of paper, claiming more than 75 percent of all waste-sector GHG emissions. This is likely due to the intensive use of paper products associated with many municipal governments. Food waste ranked second in GHG emission production, generating nearly 15 percent, followed by plant debris (10%) and wood and textiles (about 2.5%).

4.2.7. Streetlight Sector Analysis

In 2005, the streetlight sector generated 885 $MTCO_2E$, representing 13.2 percent of total government-generated GHG emissions (Figure 4.2). These emissions originate entirely from purchased electricity used to illuminate street and highway lights, traffic control signal lights, and various city park lighting costing the city $622,879.

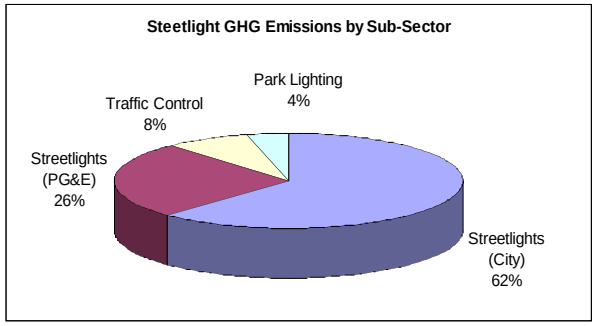

Figure 4.9 Percent of streetlight sector greenhouse gas emissions by type of light

Eighty-eight percent of emissions generated by the streetlight sector were generated from streetlights either owned by the City or PG&E (Figure 4.9). Each streetlight uses about 1.5 MMBtu of energy, costs about $125, and generates one-tenth of a $MTC0_2E$ annually. The City currently uses high-pressure sodium vapor lamps—one of the most energy-efficient street light technologies available. In contrast,

Type of Streetlight	$MTCO_2E$	MMBtu	MMBtu/ $MTCO_2E$	Cost
Streetlights (PG&E Owned)	230	3,354	14.6	**$306,517**
Streetlights (City Owned)	551	8,034	14.6	**$247,134**
Traffic Signal Control Lights	70	1,026	14.7	**$49,683**
Park Lighting	34	491	14.4	**$19,545**
Total	**885**	**12,905**	**AVG14.6**	**$622,879**

Table 4.3 Streetlight by type, GHG, energy, and cost

traffic control signals are much more energy intensive, cost significantly more to operate, and generate nearly seven times the amount of GHG emissions per light unit. The majority of the traffic control signal lights in the City of Chico are LED lights, again the most energy-efficient type of signal available.

4.2.8. Water and Sewage Sector Background

The City of Chico operates one Water Pollution Control Plant (WPCP) on the east edge of town on Chico River Road (4827 Chico River Rd). The WPCP treats more than 9 million gallons per day (GMD) and is connected to more than 28,000 homes. Wastewater from the city, with the help of nine lift pump stations, flows downward to the WPCP, where the wastewater goes through a process of being physically and chemically broken down and treated.

The WPCP uses a secondary treatment process utilizing anaerobic digestion to separate the toxic chemicals and solids from the water—this process creates methane as a byproduct. The captured methane can either be flared to reduce its harmful effects on the environment or can be used as fuel source in cogeneration. Once the liquids are separated from the solids, the water undergoes a chemical process to treat the affected water. When cleaned to EPA standards, the secondary treated plant water is discharged into the Sacramento River. The remaining solid residuals are placed in large drying bins and the cake must be at a minimum of 50 percent dried before it can be hauled off to the landfill. Approximately 1,100 dried tons of cake (biosolids) are produced each year at the WPCP and hauled off to the Neal Road Landfill, where it is used as landfill cover material.

In 1984, the WPCP reused its captured methane in a cogeneration process that produced about half of the plant's output that year. This system went off-line in 2004 due to mechanical problems. The WPCP is currently under expansion, and the City estimates that by November 2009, the plant should have a new co-generation system up and running to reduce its electricity even further.

In October 2005, the solar project came on-line, with the installation of a 1.1 megawatt on-site solar photovoltaic power system providing about 40 percent of the WPCP's electrical needs. Most cities find their wastewater treatment facilities have a high impact on the total level of GHG emissions. Due to the positive steps Chico has already taken, by installing an on-site solar photovoltaic power system, this sector does not have an outstanding impact on total government-generated emissions. The solar photovoltaic system installed in 2005 curbed 47 $MTCO_2E$ from being emitted into the atmosphere.

The plant could take additional steps by using its end byproducts for better use. For example, the city could reuse the treated water for irrigation instead of discharging it into the Sacramento River. This could save millions of gallons of water from having to be pumped from the Tuscan Aquifer. Additionally, biosolids could be composted instead of sent to the landfill and utilized as a nutrient-rich fertilizer.

4.2.9. Sewage Sector Emissions

The water and sewage sector is the second largest contributor of GHG emissions to the City government's carbon footprint, having generated 1,691 $MTCO_2E$ in 2005. This represents about 25 percent of total government-generated GHG emissions (Figure 4.2). Nearly all (99%) of the emissions originating from the water/sewage sector were generated from the Water Pollution Control Plant (WPCP). This is primarily due to the energy intensive process of wastewater treatment. However, the majority of local water services are provided by Cal Water. Emissions generated by Cal Water have been omitted from this analysis because the City has no ownership of or control over this entity.

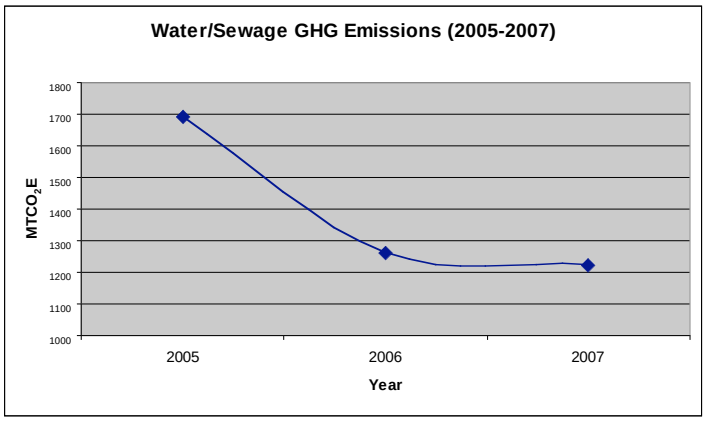

Figure 4.10 Water and sewage GHG emissions (2005-2007)

Sixty-four percent of GHG emissions generated in the water and sewage sector originated from purchased electricity. The remaining 36 percent originated from the combustion of natural gas used to heat digesters and other operations.

In addition to GHG emissions generated by purchased electricity and natural gas the WPCP also emits methane from the digesters that decompose human waste. This methane is flared, or ignited, and never reaches the atmosphere, greatly reducing its global warming potential. Alternatively, the methane gas could potentially be utilized as an on-site fuel source to heat the digesters, reducing the WPCP's natural gas consumption.

4.2.10. Employee Commute Sector Analysis

Although not considered part of direct city operations, emissions from the employee commute were assessed in this report because there are potential reduction measures that could influence employee commuting behavior. The employee commute sector has one characteristic that distinguishes it from all other government sectors:

The employee commute represents the only sector in which city employees have complete control over the amount of GHG emissions and air pollution generated.

Data for the employee commute sector was gathered by survey (see Appendix B). Out of 427 city employees, 157 (37%) completed and returned the survey. The survey results were extrapolated to represent the entire employee population. The primary aim of the survey was to determine the amount of miles driven by city employees for their respective vehicle types,

enabling the calculation of GHG and CAP emissions. Secondarily, the survey was intended to have city employees think about their driving habits. Upon analyzing the survey results, the following findings surfaced (Table 4.4).

Findings From the Employee Commuter Survey
• **The average distance from home to work = 13 miles.**
• **94.6 % of city employees drive and 90% of those employees drive alone.**
• **Only 5.4% of city employees walk/bike to work.**
• **3% of city employees drive hybrids.**
• **The most popular commuting vehicle is the medium size truck/sports utility vehicle.**
• **10% of city employees carpool or vanpool.**
• **Only 0.1% of city employees use the transit bus service.**

Table 4.4 Findings from the employee commuter survey

The City of Chico employee commute sector generates 1,443 $MTCO_2E$ of GHG emissions a year, representing 21% of total government-generated emissions (Figure 3.2). While the employee commute sector ranks as only the third largest contributing sector of GHG emissions, it is the largest contributing sector in production of criteria air pollutants (Figure 4.4).

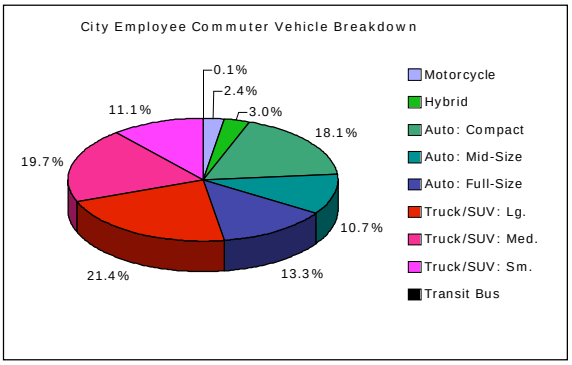

Figure 4.11 Employee commuter vehicles

5. Next Steps

5.1. Milestone II: Setting an Emissions Reduction Target

The establishment of a community emissions baseline and projection prepares the City to complete the next step by setting an emissions reduction target. An emissions reduction target will allow the City to develop a reasonable policy and programmatic response to reduce its contribution to global climate change. A well-developed emissions reduction goal should possess the following qualities:

- **Ambitious**—showcase Chico as a continuing sustainable city.
- **Attainable**—set a goal that is achievable; consider what other cities have achieved.
- **Agreeable**—establish a goal that people in the community can agree upon. After all, it is the changes in their behavior that will make the goal attainable.

When choosing among these emissions reduction targets, some issues to consider include:

1. The state of California has accepted the following reduction targets:
   - **1990 levels by 2020**
   - **80% below 1990 levels by 2050**
2. Setting a goal that is too distant can be dangerous because implementation may be put off.
3. Cities can typically reduce first-year emissions by as much as 5 percent by pursuing the "low-hanging fruit," while the next 5 percent may take years.
4. Setting intermittent goals is a good way to monitor progress and stay on track.

Potential GHG Emissions Reduction Targets:
The city council may consider the following as potential targets to set a reasonable and obtainable goal of emissions reductions for the City and the community.

1. **25% by 2020**
   Twenty-five percent below 2005 levels by the year 2020 equates to lowering emissions **2.08%** per year for the next 12 years.

2. **20% by 2020**
   Twenty percent below 2005 levels by the year 2020 equates to lowering emissions about **1.67%** per year for the next 12 years.

3. **15% by 2015**
   Fifteen percent below 2005 levels by the year 2015 equates to lowering emissions about **2.14%** per year for the next seven years.

4. **10% by 2010**
   Ten percent below 2005 levels by the year 2010 equates to lowering emissions about **5%** per year for the next two years.

5.2. Milestone III: Develop an Action Plan

After determining an agreed-upon reduction target, the City of Chico will develop a cohesive action plan based on the information revealed in this study. Developing an action plan will likely involve multiple steps including: 1) researching activities undertaken by other communities; 2) prioritizing GHG emission reduction actions by the Chico City Council and the community; 3) identifying costs and benefits associated with technological and behavior changes to reduce GHG emissions; 4) selecting policies and programs; and 5) developing an implementation and education program for GHG emissions reduction for City employees, businesses, and community residents.

5.2.1. Conducting Research

The first step to developing an action plan is to research measures, policies, and programs already developed by other communities. Efforts that were successful and seem applicable to Chico will be formulated into a master list. The tables in Appendix C outline many activities undertaken by other communities to reduce their production of GHG emissions.

5.2.2. Creating a Master List

Potential measures can be both broad and creative. In some cases, the City has already adopted measures that are successfully being implemented to reduce GHG emissions; these measures will also be rolled into the final strategy. Now may also be a good time to reassess the effectiveness of already implemented measures.

5.2.3. Selecting Policies and Programs

Preferred policies and programs to reduce greenhouse gas emissions should be selected through a community-based planning exercise that empowers and educates residents, business owners and City staff to take ownership of efforts to reduce GHG emissions. In addition, the preferred polices and programs should be based on the following criteria:

- GHG emissions reduction potential
- Cost
- Other feasibility issues
- Additional benefits associated with the measure (e.g., quality of life, city beautification)

5.2.4. Developing GHG Emission Reduction Strategy

Selected policies and programs will be rolled into a draft of the Chico Greenhouse Gas Reduction Action Plan. The action plan will be made available to the public for review through the City's Web site and at City Hall. A public forum will also be held to present the draft plan to the community and to solicit input. Public input may also be received through regularly scheduled meetings, written submissions, or through the development of a task force/committee. All public input should be reviewed and incorporated into the plan as appropriate.

5.3. Milestone IV: Implementation Plan

Measures selected for the Chico Greenhouse Gas Reduction Action Plan are likely to be too numerous and/or expensive to implement all at once. Instead, a small contingent of key measures should be chosen for implementation in the first year or two. Once these measures have been implemented, the plan can be revisited and a second set of measures chosen for implementation. This process should be repeated on an annual basis until the City meets its GHG and CAP goals.

The implementation plan will include:

- What is to be done.
- How it is to be accomplished.
- Who is responsible for what.
- Where the resources will come from.
- When it will be accomplished by.

5.4. Milestone V: Monitoring and Evaluation

As measures are implemented, efforts must be employed to track their progress in reducing GHG and CAP emissions. City staff will perform this work and will use the CACP software, following the methods recommended by the ICLEI/CCP for tracking reductions of GHG and CAP emissions. A Community and Municipal Greenhouse Gas and Criteria Air Pollutant Emissions Inventory should be completed in five-year increments starting in the year 2010.

5.5. Concluding Remarks

This report has broken down a complex issue, revealing clear trends and opportunities to reduce carbon production through meaningful steps to change behaviors. The rest is up to Chico!

6. Appendix A: List of Acronyms

APS – Arizona Power Supply; a utility that provides electricity to CSU, Chico.

Btu – British Thermal Units; a standard unit of measure equivalent to the quantity of heat required to raise the temperature of one pound of water by 1 degree Fahrenheit at the temperature at which water has its greatest density (approximately 39 degrees Fahrenheit).

CACP – Clean Air and Climate Protection; the software used by ICLEI to calculate GHG emissions.

CAP – Criteria air pollutant; a category of air pollutants including: nitrogen oxides (NOx) sulfur oxides (SOx), carbon monoxide (CO), particulate matter (PM), and volatile organic compounds (VOC), which have adverse effects on human health.

CCP – Cities for Climate Protection; a program developed by ICLEI – Local Governments for Sustainability to help local governments reduce GHG emissions from their operations and communities.

CNG – Compressed gatural gas; a fuel primarily composed of methane. Used as an alternative fuel to gasoline and diesel in flex-fuel vehicles or converted vehicles.

EPA – Environmental Protection Agency

GHG – greenhouse gas; primarily consisting of: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

GMD – Million of gallons per day; terminology used in wastewater treatment and water services.

ICLEI – Local Governments for Sustainability (formerly the International Council for Local Environmental Initiatives); more than 800 local governments that have made a commitment to sustainable development.

IPCC – Intergovernmental Panel on Climate Change

kWh – Kilowatt-hour; a unit commonly used to measure electricity. Equivalent to 1,000 watts.

LED – Light-emitting diode; a low-energy-demanding lighting technology.

LPG – Liquid petroleum gas; commonly referred to as propane. Used as an alternative fuel to gasoline and diesel in flex-fuel vehicles and converted vehicles.

MMBtu – Millions of British Thermal Units.

$MTCO_2E$ – Metric ton of carbon dioxide equivalent.

WPCP – Water Pollution Control Plant.

VMT – Vehicle miles traveled; a measure of the total distance traveled within a community. This is used to estimate fuel consumption and GHG emissions.

City of Chico 2020 Climate Action Plan
~ FINAL DRAFT ~
September 24, 2012