Public Draft

CITY OF UKIAH

Climate Action Plan

Prepared for
City of Ukiah

March 12, 2014

ESA

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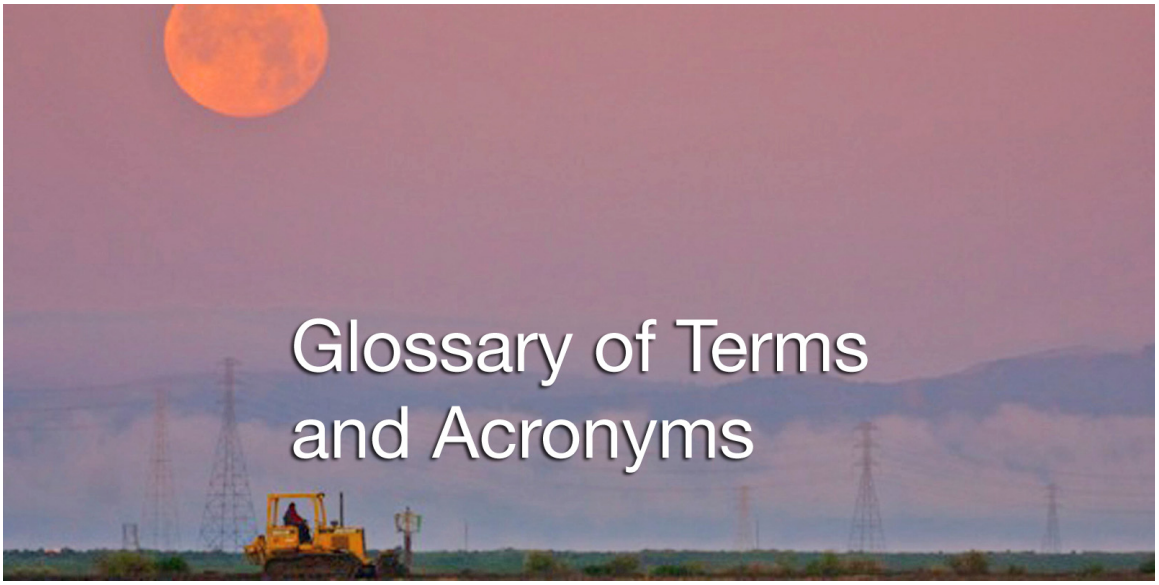

Glossary of Terms and Acronyms

AAAS	American Association for the Advancement of Science
AB 32	Assembly Bill 32, the California Global Warming Solutions Act of 2006. Establishes a comprehensive program of regulatory and market mechanisms to achieve real, quantifiable, cost-effective reductions of greenhouse gases for the state of California. Makes the California Air Resources Board responsible for monitoring and reducing statewide greenhouse gas emissions, with a target to reduce emissions to 1990 levels by 2020.
Action	Detailed steps Ukiah will take to implement the Climate Action Plan strategies. Each action was carefully considered by the City to ensure that appropriate staff and resources would be available for implementation. Each action is also designated a code that corresponds to the goal and strategy it will implement. For example, Action TLU-2.1a is associated with Strategy 2.1, which in turn is associated with Goal TLU-2.
Adjusted BAU	An adjusted emissions forecast that includes the effects of state-wide emissions reductions measures such as updates to building energy standards and implementation of programs to decrease emissions from on-road vehicles
ARRA	American Recovery and Reinvestment Act
Baseline Inventory	The base year for assessment of energy trends against which future progress can be measured for a single calendar year (2005), consistent with legislative guidance and the Assembly Bill 32 Scoping Plan.
BAU	Business as Usual. A scenario that assumes that no new local actions will be taken to reduce energy usage or associated greenhouse gas emissions from current and future residents and businesses within the City.
BTA	Bicycle Transportation Act. An annual program providing state funds for city and county projects that improve safety and convenience for bicycle commuters.
CAP	Climate Action Plan
CalEPA	California Environmental Protection Agency

CALGreen	Refers to CALGreen component of the California Building Code. See California Building Code
California Building Code	California Code of Regulations, Title 24, also known as the California Building Standards Code (composed of 12 parts). Title 24, Part 6 sets forth California's energy efficiency standards for residential and nonresidential buildings and was established in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods.
CARB	California Air Resources Board
CAPCOA	California Air Pollution Control Officers Association
CCA	Community Choice Aggregation
CEC	California Energy Commission
CEESP	California Long Term Energy Efficiency Strategic Plan. A plan adopted by the California Public Utilities Commission in 2008 that presents a single roadmap to achieve maximum energy savings across all major groups and sectors in California. This comprehensive plan for 2009 to 2020 is the state's first integrated framework of goals and strategies for saving energy, covering government, utility, and private sector actions, and holds energy efficiency to its role as the highest priority resource in meeting California's energy needs.
CEQA	California Environmental Quality Act
CFCs	Chlorofluorocarbons
CFL	Compact fluorescent light
CH4	Methane
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent. A metric measure used to compare the emissions of various greenhouse gases based upon their global warming potential (GWP). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP factor. For example, the GWP factor for methane is 21. This means that emissions of one million metric tons (MT) of methane are equivalent to emissions of 21 million $MTCO_2e$.
Community-wide	Refers to all activities within a city's geographic boundary. Typical sectors include government and civic, residential, commercial, and industrial energy use, transportation, off-road equipment, waste generation, and energy associated with water delivery and treatment.
CDC	Community Development Commission of Mendocino County
COPD	Chronic obstructive pulmonary disease
CPUC	California Public Utilities Commission
Demand Response	Mechanism for managing end-user electricity consumption in response to energy supply conditions, especially during summer periods when electricity demand on the California power grid is high. A demand response system directly or remotely controls electrical equipment such as lights or air

	conditioning to reduce electricity consumption during times of increased energy demand and/or constrained energy availability.
Direct Access Electricity	Direct access service is an optional choice that customers can select to purchase electricity and other services from an electric service provider (ESP), instead of from a public or private utility company. An ESP is an entity that contracts directly with its customers to provide electric service, and is responsible for arranging an adequate supply of electricity. ESPs are required to meet certain requirements with the California Public Utilities Commission in addition to meeting financial and technical requirements with individual utility companies.
DOE	United States Department of Energy
DOF	California Department of Finance
DOT	California Department of Transportation
E	Energy
EECBG	Energy Efficiency and Conservation Block Grant. The Energy Efficiency and Conservation Block Grant program was funded through the American Recovery and Reinvestment Act and managed by the US Department of Energy to assist cities, counties, states, and territories to develop, promote, and implement energy efficiency and conservation programs and projects.
ELF	Energy Localization/Energy Loan Fund
ENERGY STAR	A joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy to provide consumers with energy efficiency information and incentives to purchase the most energy-efficient products available.
ESA	Environmental Science Associates
ESCO	Energy service company
First Cost	Immediate purchase and installation cost. First costs do not include lifecycle or long-term operating costs, which may result in long-term cost savings from increased efficiency, reduced maintenance, and other factors.
FHA	Federal Housing Administration
Forecast	Energy and GHG emissions are forecast to future years based on current consumption patterns and projected increases in population, job growth and other local trends.
GHG	Greenhouse Gases. Gases which cause heat to be trapped in the atmosphere, generally warming the Earth. Greenhouse gases are necessary to keep the Earth warm, but increasing concentrations of these gases are implicated in global climate change. The majority of greenhouse gases come from natural sources, although human activity is also a major contributor. The principal greenhouse gases that enter the atmosphere because of human activities are carbon dioxide (CO_2), methane (CH_4), nitrous Oxide (N_2O) and fluorinated Gases (hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride).
gpcd	gallons per capita-day
Goal	A general statement of aspiration or intent to achieve a desired condition. In the Ukiah CAP there are one or more goals for each of the four sectors, and

	each goal is labeled according to the sector it is associated with, as follows: Energy Section (E), Transportation & Land Use (TLU), Solid Waste (SW), and Water (W). For example, Goal E-1 is the first goal of the Energy sector.
Green Building	Sustainable or "green" building is a holistic approach to design, construction, and demolition that minimizes the building's impact on the environment, the occupants, and the community.
Green Team	A formal or informal group of people within an organization or community that promotes more environmentally sustainable practices and sustainability plans and management approaches.
Greenhouse Gas Inventory	A greenhouse gas inventory provides estimates of the amount of greenhouse gases emitted to and removed from the atmosphere by human activities. A city or county that conducts an inventory looks at both community emissions sources as well as emissions from government operations.
GWh	Gigawatt hour
GWP	Global warming potential
HELP	Home Energy Link Program
HFCs	Hydrofluorocarbons
HPS	High pressure sodium
HVAC	Heating, ventilation and cooling
ICLEI	Local Governments for Sustainability
IPCC	Intergovernmental Panel on Climate Change
JPA	Joint Powers Agency
kWh	Kilowatt-hour. A unit of energy equivalent to one kilowatt (kW) of energy used for an hour. For example, if an appliance requires a kW of energy to function, leaving the appliance on for one hour would consume one kWh of energy.
KYC	Keep Your Cool
LCFS	Low carbon fuel standard. Requires fuel providers in the State to decrease lifecycle fuel carbon intensity by 2020. The LCFS applies, either on a compulsory or opt-in basis, to all fuels used for transportation in California.
LED	Light emitting diode
LEED	Leadership in Energy and Environmental Design. An internationally recognized green building certification system, which provides third-party verification that a building or community was designed and built using sustainable approaches, with particular regard to energy savings, water efficiency, CO2 emissions reductions, and improved indoor environmental quality, among others.
LID	Low impact development
MCAQMD	Mendocino County Air Quality Management District
MCEW	Mendocino County Energy Watch

MCOG	Mendocino Council of Governments
MGD	million gallons daily
mpg	miles per gallon
MPO	Metropolitan Planning Organization
MTA	Mendocino Transit Authority
Municipal	Refers to energy use and greenhouse gas emissions from City-owned and operated facilities and equipment.
MH	Metal halide
MT	Million tons
MT CO2e	Metric tons of carbon dioxide equivalent
N2O	Nitrous oxide
NAS	National Academy of Sciences
NOAA	National Oceanic and Atmospheric Administration
NCES	North Coast Energy Services
NPCA	Northern California Power Agency
NSHP	California Energy Commission's New Solar Homes Partnership. Part of the comprehensive statewide solar program, known as the California Solar Initiative.
NREL	National Renewable Energy Laboratory
OPR	California Governor's Office of Planning and Research
PACE	Property-Assessed Clean Energy. A form of long-term financing that creates municipal finance districts to provide loans to homeowners and businesses for energy-efficient retrofits and renewable energy system installations. Loans are repaid through an annual surcharge on property tax assessments.
PFCs	Perfluorocarbons
PG&E	Pacific Gas and Electric. An investor-owned utility that is the primary electricity and natural gas provider to City of American Canyon and Napa County.
POU	Publically owned utility
PPA	Power Purchase Agreement
ppm	Parts per million
PV	Photovoltaic
Rebate	Offered by the state, utility, or local government to promote the installation of renewables and energy efficiency projects.
REAP	Responsible Energy Awareness Practices (REAP) program of the Community Development Commission of Mendocino County
REDI	Renewable Energy Development Institute

Renewable Energy	Energy from sources that regenerate and are less damaging to the environment, such as solar, wind, biomass, and small-scale hydroelectric power.
RPS	Renewable Portfolio Standard. Requires utility providers to increase the portion of generated energy that comes from renewable sources to 20% by 2010 and to 33% by 2020.
RTPA	Regional Transportation Planning Agency
SBX707	The Water Conservation Bill of 2009
SB 375	Senate Bill 375: Enhances California's ability to reach its AB 32 goals by planning more sustainable communities.
SB 97	Senate Bill 97: Requires the Governor's Office of Planning and Research (OPR) to develop and adopt CEQA guidelines for the mitigation of GHG emissions.
SBEA	Small Business Energy Alliance
SCS	Sustainable Community Strategy
SEEC	California State-wide Energy Efficiency Collaborative
SOI	Sphere of influence
SOVs	Single occupancy vehicles
Strategy	A course of action to be undertaken by Ukiah to meet the goals related to climate change. Each strategy is designated with a code that corresponds to its sector and goal. As an example, Strategy SW-2.1 is the first strategy of the second goal for the Solid Waste Sector.
SW	Solid Waste
TDM	Transportation demand management
TEA-21	Transportation Equity Act for the 21st Century) program. A federal program administered through the state and regional governments.
Title 24	California Code of Regulations, Title 24, also known as the California Building Standards Code (composed of 12 parts). Title 24, Part 6 established California's energy efficiency standards for residential and nonresidential buildings. See California Building Standards.
TLU	Transportation and Land Use
UWMP	Urban Water Management Plan
U.S. EPA	United States Environmental Protection Agency
VMT	Vehicle miles traveled
W	Water
WWTP	Waste water treatment plant
Zero Net Energy	For buildings, use of no more energy over the course of a year than can be generated onsite through renewable resources such as solar, wind, or geothermal power.

1 Introduction

Overview

Given the scientific consensus that anthropogenic or "man-made" greenhouse gas (GHG) emissions are contributing to global climate change, and the GHG reduction policies established by the State of California, the City of Ukiah is joining an increasing number of California local governments committed to addressing climate change at the local level. The City recognizes the risk that climate change poses to its residents, business owners, and visitors, and is acting now to reduce the GHG emissions from both its government operations and the community at-large through the strategies set forth in this Climate Action Plan. Although state and regional policies and programs are being implemented to reduce GHG emissions, ultimately local action is needed to ensure that Ukiah is doing its part to mitigate climate change and adapt to its current and future effects. This Climate Action Plan takes a common sense approach to reducing GHG emissions in the City of Ukiah, with policies and cost-effective programs that the City itself, as well as its residents and businesses, can implement to reduce GHG emissions associated with energy consumption, transportation, water use, and solid waste sent to local landfills.

Purpose and Scope

This Climate Action Plan outlines strategies, goals, and actions for reducing municipal and community-wide GHG emissions. It is designed to ensure that Ukiah does its part to contribute to the goals of California's Global Warming Solutions Act of 2006 (AB 32), while remaining consistent with the Ukiah General Plan vision for future growth.

AB 32 directs the state to reduce state-wide GHG emissions to 1990 levels by 2020. To achieve these reductions, the California Air Resources Board (CARB) and the State Office of Planning and Research (OPR) recommend that local governments target their community-wide 2020 emissions to be 15 percent below 2005 levels, deemed to be equivalent to 1990 emissions levels.

As is further described in Chapter 3, *Greenhouse Gas Emissions, Forecasts, and Reduction Target*, the baseline 2005 Community GHG Emissions Inventory for Ukiah includes 155,480 metric tons of CO2 equivalents (MT

CO2e), which decreased to 144,625 MT CO2e in 2010. Emissions from municipal operations,[1] included in the community inventory, were 1,969 MT CO2e in 2005 and 1,814 MT CO2e in 2010. Under business-as-usual (BAU) conditions, annual community GHG emissions are forecasted to be 149,108 MT CO2e by 2020. To be consistent with the AB 32 goal, the City must reduce its annual emissions to approximately 132,158 MT CO2e by the year 2020. This is a reduction of 11% (16,950 MT CO2e) from the 2020 BAU forecast.

Several initiatives at the state level will reduce GHG emissions in the City of Ukiah. The 'adjusted' 2020 forecast for Ukiah, including anticipated reductions from statewide measures, is 132,437 MT CO2e – nearly enough for the City to meet its 2020 target. This Climate Action Plan outlines local GHG reduction strategies and actions that will enable the City to attain (and likely exceed) the 2020 target. It also considers the years beyond 2020, when deeper reductions in global GHG emissions will be needed if the world is to avoid catastrophic climate change.

In developing this Climate Action Plan, the City of Ukiah considered many potential GHG-reduction strategies and actions. Best-suited measures were chosen primarily based on community support, their ability to reduce GHG emissions, and cost-benefit characteristics, with additional considerations for funding availability and feasibility of implementation. As the City is in the early stages of shifting towards a low-carbon economy, high priority was also given to strategies and actions that support local economic development by creating new jobs, boosting existing and creating new local green businesses, reducing energy costs, increasing energy security, and reducing traffic congestion. Additional considerations included public health impacts, energy security, air quality impacts, and quality of life impacts.

The measures in this Climate Action Plan address energy consumption and generation, transportation and land use, solid waste disposal, and water use. For each emissions sector, the Climate Action Plan presents goals, strategies, and specific actions for reducing emissions, along with local economic and other co-benefits, such as improved air quality and reduced energy and water bills. An implementation and monitoring plan is also provided. The initial implementation timeframe will span approximately seventeen years, from 2013 through 2030.

In addition to reducing GHG emissions, the Climate Action Plan helps Ukiah's Planning and Community Development Department streamline its review process for development projects. As is further described in Chapter 2, *Climate Change Background and Regulatory Setting*, per guidance by the OPR, a lead agency may determine that an individual project's incremental contribution to a cumulative effect on climate change is not cumulatively considerable if the project complies with the requirements of a previously adopted plan to reduce GHGs. This Climate Action Plan will serve as such a plan. See Chapter 5, *Implementation and Monitoring*, for additional information on this Climate Action Plan's benefits for CEQA project review in Ukiah.

1 Excluding the City Landfill. For additional information, see Chapter 3, Greenhouse Gas Emissions Inventories, Forecasts, and Target

Relationship to Other City Plans

This Climate Action Plan, in presenting measures for reducing community GHG emissions and increasing resilience to climate change, is closely aligned with the goals and policies outlined in the Ukiah General Plan (adopted in 1995, updated in 2004), Ukiah's municipal code, and other City policies related to sustainability. The Climate Action Plan is a "stand alone" policy document, and will help the City meet its long-term planning goals.

The strategies presented in Chapter 5 of this Climate Action Plan are consistent with and support implementation of goals and strategies included in the Ukiah General Plan. Key goals and policies pertaining to energy, water, waste, transportation and land use are provided below.

- **Goal EG-1:** Create land use patterns which facilitate the conservation of energy.
    - **Policy EG-1.1:** Locate shopping, employment and recreation opportunities within walking or bicycling distance of proposed and existing housing.
- **Goal EG-2:** Improve the efficiency of energy use within the private transportation system.
    - **Policy EG-2.1:** Encourage the use of alternatively powered vehicles.
- **Goal EG-3:** Improve the efficiency of energy use within the City's and County's vehicle fleet.
    - **Policy EG-3.1:** The City and County shall serve as models for programs to operate fleet vehicles at maximum fuel efficiency.
    - **Policy EG-3.2:** Support car-pooling.
- **Goal EG-4:** Maximize on-site solar energy use, especially in new developments.
    - **Policy EG-4.1:** Incorporate solar energy considerations into the design, review and approval of all development.
- **Goal EG-5:** Site design shall incorporate shade trees for energy conservation.
    - **Policy EG-5.1:** Encourage minimum canopy coverage of all paved area on a lot.
- **Goal EG-6:** Promote energy efficiency features in the design of all new structures and in the retrofitting of existing structures.
    - **Policy EG-6.1:** Design new buildings with the maximum feasible energy efficiency.
    - **Policy EG-6.2:** Public buildings shall operate at the highest energy efficiency level economically and operationally feasible.
    - **Policy EG-6.3:** Promote retrofitting of privately -owned buildings to increase energy efficiency.
- **Goal EG-7:** Educate residents and businesses about the importance of energy efficiency.
    - **Policy EG-7.1:** Promote energy education programs.
- **Goal EG-8:** Manage existing energy resources to meet increased demands and explore the use of new energy efficient technologies.

- **Goal CF-4:** Improve the City water distribution system.
    - **Policy CF-4.1:** Work to avoid preventable water loss from the distribution system.
- **Goal CF-3:** Promote water conservation.
    - **Policy CF-3.1:** Actively develop programs to decrease the need for new water sources.

By helping to implement these General Plan goals and policies, the Climate Action Plan will reduce Ukiah's carbon footprint by ensuring buildings operate at the highest energy efficiency level, developing a balanced land use pattern, developing a connected street pattern that serves a variety of transportation modes, supporting public transit service, providing a safe and convenient bicycle and pedestrian network, improving water use efficiency, and reducing solid waste.

Document Content

The Climate Action Plan is organized into the following chapters, as described below:

Chapter 1: Introduction. This chapter provides an overview of the document, the purpose and scope of the Climate Action Plan, and its relationship the Ukiah General Plan.

Chapter 2: Climate Change Background and Regulatory Setting. This chapter presents the basic science behind climate change and the ongoing research related to its effects on the natural and human world. In addition, Chapter 2 provides a brief explanation of potential impacts of climate change in the greater Ukiah region, as well as a discussion of federal regulations, state actions, and local actions pursuant to state requirements to reduce GHG emissions.

Chapter 3: Greenhouse Gas Emissions Inventory, Forecasts, and Targets. This chapter presents the community-wide inventory of GHG emissions for the 2005 base year, and an update showing emission in 2010. A subset of those emissions—municipal emissions attributable to government operations—are also presented. Using projections of population, employment, and new residential and commercial development, future emissions for the years 2020 and 2030 are estimated for BAU market-based conditions. This chapter also estimates the cumulative effect of implementing state-wide measures to reduce GHG emissions, and provides an 'adjusted' 2020 emissions forecast that includes reductions from state-wide measures. Finally, this chapter establishes the 2020 GHG emissions target as 15 percent below base year 2005 emissions, and describes the emissions gap that the City of Ukiah Climate Action Plan must close to reach that target.

Chapter 4: Greenhouse Gas Reduction Goals and Strategies. Reducing emissions to at least 15 percent below the 2005 base year inventory will require the City of Ukiah and its residents and businesses to commit to strategies that impact energy use, transportation and land use, solid waste diversion, and water consumption. Chapter 4 addresses each of these major categories, summarizing their contribution to total city-wide emissions and describing the strategies and actions that will be implemented to reduce emissions from each category over time. Emissions reduction estimates are provided for individual strategies and actions through the years 2020 and 2030. Chapter 4 also summarizes the policies and programs that Ukiah has implemented since the 2005 base year.

Chapter 5: Implementation and Monitoring. This chapter outlines recommended steps for implementing the GHG reduction strategies described in Chapter 4, and for monitoring the progress of

implementation. It assigns implementation and monitoring responsibility to specific City departments and presents a schedule for implementation. Chapter 5 discusses potential funding sources, and partnerships the City may enter into to leverage existing work and local resources. This chapter also describes how the adopted Climate Action Plan will be used to streamline CEQA review of future development projects that are consistent with the strategies and programs in the Plan.

Chapter 6: Adaptation: Preparing Ukiah for Climate Change. This chapter presents an overview of the impacts Ukiah is expected to experience due to projected changes in the climate, and what the City can do to begin preparing for them. It describes expected local impacts and vulnerabilities, and adaptation planning strategies.

Chapter 7: Conclusion. This chapter briefly summarizes Ukiah's key challenges to meeting its 2020 GHG reduction target, and discusses opportunities to begin longer-term climate action planning, looking out to 2050.

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2 Climate Change Background and Regulatory Setting

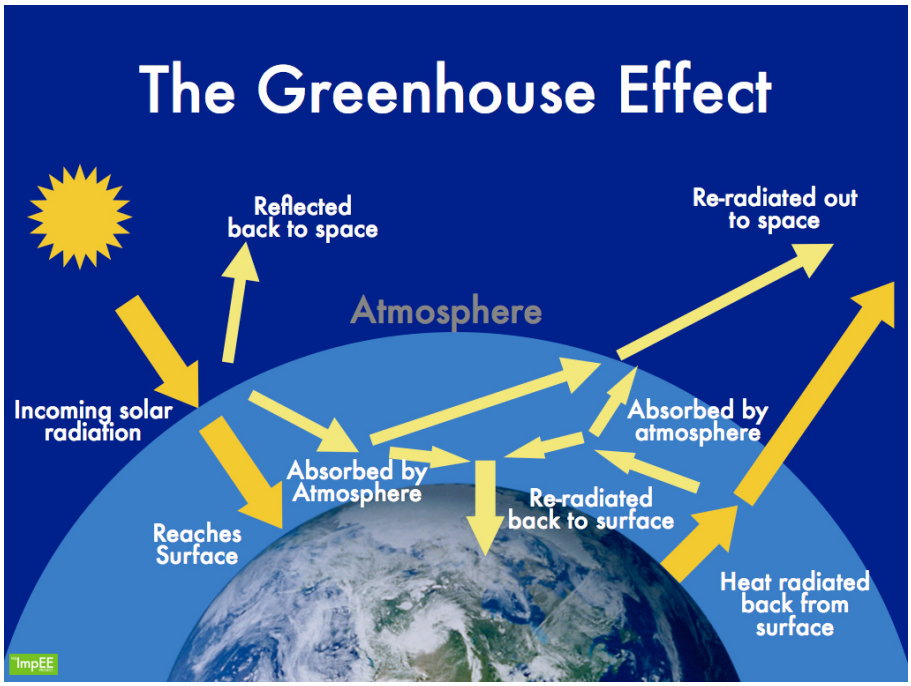
What is Climate Change?

Climate change is described as a significant and lasting change in the planet's weather patterns over a long time period. The scientific community has reached consensus that climate change is occurring at a global scale, and climate change is a widely discussed economic and political issue in California, the United States, and internationally. According to 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 average sea level."[1] Regional changes in climate, particularly temperature increases and changing precipitation patterns, are already affecting natural systems worldwide, and will have widespread impacts on water availability, food production, ecosystem biodiversity, and human health. These changes can result in significant impacts to the health, economy and environment of the Ukiah community and beyond.

GHGs are gases that trap heat in the atmosphere and regulate the Earth's temperature. This effect, known as the Greenhouse Effect, is responsible for maintaining a habitable climate, as shown in **Figure 2-1**. Climate change is occurring because of the ever-rising rate of emissions of warming-inducing gases into the atmosphere. According to the IPCC, it is very likely that human-generated GHG emissions, which have increased considerably since the mid-20th century, are a primary cause of climate change. Since the dawn of the Industrial Revolution around 1750, human activities have increased atmospheric concentrations of GHG emissions, levels of which now far exceed the average atmospheric concentrations of the past several thousand years. Land use changes, burning of fossil fuels, and agricultural practices have all contributed to this observed increase. Global climate models clearly show that human activity is having an effect on global temperatures.

1 Intergovernmental Panel on Climate Change Fourth Assessment Report, 2007. Available at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml

Figure 2-1
The Greenhouse Effect



SOURCE: (University of Cambridge, 2006)[2]

The most prevalent GHGs are carbon dioxide (CO2) and water vapor. Others important GHGs are methane (CH4), nitrous oxide (N2O), chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). These gases are emitted through a variety of natural processes and human activities, as follows:

- CO2 and N2O are byproducts of fossil fuel combustion;
- N2O is associated with agricultural operations, such as fertilization of crops;
- CH4 is commonly created by off-gassing from agricultural practices (e.g., keeping livestock), anaerobic composting, and landfills;
- CFCs were widely used as refrigerants, propellants, and cleaning solvents; their production has been mostly eliminated by international treaty, but past emissions remain in the atmosphere due to their long lifespan;
- HFCs are now used as a substitute for chlorofluorocarbons in refrigeration and cooling; and
- PFCs and SF6 emissions are common byproducts of industries such as aluminum production and semi-conductor manufacturing.

Global Warming Potential (GWP) is a quantitative measurement that expresses the relative warming potency of each GHG. CO2 is assigned a GWP value of 1. SF6 is several orders of magnitude stronger with a GWP of 22,800. For GHG emission inventories, the weight of each gas is multiplied by its GWP and presented in units of CO2 equivalents (CO2e). **Table 2-1** lists the six primary GHGs (also known as the Kyoto GHGs), their chemical formula, the lifetime of the compound, and their GWPs relative to CO2.

2 University of Cambridge, 2006. The Greenhouse Effect. Accessed on June 14, 2011, www-g.eng.cam.ac.uk/impee/?section=topics&topic=ClimateChange&page=materials

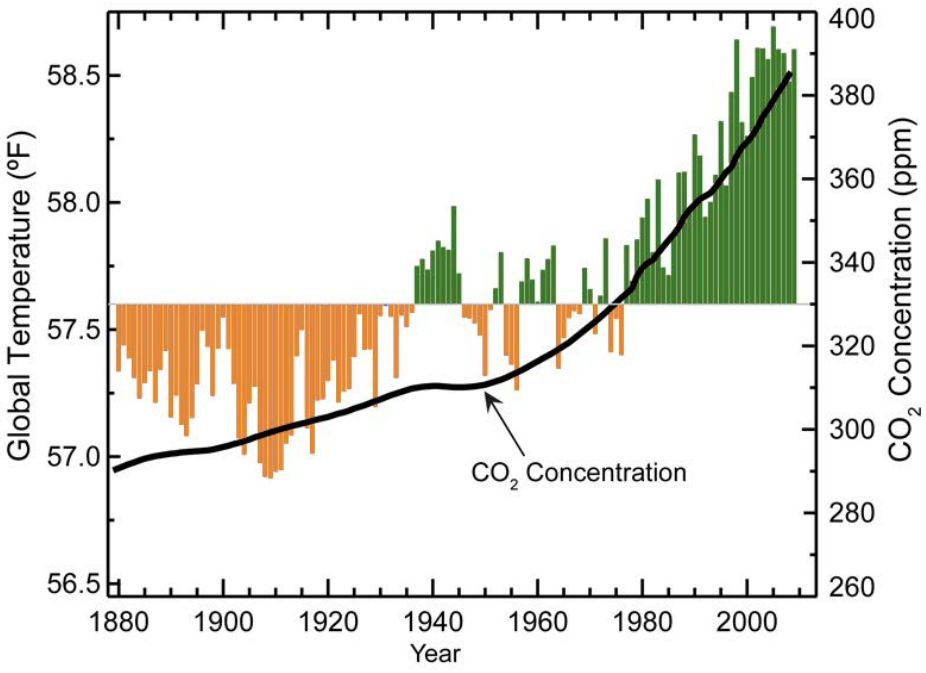
Though CO2 has a lower GWP than other GHGs in the atmosphere, it is the largest contributor to anthropogenic warming over the last century because of the sheer volume of human-induced CO2 emissions over that time. **Figure 2-2** shows the strong correlation between atmospheric CO2 levels and observed global temperatures over the past 130 years. Red bars indicate temperatures above and blue bars indicate temperatures below the 1901-2000 average temperature. The black line shows atmospheric carbon dioxide concentration in parts per million. Concentrations of CO2 have risen most rapidly since 1980, closely tracking the rise in temperature.

Table 2-1
Greenhouse Gases Covered by the Kyoto Protocol

GHG	Chemical Formula	Lifetime (years)	Global Warming Potential for 100-year horizon
Carbon Dioxide	CO_2	1	1
Methane	CH_4	12	25
Nitrous Oxide	N_20	114	298
Sulfur Hexafluoride	SF_6	3,200	22,800
Hydrofluorocarbons	HFCs	14–270	1,430–14,800
Perfluorocarbons	PFCs	1,000–50,000	7,390–22,800

SOURCE: IPCC Fourth Assessment Report: Climate Change 2007 (AR4). Available at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1

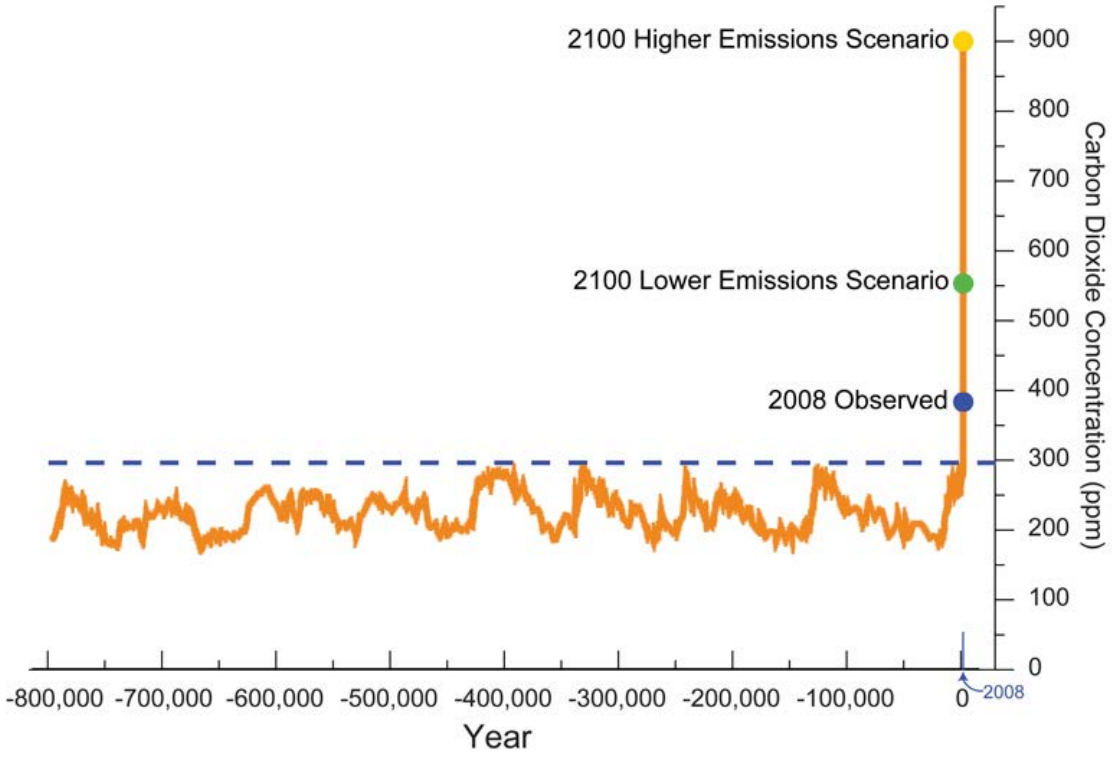
Figure 2-2
Global Temperature and Carbon Dioxide



SOURCE: NOAA Satellite and Information Service, www.ncdc.noaa.gov/indicators/, 2010

As shown in **Figure 2-3**, atmospheric CO2 levels have periodically risen and fallen over the past 800,000 years, within a relatively narrow range of approximately 180 to 300 parts per million (ppm), corresponding to repeating cycles of carbon uptake and release as continental ice sheets advance and retreat. The current era, already near the peak of an historical warming cycle, is experiencing atmospheric CO2 levels far higher than at any time over the past 800,000 years. Current concentrations are nearly 400 ppm, compared with approximately 280 ppm just 250 years ago.

Figure 2-3
800,000 Year Record of Carbon Dioxide (CO2) Concentrations



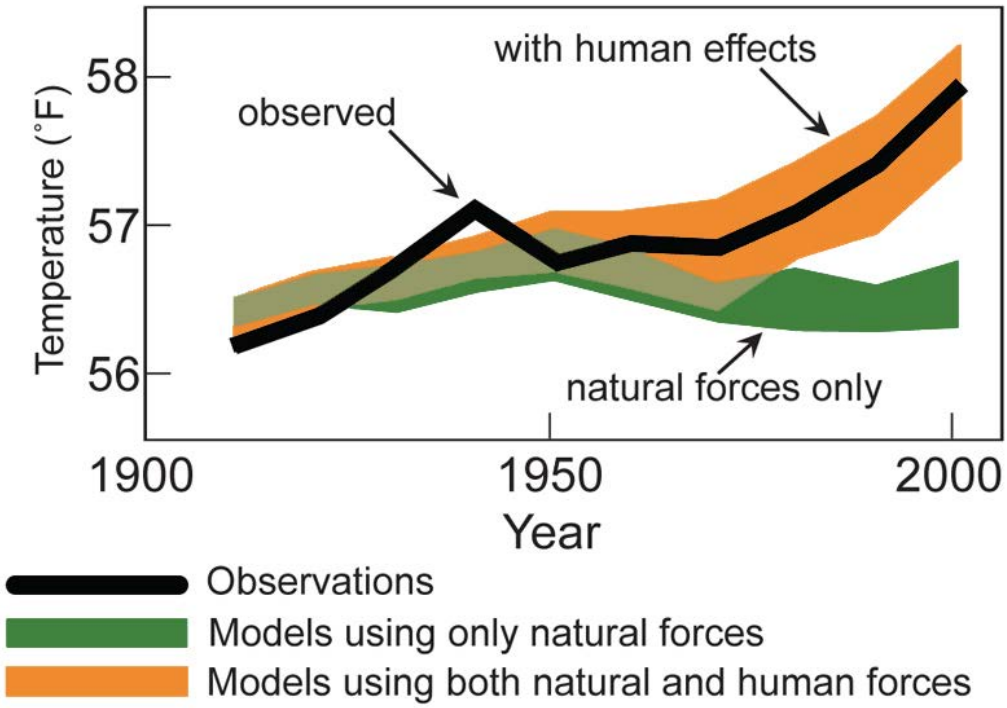
SOURCE: NOAA Satellite and Information Service, 2010, www.ncdc.noaa.gov/indicators/

By the end of the 21st Century, even the lower threshold of expected levels shown in **Figure 2-3** will far exceed known levels going back more than one million years. Climate models cited by the IPCC predict that by 2100, average atmospheric CO2 concentrations will increase to a range of 540–970 ppm, while global average temperatures are expected to rise between 1.1 and 6.4 °C (2.0 and 11.5 °F), with the greatest increases occurring at the poles. Already, observed average temperatures have increased by about 3°C at the poles since the 1980s, compared with 0.7 °C in the Earth's more temperate zones. Climate dynamics are complex, and predictions about our future climate include a level of uncertainty. Even so, current observations are consistent with modeling predictions and in many cases prove that the models are conservative.

An expanding body of scientific research supports the theory that human activity is a major contributor to observed increases in atmospheric CO2 and other GHGs. As shown in **Figure 2-4**, climate model experiments that include only natural factors, such as cycles of solar radiation variability, show a relatively

stable global temperature over the past century, while models that include human influences produce results that track very closely to the observed temperature increases over that same time period.

Figure 2-4
Climate Model Indications and the Observed Climate



SOURCE: NOAA, 2010

Impacts of Climate Change

In 2009, a consortium of U.S.-based science organizations led by the National Oceanic and Atmospheric Administration (NOAA) released its second comprehensive National Climate Assessment, a study of climate impacts in the United States.[3] The next revision is scheduled to be completed in 2014. The key findings of the 2009 Assessment are summarized as follows:

1. **Global warming is unequivocal and primarily human-induced.**

   Average global temperature has increased over the past 50 years. This observed increase is due primarily to human-induced emissions of heat-trapping gases.

2. **Climate changes are under way in the United States and are projected to grow.**

   Climate-related changes have already been observed in the United States and its coastal waters. These changes include increases in heavy downpours, rising temperatures and sea level, rapidly retreating glaciers, thawing permafrost, lengthened growing seasons, lengthened ice-free seasons in the ocean and on lakes and rivers, earlier snowmelt, and alterations in river flows.

3 U.S. Global Change Research Program, 2009. Global Climate Change Impacts in the United States. Page 12. Available at: http://www.globalchange.gov/what-we-do/assessment/previous-assessments

3. **Widespread climate-related impacts are occurring now and are expected to increase.**

   Climate changes are already affecting water, energy, transportation, agriculture, ecosystems, and health. These impacts are different from region to region and will grow under projected climate changes.

4. **Climate change will stress water resources.**

   Access to clean water is an issue in every region, but the nature of the potential impacts varies. Drought—related to reduced precipitation, increased evaporation, and increased water loss from plants—is an important issue especially in the western U.S. Floods and water quality problems are likely to be amplified by climate change in most regions. Declines in mountain snowpack are important in the western states and Alaska, where snowpack provides vital natural water storage.

5. **Crop and livestock production will be increasingly challenged.**

   Agriculture is considered one of the sectors most adaptable to changes in climate. However, increased heat, pests, water stress, diseases, and weather extremes will pose adaptation challenges for crop and livestock production.

6. **Coastal areas are at increasing risk from sea-level rise and storm surge.**

   Sea-level rise and storm surges place many U.S. coastal areas at increasing risk of erosion and flooding, especially along the Atlantic and Gulf Coasts, Pacific Islands, and parts of Alaska. Energy and transportation infrastructure and other property in coastal areas are very likely to be adversely affected.

7. **Threats to human health will increase.**

   Health impacts resulting from climate change are related to heat stress, waterborne diseases, poor air quality, extreme weather events, and diseases transmitted by insects and rodents. A robust public health infrastructure can reduce the potential for negative impacts.

8. **Climate change will interact with many social and environmental stresses.**

   Climate change will combine with pollution; population growth; overuse of resources; urbanization; and other social, economic, and environmental stresses to create larger impacts than from any of these factors alone.

9. **Thresholds will be crossed, leading to large changes in climate and ecosystems.**

   There are a variety of thresholds in the climate system and ecosystems. These thresholds determine, for example, the presence of sea ice and permafrost and the survival of species, from fish to insect pests, with implications for society.

10. **Future climate change and its impacts depend on choices made today.**

    The amount and rate of future climate change depend primarily on current and future human-caused emissions of heat-trapping gases and airborne particles. Responses involve reducing emissions to limit future warming and adapting to the changes that are unavoidable.

According to the IPCC Fourth Assessment Report, a 2°C increase in average global temperature over the next century is a “safe” level of global warming. To keep warming at this level, GHG concentrations must be stabilized at less than 450 parts per million (ppm). Currently, the global atmospheric concentration of GHGs averages nearly 400 ppm. Avoiding dangerous warming requires reducing global GHG emissions by at least 50 percent below 1990 levels by the year 2050. A target this aggressive is made especially challenging due to the current rapid rise of emissions in the developing world.

Many of California’s important natural resources are threatened by the global warming trend. Increased precipitation and sea level rise could increase coastal flooding, saltwater intrusion, and degradation of

wetlands. Mass migration and/or loss of plant and animal species, many unique to our Mediterranean climate, could also occur.

More information is available on the science of climate change from the following organizations:

- U.S. Global Change research Program, National Climate Assessment: http://www.globalchange.gov/what-we-do/assessment
- Intergovernmental Panel on Climate Change Fourth Assessment Report: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml
- National Ocean and Aeronautical Administration (NOAA): http://www.climate.gov/#climateWatch
- Pew Center on Climate Change: http://www.pewclimate.org/
- U.S. Environmental Protection Agency: http://www.epa.gov/climatechange/indicators.html
- U.S. National Academy of Sciences: http://americasclimatechoices.org/
- The American Association for the Advancement of Science (AAAS): http://www.aaas.org/

Expected Local Impacts

The City of Ukiah, like other communities in California, is likely to face serious economic, social, and environmental challenges in the 21st Century due to climate change. Although Ukiah is not susceptible to the projected rises in sea level due to melting ice caps and warming oceans, it will still be impacted directly and indirectly on many fronts as global temperatures rise.

The recently published *California Adaptation Planning Guide: Understanding Regional Characteristics (July 2012)* designates climate impact regions based on county boundaries in combination with projected climate impacts, existing environmental setting, socioeconomic factors, and regional designations. The City of Ukiah and Mendocino County are located within the North Coast climate impact region. Within this region, the Adaptation Planning Guide identifies the following climate change impacts:

- Reduced snowpack
- Increased wildfires
- Threats to sensitive species (e.g., coho salmon)
- Loss in agricultural productivity (e.g., forestry, wine grapes, nursery products, dairy)
- Public health and safety
- Sea level rise and inland flooding (not a concern for the City of Ukiah)

In addition, the Adaptation Planning Guide[4] shows the following climate projections for the North Coast Region:

Reduced snowpack. In the eastern, higher-elevation portion of the North Coast region, march snow levels will drop to almost zero by the 2090s, a decrease of 2 to 10 inches from 2010 levels. In areas with currently little snow (less than 3 inches), such as Ukiah, the snowpack is projected to be near zero by 2050.

Increased wildfires. The North Coast region is projected to experience substantial increase in fire risk. By 2050, the region will experience modest increases in area burned are projected for 2050. By 2100, the

4 Data in the Adaptation Planning Guide is taken from Cal-Adapt, the state's web-based climate adaptation planning tool (http://cal-adapt.org/)

projected frequency increases dramatically, eight times greater in parts of Mendocino County. Northern Mendocino County is projected to have up to 2.5 times greater wildfire frequency.

Temperature increases. January temperatures are predicted to increase by about 2 degrees Fahrenheit by 2050 and up to 5 degrees Fahrenheit by the year 2100 within the North Coast climate impact region. July increases in average temperatures are anticipated to be 3 degrees Fahrenheit and 6 degrees Fahrenheit by the year 2100.

Reduced precipitation. The North Coast region is expected to experience a subtle decrease in precipitation in most areas throughout the century. The City of Ukiah is projected to see a decrease of around 3 to 4 inches by 2050, and 6 inches of precipitation by 2011. Reduced precipitation will adversely impact the water supply of the City, region, and State.

Public health and heat. Ukiah is not projected to see a large increase in the number of heat waves, defined regionally as five consecutive days with temperatures as high as 93°F. Little change is expected by 2050 with possibly one to three more heat waves projected in region. By 2100, projected heat waves are more variable, with predictions of between two and eight more waves per year. However, when heat waves do occur, vulnerable populations in Ukiah may be severely affected because of a historic lack of adaptive capacity having to do with historically milder temperatures. Frequent heat waves can have the greatest impact on the elderly and children less than five years of age. Mendocino County is one of the state's counties with the highest proportion of elderly living alone.

Regulatory Setting

Strategies for monitoring and addressing climate change have emerged at the international, national, and state levels, but California has been a leader in developing mitigation and adaptation strategies. Since 2005, California has been developing policy and passing legislation that seeks to control emissions of gases that contribute to global warming. These have included regulatory approaches, such as mandatory reporting for significant sources of GHG emissions and caps on emission levels, as well as market-based mechanisms, such as market-based cap-and-trade. Some regulations apply at the state level, but others are state-imposed mandates that are applicable at the municipal level and required of local agencies and jurisdictions.

State of California Executive Order S-3-05

In June 2005, the Governor of California signed Executive Order S-3-05, which identified the California Environmental Protection Agency (CalEPA) as the lead coordinating state agency for establishing climate change emission reduction targets in California. A "Climate Action Team," a multi-agency group of state agencies, was set up to implement Executive Order S-3-05. The Governor's Executive Order established aggressive emissions reductions goals: by 2010, GHG emissions must be reduced to 2000 levels; by 2020, GHG emissions must be reduced to 1990 levels; and by 2050, GHG emissions must be reduced to 80 percent below 1990 levels. GHG emission reduction strategies and measures to reduce global warming were identified by the California Climate Action Team in 2006.

Global Warming Solutions Act of 2006 (AB 32)

In 2006, the California legislature adopted AB 32, requiring that California cap GHG emissions state-wide at 1990 levels by 2020. AB 32 requires CARB to establish a program for statewide GHG emissions reporting, and monitoring/enforcement of that program.

The **Climate Change Scoping Plan**, adopted in 2008, outlines the State's plan to achieve the GHG reductions required in AB 32. The actions vary by type, which include direct regulations, alternative compliance mechanisms, incentives, voluntary actions, and other mechanisms. The Scoping Plan identifies local governments as "essential partners" in achieving California's goals to reduce GHG emissions, encouraging the adoption of reduction targets for community and municipal operations emissions that are consistent with the State's commitment (identified as equivalent to 15% below "current" (i.e., 2008) levels).

Low Carbon Fuel Standard

The Low Carbon Fuel Standard (LCFS) requires fuel providers in the State to decrease lifecycle fuel carbon intensity by 2020. The LCFS applies, either on a compulsory or opt-in basis, to all fuels used for transportation in California. It is expected that the LCFS will reduce tailpipe carbon emissions from passenger vehicles and heavy duty trucks by approximately 10 percent by 2020[5]. CARB identified specific eligibility criteria in April 2009, and the regulation became effective in January 2010.

Assembly Bill 1493 (Pavley)

Assembly Bill (AB) 1493 (2002), known as the Pavley Bill, directed CARB to adopt regulations to reduce emissions from new passenger vehicles. AB 1493 requires GHG emission reductions from passenger trucks and light cars beginning in 2011. CARB's AB 32 Early Action Plan released in 2007 included a strengthening of the Pavley regulation for 2017. The U.S. EPA granted California the authority to implement GHG emission reduction standards for new passenger cars, pickup trucks and sport utility vehicles in June 2009. In September, CARB adopted amendments to the regulations that reduce GHG emissions in new passenger vehicles from 2009 through 2016. It is expected that the Pavley regulations will reduce GHG emissions from California passenger vehicles by about 22 percent in 2012 and about 30 percent in 2016, all while improving fuel efficiency and reducing motorists' costs.[6]

Renewable Portfolio Standard

California's Renewable Portfolio Standard (RPS) was established in 2002 under SB 1078 and accelerated in 2006 under SB 107. The program was further expanded in 2011 under SB 2. Under AB 32, the Renewable Portfolio Standard requires increased production of energy from renewable sources, like solar, wind, geothermal, and biomass generation. Investor-owned utilities, electric service providers, and community choice aggregators must increase their renewable portfolio to reach 33 percent of total procurement by 2020.

Ukiah uses electricity generated by the City-operated Lake Mendocino Hydroelectric plant, as well as electricity purchased from individual suppliers including wholesale power suppliers and PG&E. As of 2010,

5 California Air Resources Board, 2008. Climate Change Scoping Plan: a framework for change. Published December 2008.

6 California Air Resources Board. Clean Car Standards – Pavley, Assembly Bill 1493. Available at: http://www.arb.ca.gov/cc/ccms/ccms.htm

Ukiah's electric power mix was made up of approximately 55% eligible renewable sources, including geothermal (41.23%), small hydroelectric (12.33%), wind (0.74%), biomass and waste (0.64%) and solar (0.07%).

California Building Code

Title 24, of the California Code of Regulations, Part 6 sets forth California's energy efficiency standards for residential and nonresidential buildings and was established in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods. The most recent standards were adopted on April 23, 2008, and went into effect on January 1, 2010. The update to the Code supports the goals as described in AB 32, by enhancing energy efficiency of all new residential and non-residential development. It is expected that the 2008 update will reduce GHG emissions from California residential buildings for electricity by approximately 21% and natural gas by 9%, and non-residential buildings for electricity by approximately 5% and natural gas by 9%. A further update to Title 24 (the 2013 Standards) is expected to be effective on January 1, 2014.

The 2010 California Green Building Standards Code, referred to as CALGreen, is a component of the California Building Code. CALGreen went into effect on January 1, 2011, requiring that new buildings reduce water consumption, employ building commissioning to increase building system efficiencies, divert construction waste from landfills, and install low pollutant emitting finish materials. CALGreen has roughly 50 nonresidential mandatory measures and an additional 130 provisions that have been placed in the appendix for optional use. Some key mandatory measures for commercial occupancies include specified parking for clean air vehicles, a 20% reduction of potable water use within buildings, a 50% construction waste diversion from landfills, use of building finish materials that emit low levels of volatile organic compounds, and commissioning for new, nonresidential buildings over 10,000 square feet.[7] CALGreen Nonresidential updates became effective July 1, 2012, and additional updates are anticipated to become effective January 1, 2014.[8]

Senate Bill 375 (Steinberg)

In 2008, SB 375 was enacted to address indirect GHG emissions caused by urban sprawl. SB 375 develops emissions-reduction goals that apply to a region's transportation planning activities. SB 375 provides incentives for local governments and developers to create new walkable and sustainable communities, revitalize existing communities, and implement conscientiously planned growth patterns that concentrate new development around public transportation nodes. CARB has been working with the state's metropolitan planning organizations (MPOs) to align their regional transportation, housing, and land use plans to reduce vehicle miles traveled and demonstrate the region's ability to attain its GHG reduction targets. Since Mendocino County is a relatively rural county and not part of an MPO, the county (including the City of Ukiah) is not subject to the requirements of SB 375.

7 California Building Standards Commission. The CALGreen Story. Available at: http://www.documents.dgs.ca.gov/bsc/CALGreen/The-CALGreen-Story.pdf

8 California Building Standards Commission. CALGreen. Available at: http://www.bsc.ca.gov/Home/CALGreen.aspx

Senate Bill 97 (Dutton) and OPR Guidance for CEQA

Recognizing that AB 32 did not discuss how GHGs should be addressed in documents prepared under the California Environmental Quality Act (CEQA), the legislature enacted SB 97 to require the Governor's Office of Planning and Research (OPR) to develop and adopt CEQA guidelines for the mitigation of emissions. The draft guidelines were formalized on March 18, 2010, and all CEQA documents prepared after this date are required to comply with the OPR-approved amendments to the CEQA Guidelines.

OPR's guidance for agency compliance with CEQA requires that lead agencies analyze and document the environmental impacts of proposed projects. OPR has developed guidance on the analysis and mitigation of GHG emissions in CEQA documents. This guidance states that lead agencies should develop their own approach to performing climate change analysis for projects that generate GHG emissions, and that compliance with CEQA can be achieved by identification and quantification of GHG emissions, assessment of significance of the impact on climate change, and identification of mitigation measures and/or alternatives if the impact is found to be significant.

OPR developed, and the California Resources Agency has adopted, amendments to the *CEQA Guidelines* to incorporating this guidance. *CEQA Guidelines* Section 15183.5(b) states that a lead agency may choose to analyze and mitigate significant GHG emissions in a plan for the reduction of GHGs or similar document, and that such a plan may be used in a cumulative impacts analysis of a project. A lead agency may determine that an individual project's incremental contribution to a cumulative effect on climate change is not cumulatively considerable if the project complies with the requirement of the previously adopted plan to reduce GHGs. This plan should:

1. Quantify GHG emissions, both existing and projected over a specified time period, resulting from activities within a defined geographic area;
2. Establish a level, based on substantial evidence, below which the contribution to GHG emissions from activities covered by the plan would not be cumulatively considerable;
3. Identify and analyze the GHG emissions resulting from specific actions or categories of actions anticipated within the geographic area;
4. Specify 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;
5. Establish a mechanism to monitor the plan's progress toward achieving the level and to require amendment if the plan is not achieving specified levels; and
6. Be adopted in a public process following environmental review.

In developing the Ukiah Climate Action Plan, the City will fulfill OPR steps (1) through (6) for the full spectrum of GHG emissions.

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3 Greenhouse Gas Emissions Inventories, Forecasts, and Targets

Overview

The City of Ukiah Greenhouse Gas (GHG) Inventory serves multiple purposes. It quantifies the GHG emissions resulting from activities taking place throughout the City of Ukiah by the City's residents, businesses, and local government (i.e., community-wide emissions), as well as emissions attributed to operation of the local government (i.e., municipal emissions). The inventory provides an understanding of where GHG emissions are originating, and creates an emissions baseline against which the City can set emissions reduction targets and measure future progress. The inventory further allows the City to develop effective policies, strategies, and programs to reduce emissions.

The 2005 and 2010 inventories provide a breakdown of GHG emissions by sector to illustrate the contribution of various sources in the community and in municipal operations. 2005 was chosen as the baseline year based on guidance from the California Air Resources Board (CARB) and the California State-wide Energy Efficiency Collaborative (SEEC), and is consistent with most local government climate action plans in California. The 2010 updated inventory is based on more recent data and the general trend for each sector over time.

In addition to accounting for the 2005 baseline and 2010 updated emissions, this chapter forecasts future emissions using current best estimates for population, households, and job growth within the City under "business-as-usual" conditions, and under an 'adjusted' forecast scenario that includes the effect of state-mandates on GHG reductions. This chapter further provides a reduction target for 2020, based on guidance from CARB.

The boundaries of analysis, along with the methodology and assumptions used to develop Ukiah's GHG inventory and future projections, are included as Appendix A. The technical report on transportation modeling of base year and future conditions in Ukiah, provided by Fehr & Peers, is included as Appendix B.1.

Community-Wide Emissions

The emission sources and activities chosen for inclusion in the Ukiah community-wide inventory are based on the reporting framework for local governments developed by ICLEI in their *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions*. As such, emissions in the community-wide inventory include those that derive from sources located within the jurisdiction and from activities by community members for which the local government has significant influence to mitigate by 2020. This generally includes activities taking place within the City's geopolitical boundary where the local government has jurisdictional authority, as well as community-related activities taking place outside of City-limits that are attributable to community activities (e.g., landfill waste from City residents). The community-wide inventory includes emissions from residential, commercial, and industrial activities, as well as municipal operations, broken into 12 sectors: Residential Electricity, Residential Natural Gas, Commercial/Industrial Electricity, Commercial/Industrial Natural Gas, Stationary Sources Energy, Water Conveyance Electricity, On-road Transportation, Off-road Transportation, Agricultural Equipment, Wastewater Treatment (process emissions[1]), Solid Waste Generation, and City Landfill.

Emissions from municipal operations are included in the appropriate community inventory sectors, and for informational purposes a separate accounting of GHG emissions associated with municipal operations is included in the following section. That accounting includes emissions from City's operation of Ukiah Municipal Airport, from electricity, natural gas, vehicle fleet, solid waste, and stationary sources sectors, as appropriate. Emissions from privately-owned aircraft using the airport are not included in the municipal or community inventories because: 1) the City does not have operational control or significant influence over the privately-owned aircraft using the airport, and: 2) methods for quantifying and apportioning emissions from private aircraft rely on fuel and travel data that is typically of low quality or very difficult to obtain. Emissions from sources not subject to significant influence by the community were not included within the community inventory, such as the upstream impacts of materials used by the community, since the local government has limited means to influence community material uses. The community inventory also excludes emissions sources that meet the following criteria:

- Very small or insignificant sources – this includes sources such as propane-fired cooking grills or acetylene welding torches that contribute very little in terms of overall emissions, and for which accurate and complete data is difficult to obtain. In general, sources can be excluded from the analysis (e.g., are "de minimis") if, when combined, the excluded emissions from them total less than 5% of the total emissions inventory.
- Prohibitively difficult to track with accuracy or lack necessary data to calculate, especially where the science is still evolving or the data may not be available (e.g., non combustion industrial emissions sources such as the use of hydrofluorocarbons).
- Largely located outside the jurisdiction's boundaries, and outside its control or influence – such as transportation fuel used by intercity air and rail traffic.

1 Process emissions consist of methane (CH_4) and nitrous oxide (N_2O) generated by combustion of digester gas, plant processes, and fugitive emissions from effluent discharge. Natural gas and electricity consumed by the Wastewater Treatment plant are captured in the natural gas and electricity sectors.

The baseline 2005 GHG inventory for the community of Ukiah totals 155,480 metric tons (MT) of carbon dioxide equivalent (CO_2e[2]). Figure 3-1 and Table 3-1 show total GHG emissions by sector. In 2005, On-road Transportation accounted for of the largest portion of overall community-wide emissions, constituting 47.9 percent of total emissions. Contributions from other sectors, in order of magnitude, include: City-operated Landfill[3] (23.8 percent), Residential Energy (electricity and natural gas, 10.4 percent), Commercial/Industrial Energy (electricity and natural gas, 9.0 percent), Solid Waste Generation (3.0 percent), Agriculture (2.8 percent), Off-road Transportation (2.7 percent), Wastewater Treatment (0.2 percent), Water Conveyance Electricity (0.1 percent), and Stationary Sources (<0.1 percent).

Figure 3-2 shows changes in GHG emissions by sector between 2005 and 2010, when community-wide emissions decreased by approximately 7 percent to 144,625 MT CO2e, with 9 of the 12 sectors experiencing a decrease. The 44 percent reduction in emissions from Solid Waste Generation is due to a large increase in waste diversion between 2005 and 2010 (i.e., increased recycling). The decrease at the City-operated Landfill is due to the natural attenuation of methane (CH4) emissions as the waste in place decomposes and releases less landfill gas over time. Electricity-related reductions (Residential, Commercial, and Water Conveyance) can be attributed to lower power consumption resulting from the economic downturn, and an increase in the amount of low-carbon renewable energy sources in the City's electricity portfolio from 2005 to 2010. Overall, the percent that each sector contributed to total emissions did not change significantly between 2005 and 2010, with On-road Transportation continuing to comprise the largest sector (51.1 percent), followed by the City Landfill (21.1 percent), and Residential Energy (electricity and natural gas, 11.2 percent).

Table 3-1
2005 Baseline and 2010 Updated Community GHG Emissions by Sector

Emission Sector	2005 Baseline (MT CO2e)	2005 (% Total)	2010 (MT CO2e)	2010 (% Total)	2005-2010 (% Change)
Residential – Electricity	1,918	1.2%	1,679	1.2%	-12.4%
Residential - Natural Gas	14,370	9.2%	14,490	10.0%	0.8%
Commercial/Industrial - Electricity	4,323	2.8%	3,212	2.2%	-25.7%
Commercial/Industrial - Natural Gas	9,658	6.2%	9,231	6.4%	-4.4%
Stationary Sources - Energy	47	<0.1%	48	<0.1%	0.8%
Water Conveyance - Electricity	126	0.1%	78	0.1%	-38.1%
Transportation - Off-road	4,200	2.7%	4,302	3.0%	2.4%
Transportation - On-road	74,477	47.9%	73,896	51.1%	-0.8%
Agricultural Equipment	4,330	2.8%	4,134	2.9%	-4.5%
Wastewater Treatment	377	0.2%	372	0.3%	-1.3%
Solid Waste Generation	4,722	3.0%	2,641	1.8%	-44.1%
City Landfill	36,934	23.8%	30,543	21.1%	-17.3%
Total	155,480	100%	144,625	100%	-7.0%

2 Carbon dioxide equivalent (CO2e) includes carbon dioxide, methane (CH4) and/or nitrous oxide (N2O).
3 The City-Operated Landfill stopped accepting new waste in 2000. However, it continues to emit GHGs from the breakdown of stored waste.

Figure 3-1
2005 Baseline Community GHG Emissions by Sector

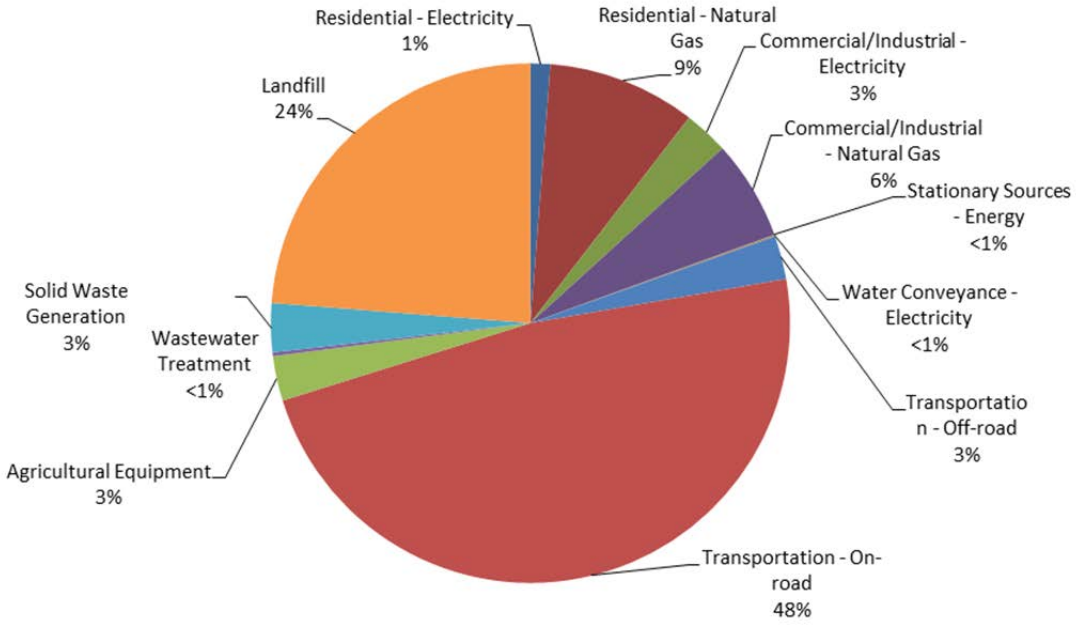
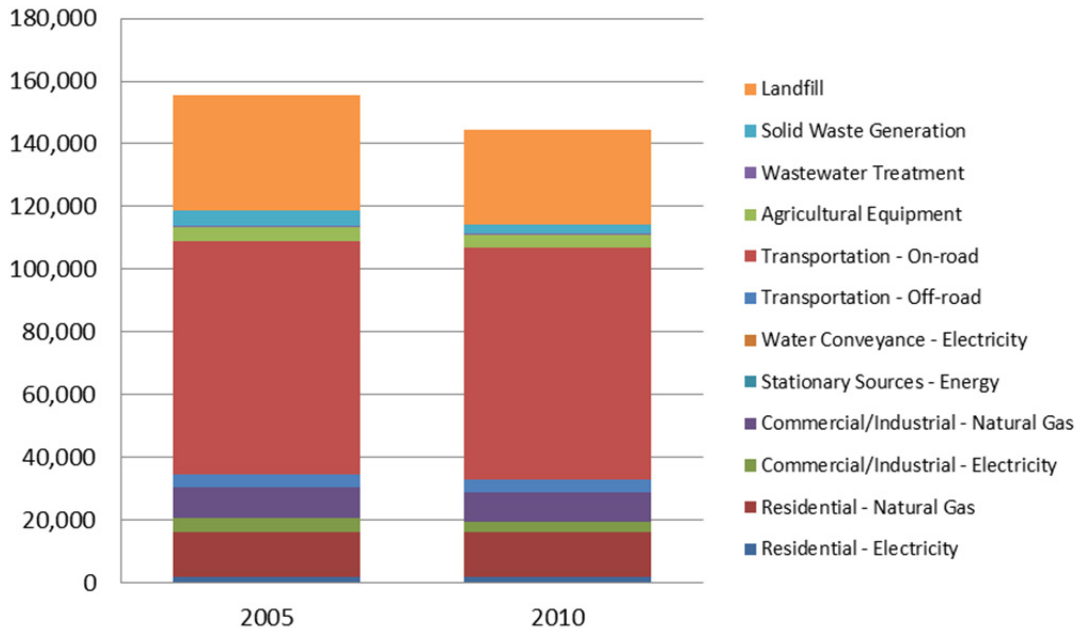


Figure 3-2
2005 and 2010 Community GHG Emissions by Sector (MT CO2e)



Municipal Operations Emissions

Although emissions from Ukiah municipal operations are included in the community inventory, this chapter provides added detail on the GHG emissions from municipal operations. The Ukiah municipal operations inventory includes all sources of GHG emissions that are under the direct control of the City, and details emissions from eight categories: Electricity, Natural Gas, City Vehicle Fleet (fuel), Solid Waste Generation, Employee Commute, Stationary Sources, Wastewater Treatment (process emissions), and City Landfill. Emissions from Ukiah Regional Airport operations are included within the municipal electricity, natural gas, vehicle fleet, solid waste, and stationary sources sectors, as appropriate.

Table 3-2 and Table 3-3 demonstrate the large influence that the closed City Landfill has the municipal operations inventory. Table 3-2 summarizes the municipal inventory with the City Landfill emissions included, resulting in a total inventory of 38,903 MT CO2e. Table 3-2 excludes the City Landfill emissions, showing a total 1,969 MT CO2e from municipal operations, but providing a clearer picture of the contributions from existing city operations. As shown in Table 3-3, between 2005 and 2010 municipal operations emissions decreased by approximately 7.8 percent (excluding City Landfill emissions) to 1,814 MT CO2e. As in 2005, in 2010 the three sectors with the highest emissions remained City Vehicle Fleet Fuel (30.2 percent), Wastewater Treatment processes (26.2 percent), and Electricity for facilities and streetlights (15.6 percent). If City Landfill emissions are included (Table 3-2), municipal emissions decreased 16.8 percent to 32,357 MT CO2e. As discussed previously for community-wide emissions, the 17.3 percent decrease City Landfill emissions is due to a natural reduction in the decomposition rate of deposited waste over time, and the 40.1 percent decrease in emissions from Solid Waste Generation is likely due to a large increase in waste diversion. Electricity-related emissions also show a sharp decrease (39.1 percent), both from lower electricity consumption in 2010 likely due to a smaller staff, and an increase in the amount of low-carbon renewable energy sources in the City's electricity portfolio. Natural Gas for municipal facilities increased 26.4 percent between 2005 and 2010, primarily due to four new facilities being brought online.

Table 3-2
2005 Baseline and 2010 Updated Municipal Operations GHG Emissions by Sector – With Landfill

Emission Sector	2005 Baseline (MT CO2e)	2005 (% Total)*	2010 Update (MT CO2e)	2010 (% Total)*	2005-2010 (% Change)
Electricity	465	1.2%	283	0.9%	-39.1%
Natural Gas	129	0.3%	164	0.5%	26.4%
City Vehicle Fleet - Fuel	550	1.4%	549	1.7%	-0.2%
Solid Waste Generation	48	0.1%	29	0.1%	-40.1%
Stationary Sources	25	0.1%	24	0.1%	-3.8%
Wastewater Treatment	474	1.2%	475	1.5%	0.1%
Employee Commute	277	0.7%	291	0.9%	4.9%
City Landfill	36,934	94.9%	30,543	94.4%	-17.3%
Total (with City Landfill)	38,903	100%	32,357	100%	-16.8%

Table 3-3
2005 Baseline and 2010 Updated Municipal Operations GHG Emissions by Sector – Without Landfill

Emission Sector	2005 Baseline (MT CO2e)	2005 (% Total)*	2010 Update (MT CO2e)	2010 (% Total)*	2005-2010 (% Change)
Electricity	465	23.6%	283	15.6%	-39.1%
Natural Gas	129	6.6%	164	9.0%	26.4%
City Vehicle Fleet - Fuel	550	27.9%	549	30.2%	-0.2%
Solid Waste Generation	48	2.4%	29	1.6%	-40.1%
Stationary Sources	25	1.3%	24	1.3%	-3.8%
Wastewater Treatment	474	24.1%	475	26.2%	0.1%
Employee Commute	277	14.1%	291	16.0%	4.9%
Total (without City Landfill)	1,969	100%	1,814	100%	-7.8%

Figure 3-3 shows 2005 baseline municipal GHG emissions by sector, excluding City Landfill emissions. The primary sources were City Vehicle Fleet Fuel (27.9 percent), Wastewater Treatment processes (24.1 percent), and Electricity for facilities and streetlights (23.6 percent). Remaining emissions came from Employee Commuting (14.1 percent), Natural Gas for facilities (6.6 percent), Solid Waste Generation (2.4 percent), and Stationary Sources fuel (1.3 percent). Figure 3-4 shows baseline emissions including the City Landfill, in which case the City Landfill generated approximately 94.9 percent of total municipal operations emissions. Figure 3-5 shows changes in GHG emissions by sector between 2005 and 2010.

Figure 3-3
2005 Baseline Municipal GHG Emissions by Sector, Excluding City Landfill

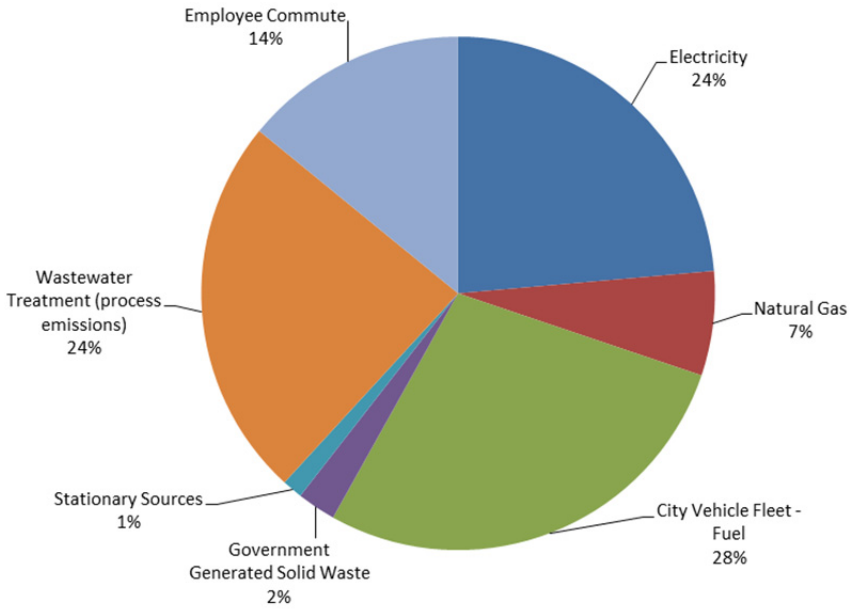


Figure 3-4
2005 Baseline Municipal GHG Emissions by Sector, Including City Landfill

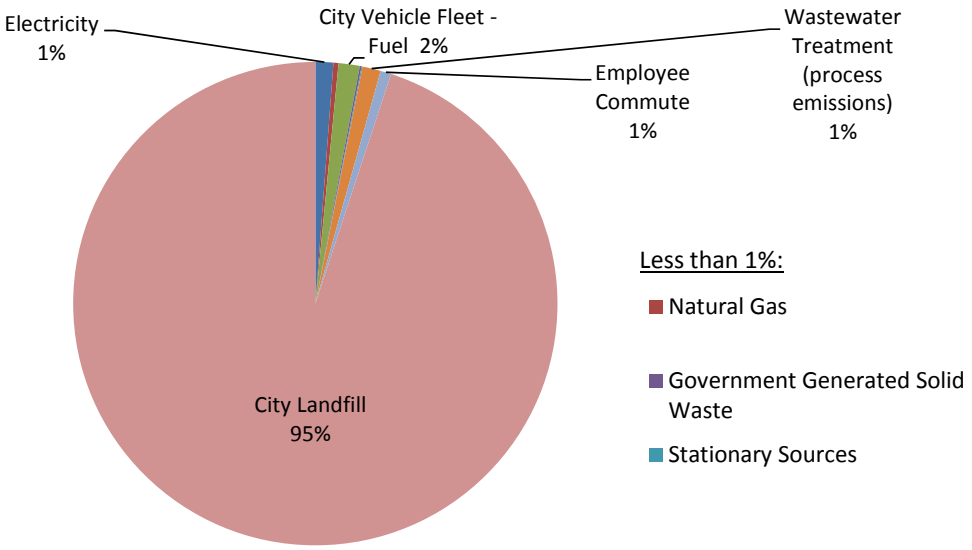
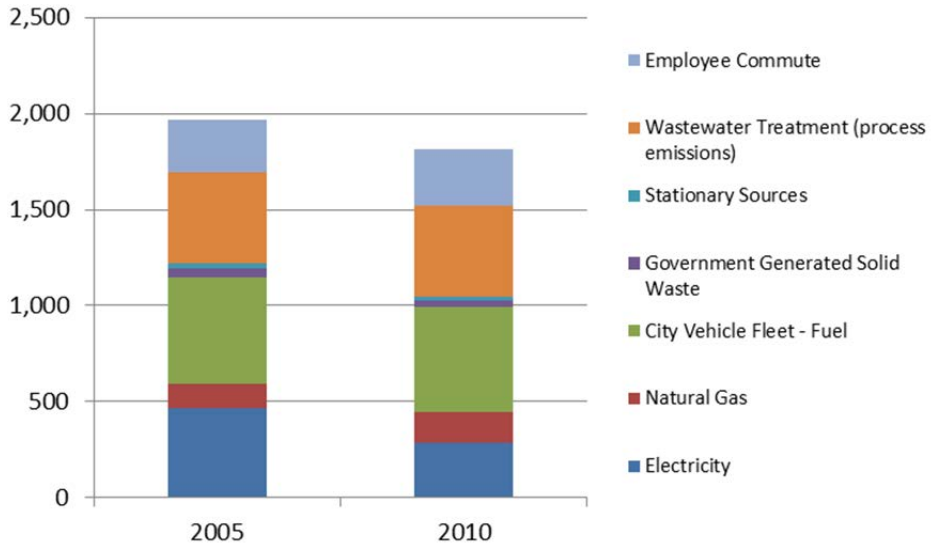


Figure 3-5
2005 Baseline and 2010 Updated Municipal Emissions by Sector (MT CO2e) (Excluding City Landfill)



Emissions Forecasts

GHG emissions projections for 2020 and 2030 were developed under a business-as-usual (BAU) scenario, i.e., a scenario that does not include regulatory actions or GHG reduction measures that were not in place by the 2005 base year. For community-wide emissions, this section also includes a 2020 "adjusted" forecast that includes the effects of state-wide emissions reductions measures such as updates to building energy standards and implementation of programs to decrease emissions from on-road vehicles.

Business-as-Usual Forecast

GHG emissions projections for the community and for municipal operations were based primarily on anticipated growth in total population, employment and/or housing in the City of Ukiah for the periods 2010 to 2020 and 2010 to 2030. Historical City population data was obtained from the California Department of Finance (DOF, 2012)[4], and future population projections were taken from the City of Ukiah 2010 Urban Water Management Plan. For community-wide employment, historical estimates were obtained from the 2010-2011 Mendocino County Economic & Development Profile (labor force only). Future employment projections were taken from the model used to estimate future vehicle miles traveled (see Appendix A). Historical housing data was obtained from the California Department of Finance, and future housing estimates were taken from the Fehr & Peers Ukiah VMT Inventory Memo (see Appendix B.1)[5]. For municipal employment, historical estimates were obtained from City records and projected trends were calculated using historical growth patterns. See Appendix A for more detail on growth factors and estimates.

Community-wide Projections

Table 3-3 shows anticipated GHG emissions for the twelve sectors included in the City's community-wide 2005 and 2010 GHG inventories. The table includes a description of the specific growth projections used as a proxy to project future emissions for each sector.

Table 3-4
Community-wide Baseline and Projected GHG Emissions 2005-2030 under a BAU Scenario (MT CO2e)

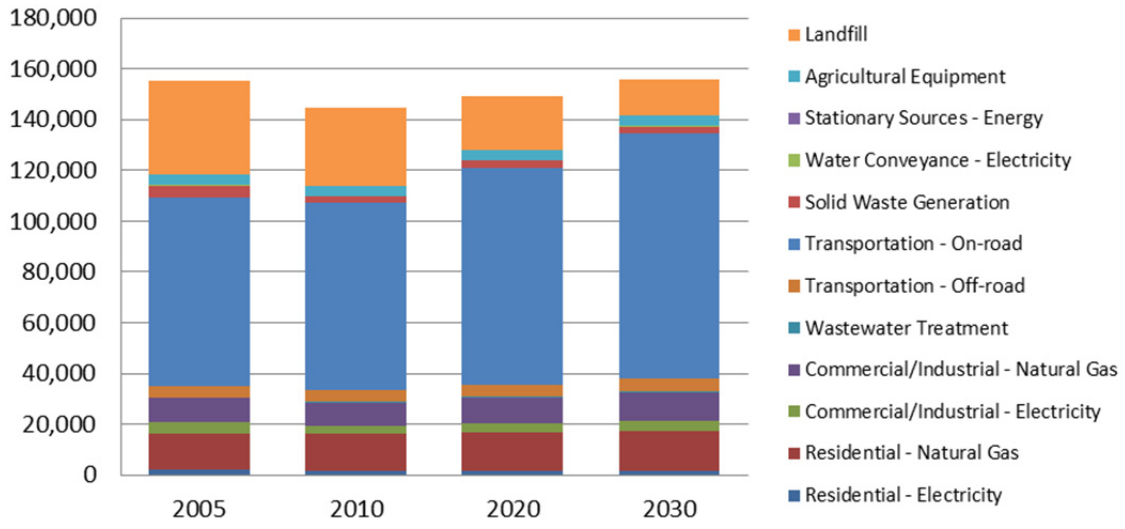
Emission Sector	2005 Emissions	2010 Emissions	2020 Emissions	2030 Emissions	Growth Proxy
Residential - Electricity	1,918	1,679	1,744	1,806	Average of population and household growth
Residential - Natural Gas	14,370	14,490	15,047	15,582	Average of population and household growth
Commercial/Industrial - Electricity	4,323	3,212	3,544	3,849	Employment growth
Commercial/Industrial - Natural Gas	9,658	9,231	10,185	11,063	Employment growth
Stationary Sources - Energy	47	48	50	51	Average of population and household growth
Water Conveyance - Electricity	126	78	82	87	Average of pop., household, and employment growth

4 California Department of Finance, (E-8 Historical Population and Housing Estimates for Cities, Counties and the State, 2000-2010). Accessible at: http://www.dof.ca.gov/research/demographic/reports/view.php#objCollapsiblePanelEstimatesAnchor

5 See Appendix B.1.

Emission Sector	2005 Emissions	2010 Emissions	2020 Emissions	2030 Emissions	Growth Proxy
Transportation – Off-road	4,200	4,302	4,718	5,155	Employment growth
Transportation – On-road	74,477	73,896	85,523	96,456	Vehicle miles traveled (VMT)
Agricultural Equipment	4,330	4,134	4,134	4,134	No growth
Wastewater Treatment	377	372	395	415	Average of pop., household, and employment growth
Solid Waste Generation	4,722	2,641	2,799	2,945	Average of pop., household, and employment growth
Landfill	36,934	30,543	20,887	14,215	N/A (Projections used California ARB Landfill Emissions Tool, and EPA's LandGEM software)
Total	**155,480**	**144,625**	**149,108**	**155,759**	

Figure 3-6
2005 Baseline, 2010 Update, and 2020 and 2030 BAU Community Emissions by Sector (MT CO2e)



Municipal Projections

For projecting municipal emissions, it was assumed that wastewater treatment (process emissions) would grow commensurate with community population, household, and employment growth, whereas other municipal departments, facilities, and services would grow in proportion to municipal employment trends. Municipal employment is anticipated to grow at a slightly slower rate than the City population from 2010 to 2020 and 2030, following the same annual rate of growth in municipal employment during the 2000 to 2011 period. Table 3-4 shows historic and projected GHG emissions for municipal sources.

Table 3-5
Municipal Baseline and Projected GHG Emissions 2005-2030 under a BAU Scenario (MT CO2e)

Emission Sector	2005 Emissions	2010 Emissions	2020 Emissions	2030 Emissions	Growth Proxy
Electricity	465	283	303	324	City employee FTE
Natural Gas	129	164	175	187	City employee FTE
City Vehicle Fleet - Fuel	550	549	586	627	City employee FTE
Solid Waste Generation	48	29	31	33	City employee FTE
Stationary Sources	25	24	26	28	City employee FTE
Wastewater Treatment	474	475	503	529	Average of pop., household and employment growth
Employee Commute	277	291	311	333	City employee FTE
Total (without City Landfill)	**1,969**	**1,814**	**1,935**	**2,060**	
City Landfill	36,934	30,543	20,887	14,215	Historical landfill emissions
Total (with City Landfill)	**38,903**	**32,357**	**22,822**	**16,275**	

'Adjusted' Forecast including State Regulations and Programs

State-wide emissions reduction measures will contribute to Ukiah's overall GHG reductions by 2020. Several high-impact state-wide measures included in the AB 32 Scoping Plan target emissions from transportation and power generation.

The Low Carbon Fuel Standard (LCFS) to reduce the carbon intensity of transportation fuels and the Pavley Bill for reducing passenger vehicle emissions (Assembly Bill 1493) are each expected to provide significant emissions reduction benefits for the City of Ukiah, particularly since on-road emissions constitute such a large proportion of total community-wide emissions (57.4% in 2020). By 2020, the impact of both the Pavley Bill and the LCFS in Mendocino County is projected to reduce on-road transportation emissions by approximately 19.3 percent.[6]

In addition, updates to California's Title 24 (Building Energy Efficiency Standards for Residential and Non-residential Buildings) will provide improvements to the energy efficiency of new residential and commercial structures constructed between 2005 and 2020. By 2020, residential energy improvements for electricity and natural gas efficiency are projected to reach 10.0 percent and 22.7 percent above pre-2005 Title standards, respectively, and commercial energy improvements for electricity and natural gas efficiency are projected to reach 9.4 percent and 4.9 percent.[7] These energy savings impact new development in the City of Ukiah

6 EMFAC 2011 Model Run for Mendocino County, accessed February, 2013.
7 Impact Analysis: 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings Available at: http://www.energy.ca.gov/title24/2008standards/rulemaking/documents/2007-11-07_IMPACT_ANALYSIS.PDF

between the base year (2005) and 2020, with a corresponding annual reductions in electricity-related emissions of 28 MT CO2e, and natural gas-related emissions of 131 MT CO2e, by the year 2020.

The state's Renewable Portfolio Standard (RPS) requires the renewable energy portion of a utility's portfolio to be at least 33 percent by 2020. However, the City-owned Electric Utility that serves Ukiah has a portfolio with eligible renewable sources already accounting for 55 percent, with hydroelectric and nuclear sources providing an additional 21 and 4 percent, respectively. Since the City Electric Utility has already far surpassed the RPS goal, and since PG&E provides less than 1 percent of the City of Ukiah's electricity needs[8], the State-wide RPS will not have a significant effect on Ukiah's emissions in 2020, and is so is not included in the adjusted emissions forecast for Ukiah.

The collective impact of state-wide measures on the City of Ukiah emissions forecast is presented in Table 5. By 2020, these measures are expected to reduce city-wide GHG emissions by an estimated 11.2 percent, resulting in annual emissions of approximately 132,437 MT CO2e.

Table 3-6
Annual GHG Reductions from State-wide Measures by 2020

State Measure	GHG Emissions (MT CO2e/year)
2008 Title 24 –Electricity	28
2008 Title 24 –Natural Gas	131
Pavley Bill and Low Carbon Fuel Standard	16,513
Total Reductions	**16,671**

Emissions Reduction Target

The City of Ukiah is setting its community-wide GHG emissions reduction target at 15 percent below its 2005 baseline by the year 2020, for both community-wide and municipal emissions. A 15 percent reduction target is deemed by CARB and the California Attorney General to be consistent with the state-wide AB 32 goal of reducing emissions to 1990 levels,[9] and is in line with current best practice for climate action plans developed for numerous California cities, many of which use a 2005 baseline.

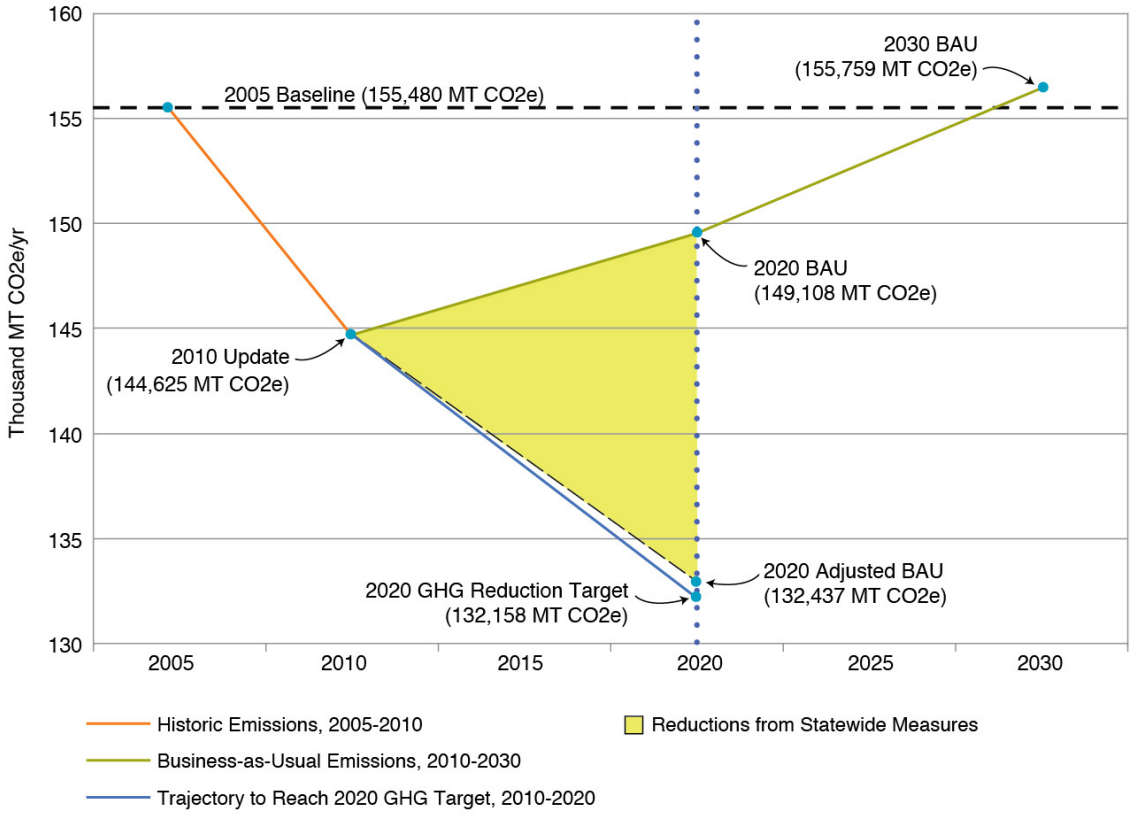
Community Emissions

The City's target of 15 percent below 2005 baseline by 2020 equates to 132,158 MT CO_2e per year for community emissions, which is 23,322 MT CO_2e below the 2005 baseline, 16,950 MT CO_2e below the projected 2020 BAU emissions, and 279 MT CO2e below the adjusted BAU. The community-wide emissions reduction target is depicted graphically in Figure 3-7.

8 Based on data provided by the City of Ukiah Electric Utility Department.

9 In its Climate Change Scoping Plan of September 2008, CARB recommends that local governments adopt a GHG reduction target consistent with the State's commitment to reach 1990 levels by 2020. This is identified as equivalent to 15% below "current" levels at the time of writing (2008).

Figure 3-7
Community-wide GHG Emissions under 2005 Baseline, 2010 Update, 2020 BAU, 2020 Adjusted BAU, and 15% Reduction Target for 2020



Municipal Operations Emissions

Though municipal operations emissions are much lower than emissions from the overall community, a reduction target for municipal operations is appropriate because many of the measures included in this Climate Action Plan apply to facilities or operations under the direct control of the City, and because the City intends to lead by example in meeting the mandates of AB 32. Applying the 15 percent reduction to the 2005 baseline emissions (without landfill) results in a 2020 target of 1,673 MT CO_2e, representing a reduction below business-as-usual of 262 MT CO2e per year in 2020.

4 Greenhouse Gas Reduction Goals and Strategies

Overview

This chapter describes the strategies that the City of Ukiah plans to implement to reduce greenhouse gas (GHG) emissions and work toward the reduction target described in Chapter 3. To be in compliance with AB 32 and CARB guidelines, Ukiah must reduce its community-wide GHG emissions to 15 percent below 2005 levels, or 132,158 MT CO_2e per year; this is equivalent to 16,950 MT CO_2e below the 2020 forecast under business-as-usual (BAU) conditions. The impacts of statewide measures included in the AB 32 Scoping Plan account for annual emissions reductions of 16,671 MT CO_2e, leaving a remainder of 279 MT CO_2e to be reduced by the strategies described herein.

This chapter presents GHG reduction goals and strategies for four different sectors: Energy, Transportation and Land Use, Solid Waste, and Water. Each section begins with a summary of the GHG reductions anticipated from the sector, followed by a general discussion of existing conditions and effective strategies for reducing emissions, and presentations of individual strategies and implementing actions. Detailed calculations used to quantify the costs and emissions reductions associated with individual strategies and actions are included in Appendix C. The City's municipal strategies are included within each relevant sector, where appropriate. In total, locally implemented strategies and measures are expected to reduce GHG emissions by 4,233 MT CO2e annually by the year 2020, thereby far exceeding the reduction target of 279 MT CO2e.

Table 4-1, below summarizes the expected contribution from each emissions reduction sector resulting from implementation of the Climate Action Plan, by the year 2020.

Table 4-1
Estimated Annual GHG Reduction Potential of Climate Action Plan Sectors, by 2020

Reductions from:	MT CO2e	Relative Contribution
Energy strategies	1,692	40%
Transportation and Land Use strategies	944	22%
Solid Waste Minimization strategies	1,597	38%
Water strategies	NA	NA
Total	4,233	100%

Outreach and Stakeholder Engagement

At the City's April 24, 2013 Planning Commission meeting, staff conducted a workshop on the Climate Action Plan and reported the results of the municipal and city-wide GHG emissions inventories. The workshop provided an opportunity for the public to learn about local and statewide GHG reduction goals, and learn about the City's current and projected emissions. At the workshop, the City sought public input about what the City can to do chart a feasible course of action for reducing community-wide emissions and to begin preparing the City for the impacts of climate change. The City gathered public input on issues such as:

- Level of support for specific actions the City can take to reduce the community's GHG emissions and prepare the City for climate change;
- The challenges and barriers to implementing such initiatives in Ukiah; and
- Suggestions for programs or policies that could help overcome the challenges and barriers.

An interactive format allowed workshop attendees to indicate preferences and ask questions about specific strategies. For interested residents and businesses who could not attend the workshop, an online survey about the CAP was made available on the City of Ukiah website. Along with the feedback gathered at the workshop, the City received over 100 responses to its survey. Information learned at the public workshop and from the survey results informed the specific goals, strategies, and actions that are included in this Climate Action Plan. Appendix D provides a copy of the survey, as well as summary of results and input from public engagement.

Nomenclature and Strategy Prioritization

The City of Ukiah has significant policy influence over four main sectors of the City's GHG emissions profile: Energy, Transportation & Land Use, Solid Waste, and Water. For each of these sectors, this chapter provides one or more goals, strategies, and actions:

Goals are general statements of aspiration or intent to achieve a desired condition. There are one or more goals for each of the four sectors, and each goal is labeled according to the sector with which it is associated, as follows: Energy Section (E), Transportation & Land Use (TL), Solid Waste (SW), and Water (W). For example, Goal E-1 is the first goal of the Energy sector.

Strategies are a course of action to be undertaken by the City to meet the goals related to climate change. Each strategy is designated with a code that corresponds to its sector and goal. As an example, Strategy SW-2.1 is the first strategy of the second goal for the Solid Waste Sector.

Actions are detailed steps the City will take to implement the strategies. Each action was carefully considered by the City to ensure that appropriate staff and resources would be available for implementation. Each action is also designated a code that corresponds to the goal and strategy it will implement. For example, Action TL-2.1a is associated with Strategy 2.1, which in turn is associated with Goal TL-2.

The goals, strategies, and actions are organized using the following numeric order:

Sector (E, TL, SW, W)

Goal 1	Goal 2
Strategy 1.1	Strategy 2.1
Action 1.1a	Action 2.1a

Each strategy was evaluated to identify the greatest opportunities for GHG reduction that can be achieved with minimum cost. The City estimated the upfront costs and ongoing staff resources needed for strategy implementation (e.g., low, medium, high), as well as the anticipated energy, GHG, and cost reduction benefits (e.g., minimal or indirect, moderate, high). Strategies in this chapter are broadly prioritized as 1 (high priority), 2 (medium priority), and 3 (low priority), based on the following matrix:

Table 4-2
Prioritization of Community Strategies

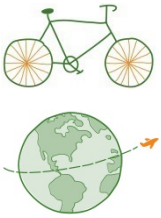
		Annual Cost		
		Low	Medium	High
Benefits	High	1	1	2
	Medium	1	2	3
	Low	2	3	3

Priority 1 and some Priority 2 strategies were evaluated for estimates of GHG reductions to be achieved by 2020 resulting from implementation. Priority 2 and 3 strategies are generally considered to have low-to-medium GHG benefits, and medium-to-high costs. Some strategies are categorized as 'supporting strategies,' meaning they do not result in direct reductions in energy use but provide beneficial support to other Climate Action Plan strategies. This plan does not include calculations of GHG savings for supporting strategies. Co-benefits, including local economic benefits (e.g., helps create local jobs), public health benefits, energy security, air quality impacts, and quality of life impacts were also considered, and are summarized for each strategy in this chapter.

The analysis considered anticipated costs of implementation, including any upfront capital investment needed to implement the strategy, ongoing annual costs, and City staff time required. Annual costs are broadly categorized as falling within one of three ranges: low (less than $10,000), medium (between $10,000 and $50,000), and high (greater than $50,000). For example, Strategy E.1.1 (Promote Commercial Energy Efficiency), it is estimated that the City will spend, on average, between $10,000 and $50,000 annually through the year 2020 on implementation and monitoring, including staff time. As such, annual cost is characterized as medium. Since Strategy E.1.1 has a relatively high impact in terms of reducing GHG emissions, it is rated as a Priority 1 strategy.

Energy (E)

Energy is an essential part of our daily lives, used for a variety of things including the lighting of buildings and outdoor spaces, heating homes, and powering equipment at homes and businesses. The energy sector, which comprises all electricity and natural gas usage in the City of Ukiah, is a significant contributor to citywide emissions, representing 20.5 percent of the projected 2020 BAU emissions. However, Ukiah has the advantage of operating its own electric power utility, providing many advantages in terms of controlling its energy sources and implementing efficiency programs for local residents and businesses. As a result, Ukiah has been very successful in lowering the GHG footprint of its energy usage to a level that is much lower than found in a typical California city. Energy-related reduction strategies in this chapter target efficiency improvements in the commercial/industrial, residential, and municipal sectors, and the expansion of renewable energy generation. Expanded public outreach to support energy efficiency projects is also important. Energy strategies account for 1,692 MT CO2e in avoided GHG emissions, or 40 percent of local CAP strategies.



Transportation and Land Use (TL)

The transportation and land use sector accounts for emissions associated with the development patterns of the City and the mobility behavior of its residents. Transportation is the largest contributor to forecasted citywide emissions, representing about 63.3 percent of the 2020 BAU emissions. Strategies for emissions reduction include pursuing sustainable growth patterns with mixed use and infill development, as encouraged by Ukiah's recently adopted Downtown Zoning Code, as well as reducing single-occupancy vehicle travel and improving non-motorized mobility. Reducing the number of vehicle miles travelled through promotion of alternative transportation will not only reduce GHG emissions but also improve air quality and public health. Transportation and land use strategies account for a reduction of 944 MT CO2e, or 22 percent local CAP strategies.

Solid Waste (SW)

The transport and disposal of solid waste is expected to account for about 1.9 percent of citywide BAU missions in 2020. Ukiah currently disposes its municipal solid waste (MSW) at the Potrero Hills landfill in Solano County. Disposing of used products, packaging, and waste creates GHG emissions when it is buried in landfills and emits GHG emissions during decomposition. Also contributing to the City's GHG emissions inventory are methane emissions from the City-owned landfill on Vichy Springs Road, which has been closed since 2000. Even though the landfill is capped, the buried organic material at the landfill produces methane (CH4), which is released through a pumping system installed at the landfill. Those emissions represent approximately 14.0 percent of the community's 2020 BAU total emissions. The level of

CH4 emissions at the closed landfill will attenuate over time, in effect providing a built-in reduction mechanism. Strategies for reducing emissions from currently generated waste include increased recycling, reducing landfill methane emissions at the Potrero Hills landfill, and reducing vehicle emissions associated with waste hauling. Strategies for this sector account for a reduction of 1,597 MT CO2e, or 38 percent of local CAP strategies.

Water (W)

The primary sources of water for the City of Ukiah are groundwater, surface water from the underflow of the Russian River, and project water available from the Mendocino County Russian River Flood Control and Water Conservation Improvement District. The energy and GHG emissions associated with the pumping and conveyance of water typically represent a small portion of a city's overall inventory, and this is the case for Ukiah (approximately 0.1 percent of 2020 BAU emissions for water conveyance and 0.3 percent for wastewater treatment). However, strategies to reduce water consumption have important co-benefits to local water supply and they are outlined here to facilitate water conservation goals established by the State and by the City of Ukiah Urban Water Management Plan (UWMP).

Municipal Commitment

As explained in Chapter 3, GHG emissions associated with municipal operations are included within the scope of the community-wide inventory. For example, vehicular use for government operations is a subset of the community-wide vehicle miles traveled (VMT), municipal building energy use is included in the community-wide non-residential electrical and natural gas usage, and solid waste generation at the municipal level is incorporated into the generation rate for Ukiah as a whole.

With respect to reduction strategies, municipal operations are considered in the context of community-wide strategies. Regardless, the City government will take a leadership role by taking specific steps to reduce emissions associated with its operations. For each of the Energy, Transportation / Land Use, Solid Waste, and Water sectors described below, strategies applicable to municipal operations or activities are presented. In most cases, GHG reductions achieved through a community-oriented strategy would also reduce emissions from municipal operations. Nonetheless, the City is committed to directly reducing its own GHG emissions.

Energy

- 2020 Adjusted Business-as-Usual GHG Emissions: 30,412 MT CO2e[1]
- Annual GHG emissions reductions by 2020: 1,692 MT CO2e
- Annual GHG emissions reductions by 2030: 3,381 MT CO2e

Emissions associated with consumption of electricity and natural gas account for approximately 23 percent of the City's 2020 adjusted BAU GHG emissions projection. 45 percent of this is associated with commercial buildings and industrial use, while the remainder is associated with residential buildings. Municipal operations, including the energy used for street lighting and traffic lights, contribute a small fraction (approximately 2 percent) of total energy use.

Energy Providers

The City of Ukiah Electric Utility Department is a City-owned utility governed by the City Council. The Electric Utility Department oversees the procurement of wholesale electric power, maintains and operates the local electric distribution system, provides system engineering and planning for , designs and maintains Ukiah's street lighting system,, and maintains and operates the Lake Mendocino Hydroelectric Plant, with a capacity of 3.5 megawatts (MW) and an annual production of 10,000 megawatt-hours (MWh).

The City of Ukiah is committed to providing environmentally friendly electric power to its City residents and businesses. Ukiah Electric Utility Department's latest annual report to the CEC, for fiscal year 2012, indicates that the utility serves more than 8,200 residences and businesses and provides approximately 115,000 MWh of power annually. Ukiah Electric Utility Department is a member of the Northern California Power Agency (NCPA), from which it receives the majority of its electricity supply. The NCPA is a joint powers association (JPA) where members including Ukiah have elected to participate in power generation projects. Due to Ukiah's participation in NCPA projects and power purchasing strategies, Ukiah's electricity GHG footprint is much lower than most California cities.

As described in Chapter 2, the California Renewable Portfolio Standard (RPS) seeks to reduce the proportion of fossil fuel-based electricity generation, and increase the amount of clean, low-emission renewable energy to the power grid. The RPS program requires investor-owned and publically-owned utilities, electric service providers, and community choice aggregators to increase their use of renewable energy resources by up to 33 percent of procurement by 2020. As of 2010, the City's electric power mix was comprised of approximately 41 percent geothermal, 21 percent large hydro, 12 percent small hydro, 14 percent natural gas, 6 percent coal, 4 percent nuclear, and 1 percent each solar, wind, and biomass[2]. In 2010, 55 percent of the electricity supplied by the Ukiah Electric Utility Department qualified under RPS rules as renewable power. This was up from 46.7 percent in 2005.

Pacific Gas and Electric (PG&E) Company serves as the City's primary natural gas utility, providing natural gas for residential, commercial, industrial, and government customers.

[1] Includes impact of statewide GHG reduction measures
[2] Percentages do not add up to 100 because of rounding.

Existing Energy Programs

The majority of electricity and natural gas-related GHG emissions in the City are related to residential and commercial buildings. Under State Assembly Bill 2021, as a publically-owned utility (POU), Ukiah Electric Utility Department must establish 10-year energy efficiency savings targets and identify all potentially achievable cost-effective efficiency savings. The City recently revised its 10-year energy goals that cover energy conservation, solar energy, low-income assistance, and research and development.

The City of Ukiah's electric utility manages a comprehensive energy efficiency incentive program for residential and commercial customers, focusing on peak load reduction and energy conservation. For residential customers, rebates are offered for the installation of various energy efficiency measures. For commercial customers, rebates are available for upgraded lighting, refrigeration equipment, HVAC equipment, and customized programs for specialized customer equipment and applications that reduce energy use. The City's current residential and commercial efficiency programs are summarized below.

City of Ukiah Residential Programs:

- Energy Efficiency Hotline: The City offers electricity customers a toll free to answer questions and provide information on energy efficiency related matters.
- Home Energy Audits: The City provides on-site energy audits to residential customers. Energy efficiency measures are evaluated and recommended based on each audit. Energy savings and rebate analysis are provided for identified measures.
- Appliance Rebates: The City provides rebates for the purchase of several ENERGY STAR® Qualified appliances.
- Residential Heat Pump and Efficient Air Conditioning Rebates: The City offers rebates for residential and small business customers who install high performance heat pumps or air-conditioners that exceed current state efficiency requirements.
- Residential Lighting Rebates: The City offers rebates to homeowners who install ENERGY STAR Qualified compact florescent lamps (CFLs) and LED lighting.
- Insulation, Windows and Weatherization Rebates: The City offers a wide range of rebates to homeowners who invest in insulation, windows and weatherization upgrades.
- Photovoltaic (PV) Buy-Down Program: This program offsets the investment required to install a PV system. The City utility provides rebates to its residential customers to reduce the initial system cost.

City of Ukiah Commercial and Industrial Programs:

- Energy Audits and Rebates: This program offers complementary, on-site energy audits for both commercial and industrial customers. Energy efficiency recommendations and follow up visits support implementation of recommended energy efficiency measures. Rebates and analysis are available for energy efficiency upgrades identified in these audits.
- Commercial Lighting: This program engages local lighting and electrical contractors to promote and install energy efficient lighting upgrades using technical assistance and financial incentives available from the City.
- Keep Your Cool: This offer provides a free, no obligation check of commercial refrigeration equipment. A third-party Keep Your Cool (KYC) contractor examines the condition of fan motors, controls, case

lighting, door gaskets, strip curtains and door closers. If the contractor finds that the current equipment is in need of replacement or upgrading, recommendations are made to customers to have the appropriate equipment installed. Most measures are installed at no cost to the customer, while other measures may require customer co-pay.

- PV Buy-Down Program: This program offsets the investment required to install a PV system. The City utility provides rebates to its commercial customers to reduce the initial system cost.

Table 4-3 shows the estimated energy savings and GHG emissions reductions achieved through energy efficiency programs since fiscal year 2005.[3] The bulk of the savings have come from efficiency improvements to commercial lighting and refrigeration systems. Over this period, the cost of energy efficiency programs has averaged $0.41 per annual kWh saved.

Table 4-3
City of Ukiah: Impact of Energy Efficiency Programs Since 2005

Fiscal Year	Estimated Annual Savings (kWh)	City rebates & admin cost	Approximate GHG equivalent (MT CO2e)**4**
2005	245,644	$100,100	11
2006	252,824	$103,026	11
2007	2,518	$14,510	0
2008	278,721	$105,440	12
2009	552,727	$148,727	24
2010	281,198	$112,838	12
2011	1,095,800	$593,189	48
2012	802,099	$253,122	35
CUMULATIVE	3,511,531	$1,430,952	154

[3] Derived from the City of Ukiah Electric Utility Department's records and annual summary reports submitted to the CEC since FY2007, which outline the City utility's efficiency programs and their performance results, including energy savings achieved. kWh savings estimates for FY2005 and FY2006 are based on annual city expenditures and the average kWh saved per $ spent on rebates and administrative costs from FY2007 through FY2012.

[4] Estimates based on 2010 emission factor for Ukiah Electric Utility Department.

Table 4-4 shows the estimated installed capacity of solar PV systems resulting from City rebates since 2005, and the equivalent GHG emissions reductions.[5]

Table 4-4
City of Ukiah: Impact of Solar PV Rebates Since 2005

Fiscal Year	Estimated Installed PV Capacity (KW)	Estimated Annual GHG equivalent (MT CO2e)[6]
2005	8.0	1.0
2006	23.5	3.0
2007	15.0	1.9
2008	12.0	1.5
2009	7.0	0.9
2010	0.0	0.0
2011	20.0	2.6
2012	18.4	2.3
CUMULATIVE	103.9	13.3

North Coast Energy Services

North Coast Energy Services (NCES), a non-profit business based in Ukiah, provides low-income weatherization services in Ukiah in addition to other communities. These programs complement what the City offers in terms of energy efficiency programs. The NCES weatherization programs are federally funded through the federal Department of Health and Human Services and the Department of Energy, and administered by the Department of Community Services and Development of the State of California. NCES administers these funds for seven California counties, including Mendocino County. They install CFL's, low flow showerheads, faucet aerators, caulking, weather stripping, attic insulation, underfloor insulation, dual pane window replacements, storm windows, door replacements, heater replacements, and AC or evaporative cooler installations. They also provide duct testing, blower door testing, and safety testing for carbon monoxide.

As shown in Table 4-5, from 2005 through 2012, the NCES weatherization program serviced nearly 1,300 households with Ukiah addresses,[7] accounting for more than $1,650,000 in improvements.

In 2011, NCES administered a special program where PV solar panels were installed on 14 households in Ukiah (average 3KW systems). Installations were performed using third-party contractors.

[5] City of Ukiah Electric Utility Department records.
[6] Estimates based on 2010 emission factor for Ukiah Electric Utility, and assumption of 8 hours PV production per day on average.
[7] Figure includes some households that are located outside the city limits.

Table 4-5
NCES Low-Income Weatherization Program

Year	Households Serviced	Total Value of Jobs
2005	79	$97,321
2006	129	$172,692
2007	104	$163,160
2008	85	$91,519
2009	136	$214,008
2010	304	$302,078
2011	313	$407,975
2012	138	$202,365
TOTAL	1,288	$1,651,117

PG&E Programs

Pacific Gas and Electric (PG&E) provides commercial energy audits for its natural gas customers in Ukiah. PG&E also offers rebates and incentives to its natural gas customers, for efficiency upgrades to hot water heaters, furnaces, boilers, ovens, steamers, and other natural gas consuming equipment.[8] The latest information is available on PG&E's web site.

Mendocino County Energy Watch

In 2008, the Community Development Commission of Mendocino County partnered with Pacific Gas and Electric (PG&E) to create Mendocino County Energy Watch (MCEW), which offers a energy efficiency solutions and education for non-residential PG&E customers in the County. Services offered through the partnership include energy efficiency audits and advice, energy benchmarking, informative seminars, GHG emissions inventorying, ENERGY STAR ® benchmarking services, and access to l PG&E incentives/rebates for small businesses, nonprofits, and local governments.

MCEW provides advice and assistance to non-residential energy consumers for taking advantage of available rebates and incentives. Since Ukiah has its own Electric Utility, MCEW's focus in Ukiah is on natural gas, and they actively engage with Ukiah businesses to provide many free or low-cost services to the community, including free auditing and benchmarking services, and assistance with PG&E's programs for improving the energy efficiency of hot water heaters, furnaces, boilers, and other natural gas consuming equipment.

Green Building

The City of Ukiah has implemented a green building education program. The program promotes the use of green building materials and techniques in construction projects to reduce waste and inefficient resource use, reduce pollution and reduce toxicity in the places we live and work, and reduce GHGs. The program is geared towards all construction projects and includes free information about alternative building materials and products, site design techniques, architecture, energy, and ways to reduce waste in the construction process.

[8] Visit www.pge.com/moneybacksolutions to access the latest rebate information, catalogs, application and guidance

The program offers a link to green building resources, and suggestions on the following issue areas:

- Green building design
- Build it to scale
- Energy efficiency
- Site inventory and assessment
- Reduce/reuse/recycle
- Water conservation
- Multiple functions
- Low Impact Development (LID) (a sustainable storm water management strategy that manages storm water at its source and collects rainwater for secondary use.)

In October of 2012, the City adopted the Downtown Zoning Code. The Code promotes infill and other sustainable development concepts, including infill development, more mixed use and pedestrian-oriented development, the reuse and improvement of existing buildings, green building and resource conservation (such as the enhancement of the creek corridor, tree planting, and tree preservation). The update uses a new a hybrid form-based code, a kind of zoning code that does not differentiate between usage types, but instead by physical forms. Specific development standards that apply to green building, and energy and water demands include:

- Outdoor Lighting, Energy Efficiency: Energy efficient fixtures/lamps, such as high pressure sodium, hard-wired compact fluorescent, LED, or other lighting technology that is of equal or greater energy efficiency.
- General requirements, Model Water Efficiency Landscape Ordinance (MWELO): Landscaping and irrigation plans for development projects shall comply with the State of California Model Water Efficiency Landscape Ordinance. Landscaping and irrigation plans submitted as part of the development permit application shall demonstrate compliance with the most recently adopted version of the MWELO unless superseded by City ordinance.
- Irrigation, Design: To reduce water usage.
- Roofs, Roof Slope: Shall be designed to accommodate PV.

In addition, the Code contains the following sections on design criteria (Section 12.030, B):

- Landscape elements that integrate opportunities for outdoor use areas and adequate shading of pavement and windows.
- Articulation in rooflines and the type and pitch of roofs and/or mechanical screening and overhangs for proper shading and solar access to windows.
- Location, size, and spacing of windows, doors, and other openings and orientation for passive solar heating and cooling and provision of awnings, enclosures, and overhangs for entryways.
- Location and orientation of windows, doorways, and outdoor use areas and the potential for heat, glare, odors, noise, or other disturbances from on or off-site sources (i.e., direct sun from west exposures, outdoor lighting, food services areas, recycling and refuse areas, mechanical equipment, roadways, railroads, aircraft overflight, etc.).
- Functional awnings to promote passive solar.

Energy Goals and Strategies

Following California's clean energy policy, which prioritizes energy efficiency in the state's quest to meet energy demand[9], this CAP seeks first to reduce energy demand and maximize energy efficiency, and then to expand new sources of renewable electricity to meet a portion of the remaining demand. Table 4-6 summarizes the Climate Action Plan's energy goals and strategies, along with their estimated GHG reduction impact. Specific energy goals, strategies, and actions are described in the sections that follow. Appendix C provides details on the assumptions and methods used to quantify GHG reductions associated with each strategy.

Table 4-6
Summary of GHG Reduction Impacts for Energy Strategies in 2020 and 2030

	Goal/Supporting Strategy	2020 Annual GHG Reduction (MT CO2e)	2020 Percent of Category	2030 Annual GHG Reduction (MT CO2e)
E.1	Decrease Energy Demand Community-Wide			
E.1.1	Promote Commercial Energy Efficiency	646	38%	1,085
E.1.2	Promote Residential Energy Efficiency	567	34%	964
E.1.3	Improve Municipal Energy Efficiency	76	5%	107
E.1.4	Reduce Urban Heat Islands	2	<1%	16
E.1.5	Promote Commercial & Residential Green Building	23	1%	53
	Promote Renewable Energy Generation			
E.2.1	Promote Cost-effective Renewable Energy for Commercial and Industrial Users	247	15%	817
E.2.2	Promote Cost-effective Renewable Energy for Homes	130	8%	337
E.2.3	Expand Municipal Renewable Energy	<1	<1%	1
E3	Increase Outreach, Education and Collaboration			
E.3.1	Increase Local Education and Outreach	Not quantified	--	Not quantified
E.3.2	Establish Regional Renewable Energy Partnerships	Not quantified	--	Not quantified
	TOTAL	1,692	100%	3,381

[9] Energy resource loading order adopted in the state's *2003 Energy Action Plan*, and established by California's principal energy agencies: the California Energy Commission, the California Public Utilities Commission, and the California Consumer Power and Conservation Financing Authority.

Goal E.1 Decrease Energy Demand Community Wide

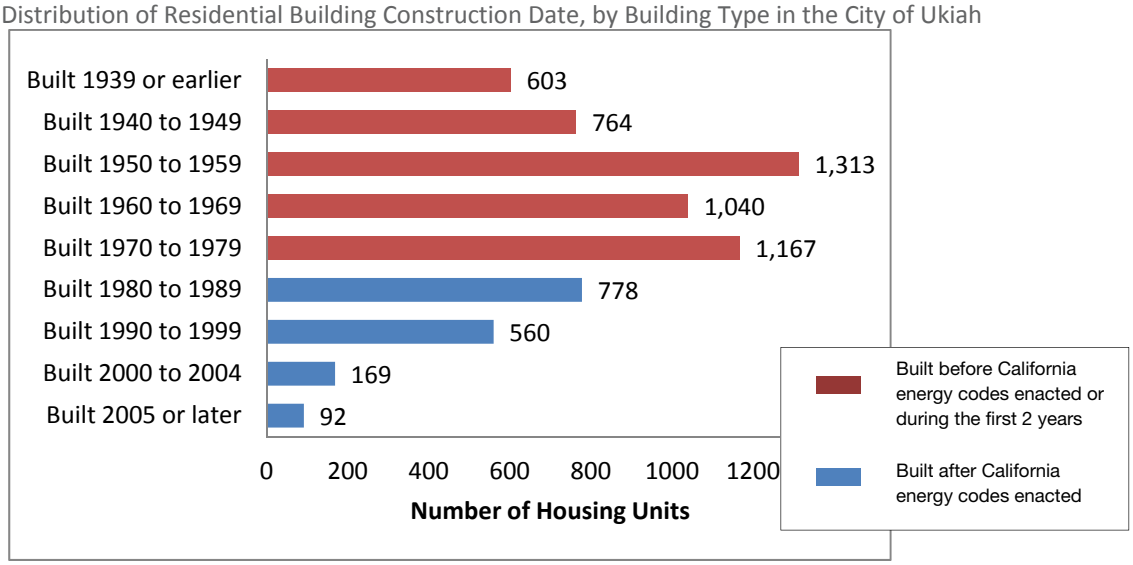
Buildings comprise the largest source of demand for community electricity and natural gas usage. The major factors determining building energy demand are the size and type of building, age of building, and occupancy characteristics. Increasing the energy efficiency of existing homes and buildings can have a significant, ongoing impact on overall energy consumption. Nationwide, single-family detached homes consume twice the energy of multi-unit dwellings, and individuals living in single family homes consume about one and a half times as much as those living in multi-unit dwellings, on average. Typically, the best strategies for reducing energy-related emissions start with conservation (reducing demand) and energy efficiency, followed by assessing the opportunities to add renewable energy generation capacity if cost-effective.

Prior to 1978, there were no energy codes for buildings. Therefore, the greatest opportunities for improving energy efficiency are typically found in the oldest buildings. Starting in 1978, the State of California adopted Title 24, Part 6 of the California Code of Regulations for Energy Efficiency Standards for Residential and Nonresidential buildings. Title 24 code is typically updated every 2 to 4 years. In Ukiah, the majority of buildings were built before Title 24 was enacted, or during the early years of the building energy codes.

Significant reductions in building energy demand can be achieved using construction techniques that increase energy efficiency. Efficiency improvements for buildings can be accomplished by:

- going beyond the state building code (Title 24) for energy efficiency in local construction;
- incentivizing green building practices by streamlining permitting and other City processes;
- leveraging existing utility efficiency incentives and other programs;
- supporting the rollout of smart meter technology;
- improving industrial factory equipment energy efficiency; and
- establishing a shade tree program.

Figure 4-1
Distribution of Residential Building Construction Date, by Building Type in the City of Ukiah



Data Source: American Factfinder of the US Census:
http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_11_5YR_DP04

Strategy E.1.1: Promote Commercial Energy Efficiency

Promote various federal, State, local and utility programs and other opportunities to improve the energy efficiency of commercial buildings.

Priority:	1
Timeframe to start implementation:	In progress
Annual GHG Reduction Potential in 2020 (MT CO2e):	646
Estimated Annual Cost to the City in 2020:	Medium (City staff time and promotional materials)
Responsibility:	Planning and Community Development Department; Electric Utility Department
Objective(s):	By 2020: 15% of commercial square footage updated By 2030: 25% of commercial square footage updated
Local Economic Benefits:	Lower energy bills, higher building values, reduced maintenance costs, increased community energy knowledge and training, generates work for local contractors (green jobs)
Other Local Co-benefits:	Lower energy demand, increased indoor comfort in buildings

Action E-1.1a: Promote existing energy audits, rebates, energy efficiency programs offered by City of Ukiah Electric Department to improve energy efficiency in commercial buildings.

Action E-1.1b: Develop a low-cost local education campaign to promote benchmarking and cost-effective commercial energy efficiency improvements.

Action E-1.1c: Outreach to the business community to encourage energy audits and point of sale energy use disclosure, and energy efficiency upgrades; As Staff and resources allow, develop a local "Green Business" program to promote energy efficiency actions.

Commercial building electricity consumption decreased by about 5 percent in the City of Ukiah from 2005 to 2010, while the GHG emissions associated with that electricity usage declined by approximately 26%. This is largely attributed to the City's energy purchasing policies and membership in the NCPA, allowing the City to purchase a portion of its wholesale electricity from renewable sources. PG&E's natural gas usage decreased by approximately 4 percent over the same period, as did the GHG emissions associated with natural gas consumption.

Overall energy consumption and GHG emissions could be further reduced if businesses were more aware of available financial incentives for saving energy. This appears to be particularly true for natural gas supplied by PG&E. Roughly three-quarters of the GHG emissions associated with community energy usage are associated with natural gas combustion. It is evident that the City, with its own electric utility serving the Ukiah community, has been successful in recent years with its commercial electricity efficiency programs.

Under this strategy, the City of Ukiah Electric Utility Department will continue to promote energy efficiency programs and rebates available to commercial and industrial customers, as outlined in a previous section. The City will continue these programs for the foreseeable future, with the aim of increasing commercial participation rates and lowering energy demand. The City will also promote energy benchmarking for City

businesses and expand awareness of the free-of-charge EPA Portfolio Manager benchmarking tool to assess a building's energy performance, water efficiency, and carbon emissions.

Commercial Energy Efficiency Tax Credits

Pursuant to the Energy Policy Act of 2005, businesses may qualify for a federal tax credit on a square-foot basis. Owners or tenant businesses are eligible for the credit if a licensed contractor or engineer verifies lighting power density and/or verifies through energy modeling that the portion of the building being submitted for the tax credit is 25%-50% better than ASHRAE 90.1-2001 standards.

Strategy E.1.2: Promote Residential Energy Efficiency

Promote various federal, State, local and utility programs and other opportunities to improve the energy efficiency of residential buildings.

Priority:	1
Timeframe to start implementation:	In progress
Annual GHG Reduction Potential in 2020 (MT CO2e):	567
Estimated Annual Cost to the City in 2020:	Medium (City staff time and promotional materials)
Responsibility:	Planning and Community Development Department
Objective(s):	By 2020: 15% of residential square footage updated By 2030: 25% of residential square footage updated
Local Economic Benefits:	Lower energy bills, higher home values, reduced maintenance costs, increased community energy knowledge and training, generates work for local contractors (green jobs)
Other Local Co-benefits:	Lower energy demand, increased indoor comfort in homes

Action E-1.2a: Promote existing energy audits, rebates, energy efficiency programs offered by City of Ukiah Electric and Water Departments to improve energy efficiency in commercial buildings.

Action E-1.2b: Develop a low-cost local education campaign for cost-effective residential energy efficiency improvements.

Action E-1.2c: Outreach to residential property owners to encourage energy audits, benchmarking, and energy efficiency upgrades.

Action E-1.2d: Outreach to local realtors to help communicate the value of energy improvements to prospective home buyers and sellers.

The California Public Utilities Commission (CPUC) has set an ambitious goal to reduce energy use in existing homes by 40% and install low-energy heating and cooling systems in 50% of new and existing homes by 2020.[10]

Residential building electricity consumption increased by more than 12 percent in the City of Ukiah from 2005 to 2010, while the GHG emissions associated with that electricity usage declined by approximately

[10] California Public Utilities Commission, 2008. California Long Term Energy Efficiency Strategic Plan: Achieving Maximum Energy Savings in California for 2009 and Beyond.

12%. This is largely due to the City's wholesale electricity purchase policies of cost effective renewable energy. Natural gas usage increased by almost 1 percent over the same period, as did the GHG emissions associated with natural gas consumption.

Overall energy consumption and GHG emissions could be reduced further if residents were more aware of available financial incentives for saving energy. This appears to be particularly true for natural gas supplied from PG&E. Nearly 90% of the GHG emissions associated with the City's residential energy usage are associated with natural gas combustion. It is evident that the City, with its own electric utility serving the Ukiah community, has been very successful in recent years with its residential electricity efficiency programs.

Ukiah's Electric Utility Department offers substantial rebates and energy efficiency programs that provide cost savings to the City's residential property owners, through up-front rebates and a payback in energy savings over time. These rebates are meant to incentivize actions that reduce energy demand and associated GHG emissions.

The City of Ukiah Electric Utility Department will continue to provide audits, energy efficiency programs and rebates available to residential, commercial and industrial customers of the Ukiah Electric Utility Department. As outlined in a previous section, for several years the City has been operating a comprehensive energy efficiency incentive program for residential customers, including energy audits with efficiency recommendations, appliance rebates, heat pump and efficient air conditioning rebates, lighting rebates, weatherization upgrade rebates, and an Energy Efficiency Hotline to answer customer questions and provide information on energy efficiency related matters. The City will continue these programs for the foreseeable future, with the aim of increasing residential participation rates and lowering energy demand.

North Coast Energy Services (NCES), located in Ukiah, operates programs for low-income weatherization in Ukiah plus seven counties. These programs complement what the City does in terms of energy reductions. In addition to financial bill assistance, NCES programs include dual pane windows, storm windows, microwave ovens, refrigerators, CFL lighting, and insulation.

The City will promote energy benchmarking for City residents, and expand awareness of the free-of-charge EPA Portfolio Manager benchmarking tool to assess a building's energy performance, water efficiency, and carbon emissions. The Community Development Department staff could perform outreach to local residents using flyers, inserts, or postings at public locations and during public events. Outreach to local realtors could help communicate the value of energy improvements to prospective home buyers and sellers. Staff time will be focused on distributing materials, discussing the program with interested parties, and directing interested parties to available resources.

Strategy E.1.3: Improve Municipal Energy Efficiency

The City of Ukiah will take steps to increase the energy efficiency of municipal operations, including City buildings and facilities, setting an example and providing leadership to the overall community.

Priority:	2
Timeframe to start implementation:	2015-2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	76

Estimated Annual Cost to the City in 2020:	Low (City staff time)
Responsibility:	Planning and Community Development Department
Objective(s):	25% of public use building square footage updated by 2020 and 2030
Local Economic Benefits:	Lower energy bills, higher building values
Other Local Co-benefits:	Lower energy demand, increase indoor comfort in buildings

Action E-1.3a: Perform energy audits of existing municipal buildings;

Action E-1.3b: As funding allows, install more energy efficient street lighting, such as LEDs;

Action E-1.3c: Consider requiring that all new municipal construction achieve 15% above 2013 Title 24 Standards.

Electricity usage by City of Ukiah municipal operations (buildings, facilities, streetlights and traffic lights) decreased by approximately 22% from 2005 to 2010, while the GHG emissions associated with that electricity usage declined by approximately 40%. This is largely due to the City's success in purchasing a larger portion of its wholesale electricity from renewable sources. Natural gas consumption in municipal buildings increased 57% over that same period. Meanwhile, natural gas consumed by the waste water treatment Plant (WWTP) decreased by 13%.

The City of Ukiah will continue to seek out energy efficiency opportunities at its existing buildings and facilities by performing audits and benchmarking energy usage at its largest facilities.

For improving the electrical energy efficiency of its existing buildings, the City will continue to take advantage of the same programs and rebates offered to commercial customers by Ukiah's Electric Utility Department as described in Strategy E.1.1. Where it is feasible and cost-beneficial, the City will install more energy efficient street lighting, such as LEDs, and eliminate extraneous streetlights.

For improving natural gas efficiency in existing buildings, the City will consider participation in PG&E programs applicable to municipal operations, such as the PG&E Commercial HVAC Quality Maintenance Program, and rebates for high efficiency boilers and other equipment.

Strategy E.1.4: Reduce Urban Heat Islands

Strive to cool buildings and pavement in the summer, which decreases energy use and reduces the "heat island effect" within the City.

Priority:	2
Timeframe to start implementation:	2015-2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	2
Estimated Annual Cost to the City in 2020:	Low (City staff time)
Responsibility:	Planning and Community Development Department
Objective(s):	By 2020: 17 housing units and 2 commercial units participating By 2030: 35 housing units and 5 commercial units participating

Local Economic Benefits:	Lower energy demand, lower energy bills
Other Local Co-benefits:	Aesthetic benefits, improved air quality, more comfortable outdoor environment

Action E-1.4a: Implement the existing Master Tree list; consider establishing and monitoring a voluntary shade tree program. Strongly encourage the protection of mature trees on private property and in the community,

Action E-1.4b: Promote light-colored paving material for roads and parking areas, cool roofs, and shade trees for parking lots and buildings.

Action E-1.4c: Implement City policy and zoning ordinance promoting shading of parking lots using trees; promote installation of parking canopies (preferable with solar PV panels) to shade parking lots.

Action E-1.4d: Consider setting up a fund to subsidize the purchase of shade trees for homeowners. Continue to support the efforts of Releaf and the Ukiah Tree Advisory Group.

The "heat island effect" describes the warming of asphalt, concrete and the built environment to higher temperatures than temperatures in surrounding open space and rural areas. In the summertime, heat islands retain heat and radiate that heat long after the sun goes down, increasing the energy needed to cool buildings later in the evening. Shading with trees or canopies can effectively reduce the heat island effect by keeping streets, parking lots, and individual buildings out of direct sunlight, thus, reducing the need for air conditioning and reducing the GHG emissions associated that that energy demand. Light-colored roofs (cool roofs) and paving materials help to reduce heat absorption and retention. Reducing the heat island effect helps reduce energy demand during the hottest parts of the day when grid energy is typically the most expensive and most carbon-intensive energy supplied by utilities, as they tend to utilize their older and least efficient power plants at such times or import power from states where coal-fired power plants are more prevalent.

The City's existing Downtown Zoning Code (2012, Article 18) requires a minimum of one shade tree for every five parking spaces or trees provided to achieve 50% canopy coverage of paved area at maturity, whatever is greater. This applies to new parking lots in the City. The City is working with its Tree Advisory Group (TAG) as well as Mendocino County ReLeaf - a volunteer organization that promotes community and urban forests – to implement the ordinance, and to provide tree care guidelines, a master tree list, and a landmark tree program. The City of Ukiah will consider establishing and monitoring a voluntary shade tree program, particularly for existing parking lots, encouraging the planting of new shade trees and maintaining and preserving existing trees. Additionally, through its building and site development permit process, public outreach, and/or a revision to City design guidelines, the City will continue to encourage cool roofs and pavements (currently allowed and encouraged in compliance with all applicable Building Code requirements, per Article 18 of the Downtown Zoning Code). This strategy will complement Strategy E.1.5 (Promote Commercial and Residential Green Building) and the Title 24 Building Energy Efficiency Standards (CalGREEN) which includes several voluntary measures that relate to heat island mitigation, including shading, cool pavement, and cool roof technologies.

Strategy E.1.5: Promote Commercial and Residential Green Building

Provide incentives, such as permit streamlining and increased outreach, to expand green building and energy efficient design for new commercial and residential development.

Priority:	2
Timeframe to start implementation:	In progress
Annual GHG Reduction Potential in 2020 (MT CO2e):	23
Estimated Annual Cost to the City in 2020:	Low to Medium (City staff time)
Responsibility:	Planning and Community Development Department; City Building Division
Objective(s):	10% of new commercial and residential properties achieve CalGreen Tier 1 for energy efficiency (15% improvement over minimum requirement).
Local Economic Benefits:	Lower energy and water demand, lower energy and water bills, reduced maintenance costs, higher building values, increased community energy knowledge and training
Other Local Co-benefits:	Better air quality, increased indoor comfort in buildings

Action E-1.5a: Provide incentives, such as permit streamlining and increased outreach, to expand green building and energy efficient design for new commercial and residential development.

The State of California regulates energy consumption under Title 24 of the California Code of Regulations. Strategy E.1.5 assumes that, pursuant to state and Ukiah local building codes, all residential, commercial and industrial development through 2020 will adhere to minimum Title 24 standards for energy and water efficiency.

The current Title 24 Building Energy Efficiency Standards (CalGREEN), developed by the California Energy Commission (CEC), promote efficiency in new construction by reducing energy consumed for heating, cooling, ventilation, water heating, and lighting in new residential and non-residential buildings. The CEC updates Title 24 periodically; Assembly Bill 970, signed September 2000, requires the CEC to update and implement its appliance and building efficiency standards to make the "maximum feasible" reduction in unnecessary energy consumption. The 2010 Standards became effective statewide on January 1, 2011. The 2013 edition of the code, with an increased emphasis on energy efficiency, will become effective Jan 1, 2014.

In addition to meeting minimum CalGREEN standards, developers can implement additional energy efficiency measures to achieve voluntary "Tier 1" CalGREEN standards which exceed minimum energy efficiency requirements by 15 percent. Under strategy E.1.5, the Ukiah Planning and Community Development Department will fast-track permit approval of proposed development projects that meet Tier 1 standards.

The City currently has a green building education program that provides an array of green building information to the public. As part of the City's current design review process, the City promotes green building practices and includes reference to the Leadership in Energy and Environmental Design (LEED) standard in its *Design Guidelines for Commercial Development in the City of Ukiah*. The City will continue these programs, and review the following methods for encouraging implementation of the green building practices:

- Reduced fees or fee waivers for "green" permit applications;
- Priority permit processing; or
- Amending the municipal code to further encourage green developments, such as implementing a "Green Pathway" process under which certain projects that require discretionary review (e.g., a use

permit) are approved "as of right" if they meet specific green building requirements. These types of projects may also be streamlined with respect to CEQA review (see Chapter 5, "CEQA Project Review").

The City Building Division will continue to promote and/or provide relevant information to developers on the energy and resource efficiency benefits of exceeding CalGREEN standards. Information on the permit streamlining benefits of exceeding CalGREEN standards will be provided at the City's Building Permit desk, on the City's web site, and through the permit application process itself. The City Council will also promote community green building leaders and projects that exceed CalGreen standards by recognizing them at Council meetings and through print and web media.

Municipal Commitment

Although there are no current plans for new construction of municipal facilities, the City of Ukiah understands that it should lead by example by promoting energy-efficient design and construction. Therefore, the City will consider going beyond CalGREEN standards for any new construction (or major remodeling) of municipal buildings through the year 2030. Options include designing and building to LEED standards, and meeting Tier 1 of the enhanced CalGREEN standard.

Goal E.2  Increase On-site Renewable Energy

Renewable energy is energy from natural sources such as sunlight, wind, geothermal heat, and biomass. The use of renewable energy sources, instead of fossil fuels, substantially reduces GHG emissions. The City of Ukiah has opportunities to supplement or offset grid-supplied electricity with renewable energy that is generated in close proximity to the load being served. Non-grid renewable electricity generation can be implemented at the building scale (i.e., rooftop solar) or at the municipal and/or regional scale, through cooperation among businesses, jurisdictions, and other organizations.

Solar Energy

Solar energy is a source of renewable energy for the residents and businesses of Ukiah, as well as the local government. According to the National Renewable Energy Laboratory (NREL), more energy from the sun falls on the earth in one hour than is used by everyone on the planet in one year. Although solar PV systems will never be 100% efficient in capturing the sun's energy, technological improvements in this area are ongoing; meanwhile, there are a variety of other available approaches and technologies that can efficiently convert sunlight to usable energy for buildings. The most commonly used solar technologies for homes and businesses, other than solar PV, include solar water heating and passive solar design for space heating and cooling. Solar PV and concentrating solar power technologies are also being used by developers and utilities to produce electricity on a massive scale to power cities and small towns.[11]

One key benefit of solar energy is that its peak resource availability corresponds to peak system loads for conventional electricity (i.e., when demand for cooling and air conditioning is highest). Therefore, solar energy systems have the potential to offset electricity usage when it is the most expensive – and typically the most carbon-intensive – as older, less efficient power plants are brought online to meet peak loads.

[11] National Renewable Energy Laboratory (NREL), Solar Energy Basics, available online: http://www.nrel.gov/learning/re_solar.html, accessed April 9, 2013.

Wind Energy

NREL indicates that the average wind energy potential for the City of Ukiah is not considered suitable for cost-effective wind energy development. Areas with annual average wind speeds around 6.5 meters per second and greater at an 80-m height are generally considered to have a resource suitable for wind development. NREL's wind resource map shows that the City of Ukiah is located in an area with wind speeds between 4.0 and 5.0 meters per second.[12] Therefore, wind energy is not considered further as a viable source of renewable energy in Ukiah.

Strategy E.2.1: Promote Cost-effective Renewable Energy for Commercial and Industrial Users

Increase the installation rate of commercial and industrial solar water heating and/or roof-top photovoltaic (PV) systems.

Priority:	1
Timeframe to start implementation:	In progress
Annual GHG Reduction Potential in 2020 (MT CO2e):	247
Estimated Annual Cost to the City in 2020:	Medium (City staff time)
Responsibility:	Planning and Community Development Department
Objective(s):	By 2020: 15% participation By 2030: 30% participation
Local Economic Benefits:	Create jobs, increased real estate values
Other Local Co-benefits:	Increased energy independence

Action E-2.1a: Continue the City Utility's PV Buy-Down Program (rebates for PV systems) for commercial and industrial customers.

Action E-2.1b: Support streamlined permit procedures and/or establish minimum PV installation requirements for new commercial facilities of a certain size (e.g., for facilities larger than 3,000 square feet).

On-site renewable energy systems can substantially reduce GHG emissions associated with energy usage. Generally, renewable energy systems should be installed only after implementing all cost-effective efficiency measures. The best options for Ukiah businesses are solar hot water heating and roof-top PV systems.

The largest barriers to expanding on-site renewable energy are access to information, high up-front financing costs, and long cost-recovery periods. Under this strategy, the City of Ukiah Electric Utility will continue its PV Buy-Down Program, which helps offset the investment in a PV system with customer rebates to reduce the initial system cost. The rebate program is funded through 2017.

The City will continue to disseminate renewable energy information to developers and promote existing financial incentives (local and state) for solar PV and hot water system installation. The City will also consider expediting permits associated with the installation of renewable energy facilities.

[12] NREL, California – Annual Wind Speed at 80 Meters, available online, http://www.windpoweringamerica.gov/wind_resource_maps.asp?stateab=ca, accessed June 26, 2013.

Strategy E.2.2: Promote Cost-effective Small-scale Renewable Energy for Homes

Increase the installation rate of residential solar water heating and/or roof-top photovoltaic (PV) systems.

Priority:	1
Timeframe to start implementation:	In progress
Annual GHG Reduction Potential in 2020 (MT CO2e):	130
Estimated Annual Cost to the City in 2020:	Medium (City staff time)
Responsibility:	Planning and Community Development Department, Building Division, Electric Utility Department
Objective(s):	By 2020: 675 new solar PV systems (10% of homes) By 2030: 1,747 new solar PV systems (25% of homes)
Local Economic Benefits:	Create jobs, increased home values
Other Local Co-benefits:	Increased energy independence

Action E-2.2a: Continue the City Utility's PV Buy-Down Program (rebates for PV systems) for residential customers.

Action E-2.2b: Require pre-wiring for solar systems in new building development.

Action E-2.2c: Streamline permit processes, and promote existing financial incentives for renewable systems.

Action E-2.2d: Provide public education about various options (including power purchasing agreements - PPAs),

On-site renewable energy systems can substantially reduce GHG emissions associated with energy usage. Generally, renewable energy systems should be installed only after implementing all cost-effective efficiency measures. The best options for Ukiah residences are solar hot water heating and roof-top PV systems.

The largest barriers to expanding on-site renewable energy are access to information, high up-front financing costs, and long cost-recovery periods. Under this strategy, the City of Ukiah Electric Utility will continue its PV Buy-Down Program, which helps offset the investment in a PV system with customer rebates to reduce the initial system cost. The rebate program is funded through 2017.

The City will continue to disseminate renewable energy information to residential developers and homeowners and promote existing financial incentives (local and state) for solar PV and hot water system installation. The City will also consider expediting permits associated with the installation of renewable energy facilities.

Additional Incentive for Developers

The CEC's New Solar Homes Partnership (NSHP) is part of the comprehensive statewide solar program, known as the California Solar Initiative. The NSHP provides financial incentives and other support to home builders, encouraging the construction of new, energy efficient solar homes that save homeowners money on their electric bills and protect the environment. Under this strategy, Ukiah would promote this program to developers seeking permits or other approvals from the City.

Strategy E.2.3: Expand Municipal Renewable Energy

Increase on-site renewable energy generation (e.g. solar PV) at City facilities.

Priority:	2
Timeframe to start implementation:	2015-2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	<1
Estimated Annual Cost to the City in 2020:	Medium to high (Upfront capital for PV system, City staff time)
Responsibility:	Planning and Community Development Department
Objective(s):	By 2020: 4 kW solar PV installation By 2030: 12 kW solar PV installation
Local Economic Benefits:	Lower energy bills, create jobs, increased real estate values
Other Local Co-benefits:	Increased energy independence

Action E-2.3a: Evaluate existing installed renewable energy capacity and set future installed goal.

On-site renewable energy systems can substantially reduce GHG emissions associated with energy usage. Generally, renewable energy systems should be installed only after implementing all cost-effective efficiency measures. The best options for Ukiah's municipal buildings are solar hot water heating and roof-top PV systems.

The City currently has solar PV panels installed on the roof of the City Hall Annex. After implementing all feasible energy efficiency programs, the City will consider renewable energy as a viable option to reduce escalating energy costs and increase local generation of energy. As funding and financial incentives allow, the City will evaluate opportunities for additional solar PV and solar hot water installations on City property or infrastructure. The City owns and operates a number of facilities that have available roof space for solar PV systems, as well as parking facilities with the potential for canopy structures. Installations on surface lots provide additional shaded parking areas for City employees and visitors, and increase PV visibility. On a larger scale, solar canopies can reduce a site's contribution to the local "urban heat island" effect, where heat is retained by paved surfaces.

The City will evaluate its capacity for solar PV installations and establish a target (either percentage of total municipal energy used or a number of kW to be installed) for renewable energy generation. Renewable energy projects will be pursued as funding becomes available.

Goal E.3 Increase Outreach, Education and Collaboration

In general, outreach and education is needed to support the other energy goals, strategies and actions in the Climate Action Plan. The overarching goal is to promote personal responsibility for residents and businesses to reduce their carbon footprints, and to raise awareness of existing programs, funding

opportunities, and City and community efforts to reduce GHG emissions. Community engagement and education fosters public involvement, information exchange, and transparency into sustainability initiatives that support the Climate Action Plan. It is difficult to account for the emissions reduction impact of these efforts, but such measures are critical to gaining public support and the participation essential to program success, by seeking to influence personal behavior to become more carbon friendly.

As described earlier in this chapter, the City Electric Utility currently provides outreach and education to its residential, commercial and industrial customers, to raise awareness of its energy efficiency and renewable energy programs. Several organizations in the Ukiah area complement this effort, including NCES, the non-profit that provides low-income weatherization services in Ukiah.

Strategy E.3.1: Increase Local Education and Outreach

Increase local knowledge and training opportunities related to energy efficiency and renewable energy.

Priority:	1
Timeframe to start implementation:	In progress
Annual GHG Reduction Potential in 2020 (MT CO2e):	Not quantified – supporting measure
Estimated Annual Cost to the City in 2020:	Low to medium (some City staff time)
Responsibility:	Planning and Community Development Department
Objective(s):	None identified
Local Economic Benefits:	Promote education and develop green jobs in the City
Other Local Co-benefits:	Efficient implementation of the Climate Action Plan

Action E-3.1a: Promote existing residential and nonresidential energy efficiency programs, and rebates for solar PV; consider establishing a Committee on Energy and the Environment to assist in promotion activities and/or develop and operate a local public education and/or a direct financing program.

Action E-3.1b: Increase City staff knowledge and training opportunities related to energy efficiency and renewable energy, and dedicate staff time to outreach and education regarding existing programs and financing mechanisms.

Action E-3.1c: Collaborate with local groups and interested organizations to facilitate community outreach and education.

Action E-3.1d: Develop a low-cost local education campaign to promote nonresidential energy efficiency improvements, and conduct at least two events per year to educate the community about energy efficiency options.

This strategy includes a voluntary, education-based approach in which the City would increase outreach/education to residential, commercial and industrial building owners to raise awareness of utility energy efficiency programs, The City will promote and market selected programs to specific sectors of the community, utilizing existing channels of communication. For example, the City could provide information in existing newsletters, or at regular Chamber of Commerce meetings, and could also work with the local school district. Groups that could be useful partners include the Solar Living Institute in Hopland, REDI in Willits, and the Community Development Commission in Ukiah.

Strategy E.3.2: Expand Regional Renewable Energy Partnerships

Continue membership in the NCPA and explore strategies for partnering with nearby jurisdictions for low-cost renewable energy development through economies-of-scale.

Priority:	2
Timeframe to start implementation:	2015-2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	Not quantified – supporting measure
Estimated Annual Cost to the City in 2020:	Low (some City staff time)
Responsibility:	Planning and Community Development Department
Objective(s):	None identified
Local Economic Benefits:	Promote education and develop green jobs in the City and region, support businesses in the local economy
Other Local Co-benefits:	Energy reductions

Action E-3.2a: Promote existing residential and nonresidential energy efficiency programs and rebates for solar PV; consider establishing a Committee on Energy and the Environment to assist in promotion activities and/or develop and operate a local public education.

Action E-3.2b: Work with the County and other cities in the region, Mendocino College, and other organizations, to explore strategies for developing renewable energy resources and to develop a valley-wide clean/green industry and jobs development strategy.

Regional initiatives to promote shared renewable energy can help drive down start-up costs for individuals or smaller organizations by providing economies of scale, and provide community and regional control of energy resources. The City of Ukiah will continue its membership in the NCPA, which has a longstanding commitment to the generation of electricity from environmentally-responsible sources, and which supports federal, regional, and statewide efforts to reduce GHG emissions and combat global climate change.

The City will also be open to partnering with neighboring cities, Mendocino County, Mendocino College, the Employers Council of Mendocino County, the Chamber of Commerce, and green industry/business leaders to develop a valley-wide clean/green industry and jobs development strategy, and to explore strategies for developing renewable energy resources (including grant monies) that can benefit Ukiah's citizens as well as the wider region as a whole.

Transportation and Land Use

- 2020 Adjusted Business-as-Usual GHG Emissions: 77,863 MT CO2e[13]
- Annual GHG emissions reductions by 2020: 944 MT CO2e

GHG emissions associated with transportation and land use patterns represent approximately 59 percent of the City's adjusted BAU emissions forecast for 2020. The bulk of these emissions are expected to be generated by vehicles travelling on state highways and City streets. The remainder will be generated by vehicles engaged in off-road activities, like construction, agricultural production, and recreation.

As of 2009/10, Ukiah encompassed approximately 1,935 businesses[14] (excluding home occupations) which together employed about 11,237 full- and part-time workers.[15] Ukiah consists of 6,497 households with a total of 16,113 residents.[16]

Reducing Emissions with Transportation and Land Use

The job-housing ratio was approximately 1.71 in 2009/10, and jobs are expected to grow faster than new residents over the next 20 years. As such, the vehicle miles travelled (VMT) per capita will increase, as workers from residential locations outside the City boundaries commute in for employment opportunities.[17] The average work-commute for a resident of Ukiah is approximately 14.5 minutes, nearly half that of the average California resident.[18] Driving alone to work represents 86.6 percent of the transportation mode split.[19] As employees are forced to live further from jobs, commute times and VMT will increase if the primary mode of travel continues to be the single-occupancy vehicle. In the absence of GHG reduction strategies, annual VMT in 2020 is expected to increase by 10 percent over 2010 levels, from 399,199 to 439,657.

Existing development patterns and the supporting transportation infrastructure are major factors in the transportation habits of residents because they limit mobility choices, fostering an auto-dependant culture that relies less on walking, biking, and public transit and more on personal daily motor vehicle trips. Further, public transit service is somewhat limited in the City, reducing its efficiency and appeal as a viable alternative to driving. In addition, the lack of an extensive and well-connected pedestrian and bicycle system and associated amenities can be a disincentive to choosing non-motorized mobility alternatives.

State regulations will require higher fuel efficiency and lower carbon fuels over the next few years. However, state regulations alone will not achieve the transportation emissions needed over the long term (i.e., post 2020). Effective local strategies for reducing emissions associated with transportation and land use focus on reducing the total VMT and number of vehicle trips required for City residents and

13 Includes impact of statewide GHG reduction measures
14 U.S. Census Bureau, 2002 and 2007 Economic Census, Available Online: http://quickfacts.census.gov/qfd/states/06/0681134.html, accessed June 14, 2013.
15 Fehr and Peers, 2012. City of Ukiah- Vehicle Miles of Travel (VMT) Inventory. Tellez, K. et al. Memorandum. November 19, 2012.
16 ibid.
17 ibid.
18 U.S. Census Bureau, 2002 and 2007 Economic Census, Available Online: http://quickfacts.census.gov/qfd/states/06/0681134.html, accessed June 14, 2013.
19 ibid.

businesses, and on proliferation of more zero- and low-emission vehicles. VMT can be reduced and traffic congestion relieved by gradually changing land use patterns to be more sustainable, improving pedestrian and bicycle infrastructure, and improving public transit options. Alternative vehicle infrastructure can be improved by partnering with regional agencies.

As explained in Chapter 3 and earlier in this chapter, the City is expected to meet its overall 2020 GHG reduction target relatively easily, without requiring a significant contribution from the transportation and land use sector. However, the challenge will be much greater to achieve the deep GHG emissions reductions needed to help meet the state's longer term goals (e.g., 80% reduction below 1990 levels by the year 2050). Such reductions will require new technologies and additional policies and actions at the federal and state levels, but they will also require profound changes in local development patterns and mobility, many of which we can only begin to envision. As the state continues to develop its longer term policies and strategies for reducing emissions, the City of Ukiah will begin its longer-term visioning on how future growth can be accommodated while still reducing GHG emissions. Over the next several years the City will be embarking on its General Plan Update, providing an excellent opportunity to develop this vision. Chapter 5 provides additional thoughts on how the City will continue to look for long-range opportunities to reduce GHG emissions associated with land use and transportation.

Existing City Policies and Codes

The City's General Plan *Transportation Technical Report* describes several recommended program options for reducing trips that could be considered in Ukiah. Reducing vehicle trips have a direct effect on GHG reduction. The actions presented in the technical report are reflected in Strategy TL 1.1 below.

Further, in October of 2012, the City adopted an update to Article 18: Downtown Zoning Code. The update promotes infill and other sustainable development concepts (e.g. more mixed use and pedestrian-oriented streets, buildings and landscapes), and states as part of its purpose:

"To promote and encourage a sustainable community through the reuse and improvement of existing buildings, infill development, green building and smart growth practices, and resource conservation (such as the enhancement of the creek corridor, tree planting, and tree preservation)."

The update uses a form-based code, a kind of zoning code that differentiates by both use and physical form. This type of zoning addresses the physical layout; proximity and accessibility to goods, services, workplaces, and schools; and the materials and designs used in building and infrastructure—directly affecting energy consumption and vehicle use, and thus GHG emissions.

Transportation and Land Use Goals and Strategies

Specific approaches considered for the City of Ukiah include:

- Create a built environment that allows people to have more transportation choices, including walking, bicycling, or taking public transit, rather than relying solely on single occupancy vehicles (SOVs);
- Encourage higher density, mixed-use development near local-serving commercial areas;
- Encourage the use of lower-emission vehicles, and expand the infrastructure and safety for people to walk or bike;

- Expand alternatives for commuting and local travel, and provide secure bike parking and related amenities for all new development; and
- Continue applying parking reduction policies in the downtown core of the City.

Table 4-7 summarizes the Climate Action Plan's transportation and land use strategies and their estimated GHG reduction impact. Specific goals, strategies, and actions are described in the sections that follow. Appendix C provides details on the assumptions and methods used to quantify GHG reductions associated with each strategy.

Table 4-7
Summary of GHG Reduction Impacts for Transportation and Land Use Strategies in 2020 and 2030

	Goal/Supporting Strategy	2020 Annual GHG Reduction Potential (MT CO2e)	2020 Percent of Category	2030 Annual GHG Reduction (MT CO2e)
TL.1	Reduce Single-Occupancy Vehicle Travel			
TL.1.1	Local Commute Trip Reduction	88	9%	90
TL.1.2	Sustainable Growth Patterns	616	65%	857
TL.1.3	Regional Transportation Management	NA	NA	NA
TL.1.4	Expand/Improve Public Transit	NA	NA	NA
TL.2	Increase Non-Motorized Travel			
TL.2.1	Improve Bicycle and Pedestrian Infrastructure	22	2%	37
TL.2.2	Establish Safe Routes to Schools	173	18%	375
TL.3	Increase Motor Vehicle Efficiency			
TL.3.1	Improve Fuel Efficiency for Municipal Fleet	45	5%	131
	TOTAL	944	100%	1,490

Goal TL.1 Reduce Single-Occupancy Vehicle Travel

In California, approximately 38 percent of all GHG emissions are attributable to transportation, with approximately 92 percent of that coming from on-road vehicles.[20] Light duty passenger vehicles accounted for approximately 74 percent of on-road vehicle emissions in 2009.[21] According to the California Department of Transportation (Caltrans), California can expect a 61 percent increase in the number of light duty passenger vehicle miles traveled (VMT) from 2007 to 2030.[22] One of the biggest contributors to that increase will be commuter trips; commute trips represent the largest contributor to VMTs at the local level.

To reduce commute trips, we must reduce reliance on the single-occupancy vehicle as the primary mode of transportation. Transportation demand management (TDM) strategies are effective at reducing GHG emissions in the transportation sector. TDM strategies include providing telecommuting options, alternative

20 California Environmental Protection Agency Air Resources Board, *California Greenhouse Gas Emission Inventory*, December, 2011.
21 Ibid.
22 California Department of Transportation, *2008 California Motor Vehicle Stock, Travel, and Fuel Forecast*, June 2009.

work and school schedules, on-site amenities, car and vanpooling programs, and parking reduction strategies – in general, anything that entices or encourages people to choose alternatives to traveling alone in vehicles.

Ukiah currently has an abundance of employment opportunities for area residents, resulting in an inflow of employees from neighboring communities to jobs located in Ukiah. The City is also a regional hub of retail services attracting residents from neighboring communities to travel to Ukiah to shop. In order to promote sustainable growth patterns in the future, the Ukiah General Plan encourages the development of a diversity of housing types, to achieve a better jobs-housing balance. When housing and transportation choices are located near jobs and services, the need to travel in single occupancy vehicles goes down. Mixed use, higher-density, and infill development facilitates fewer and shorter car trips by providing more diverse land uses within close proximity of a larger population. These fewer and shorter car trips will reduce total VMT, and associated GHG emissions. According to a study from the National Academy of Sciences (NAS), a private nonprofit chartered by Congress,[23] more compact mixed-use development of residential and employment centers can result in overall GHG reductions of up to 25 percent. The report suggests that such reductions can be accomplished with:

- Smaller lots for detached houses which shorten vehicle trip distances in low-density urban fringes;
- Smaller lots and multiple-unit housing which support public transportation and encourage walking and bicycling in moderate density suburbs; and
- Redevelopment of strategically located underused parcels within proximity of existing services and amenities.

Strategy TL.1.1: Local Commute Trip Reduction

Support local employer-based trip reduction programs to reduce single-occupancy vehicle travel to and from Ukiah.

Priority:	2
Timeframe to start implementation:	2015-2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	88
Estimated Annual Cost to the City in 2020:	Low (some City staff time)
Responsibility:	Planning and Community Development Department
Objective(s):	By 2020: 0.5% reduction in VMT By 2030: up to 1.2% reduction in VMT
Local Economic Benefits:	Reduced roadway maintenance, lower fuel costs
Other Local Co-benefits:	Better local air quality, lower fuel demand, less road congestion

Action TL-1.1a: Consider implementing local commute trip reduction requirements in the municipal code. This could require larger employers (50+ employees) to establish TDM programs to

[23] Transportation Research Board, 2009, Special Report 298, "Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use and CO2 Emissions," examines trends in national and metropolitan-area development patterns, effects of land-use patterns on VMT, and the potential effects of more compact development on VMT, energy use, and CO2 emissions.

reduce single-occupancy vehicle trips, which may include 9/80 work weeks, carpooling, telecommuting, car sharing, bike sharing, shuttles, vanpooling, guaranteed rides home, etc.

Action TL-1.1b: Consider a coordinated TDM program covering large employers and concentrations of smaller employers (e.g., shopping malls) to share costs and also travel pool (e.g. vanpooling, carpooling and/or shuttles for the Medical Center and other key employers).

Action TL-1.1c: As staff and resources allow, develop a City Program (with incentives) to encourage private sector employers to implement effective voluntary trip reduction programs.

Action TL-1.1d: Promote telecommuting and alternative work schedules for City employees.

The City of Ukiah will encourage a compressed work week for local employers and City staff. This encouragement could take the form of public information inserts in the local utility bill, e-mail distribution, and/or through Chamber of Commerce presentations and coordination.

Employers would be encouraged to implement a compressed work week, involving at least one of the following:

- Forty hours spread among four workdays days in one week (4/40)
- Eighty hours spread among nine workdays in two weeks (9/80)
- Telecommuting 1.5 days per week

The City will also encourage employers of more than 50 employees, and commercial zones where there are many smaller employers (e.g., shopping malls), to implement TDM measures to support the use of alternatives to single occupancy vehicles during peak hours by employees and others. TDM strategies for employers could include transportation coordinators; on-site transit information and/or pass sales; rideshare matching services; preferential parking for carpools or vanpools; provision of bike lockers, showers, and/or changing facilities; and guaranteed ride home.[24]

Strategy TL.1.2: Promote Sustainable Growth Patterns

Increase neighborhood density (including infilling), mixed-use developments, and increase community pedestrian-friendly design.

Priority:	2
Timeframe to start implementation:	2015-2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	616
Estimated Annual Cost to the City in 2020:	Medium (City staff time and infrastructure costs)
Responsibility:	Planning and Community Development Department
Objective(s):	2020: 1.2% reduction in VMT 2030: up to % reduction in VMT
Local Economic Benefits:	Lower fuel bills
Other Local Co-benefits:	Better local air quality, a more connected community

[24] TRP Report 95 Chapter 19: *Employer and Institutional TDM Strategies -- Traveler Response to Transportation System* Changes, Transportation Research Board, 2010.

Action TL-1.2a: Consider adopting a Complete Streets Ordinance that directs the City to meet the needs of all of its transportation users.

Action TL-1.2b: Continue to consider modifications to the municipal code to achieve smart growth objectives (i.e., increase density and mixed-use infill development).

Action TL-1.2c: Implement SmartCode or form-based code to increase mixed use and pedestrian connectivity in urban core near transit.

Action TL-1.2d: Promote and encourage downtown revitalization and the vitality of small local businesses in the downtown core area.

Action TL-1.2e: Encourage smart growth development by eliminating or reducing minimum parking requirements, creating maximum parking requirements, and providing shared parking.

Action TL-1.2f: Implement traffic calming measures within the downtown core, such as curb extensions (bulb-outs) and rumble strips.

Action TL-1.2g: Promote and encourage clean energy and green jobs/industries ~~with~~ within the City and in its Sphere of Influence.

Action TL-1.2h: Develop a plan for creating urban open spaces and natural resources enhancement to complement the compact infill development and mixed use growth strategy.

The City will continue to encourage and support higher density, infill, and mixed-use development through implementation of the City's Zoning Code. Residential densities in the City of Ukiah are among the highest in Mendocino County. Ukiah's Zoning Code includes a High Density Residential (R-3) zone and a Community Commercial (C1) zone that both allow up to 28 dwelling units per acre. The Downtown Zoning Code allows 28 units per acre as part of mixed-use developments, and has a minimum density requirement as well.

Local-serving commercial areas are typically supported by commercial anchors, as well as by their proximity to adjacent residential or employment areas. Increasing residential uses in close proximity to those commercial areas would allow for residents to walk to these services, thereby reducing VMT and associated GHG emissions. The increase in residential uses would be accomplished through introduction of residential uses in currently exclusively commercial areas such as in the downtown area, or through increasing residential densities in these areas.

In addition, the City will focus future development within the City limits and its Sphere of Influence (SOI) to prevent urban sprawl and leapfrog development. The SOI consists of areas closest to the existing City limits and targeted for development before other parts of the SOI. Areas within the SOI are contiguous with existing urban uses where urban services are already available, which allow for the well-planned expansion of services. The historic growth pattern – north to south – is expect to continue through 2035, as the City is constrained by prime agricultural land and floodplain on the east and by the hillsides on the west.

Strategy TL.1.3: Regional Transportation Management

Support regional transportation management programs to shift single-occupancy vehicle trips to other modes.

Priority:	2
Timeframe to start implementation:	2015-2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	Not quantified (Supporting strategy)
Estimated Annual Cost to the City in 2020:	Low (some City staff time)

Responsibility:	Planning and Community Development Department
Objective(s):	None identified
Local Economic Benefits:	Lower fuel bills
Other Local Co-benefits:	Improved air quality, less traffic congestion, lower commute times

Action TL-1.3a: Coordinate with Mendocino County and cities within the County to encourage alternatives to SOV travel.

The City of Ukiah will support regional transportation management programs to shift single-occupancy vehicle trips to other modes. The City will coordinate with the Mendocino Council of Governments (MCOG), Mendocino County and neighboring cities within the County to encourage alternatives to single-occupancy vehicles.

Strategy TL.1.4: Public Transit Expansion

Expand public transit options for the Ukiah community.

Priority:	2
Timeframe to start implementation:	2015-2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	Not quantified (Supporting strategy)
Estimated Annual Cost to the City in 2020:	Low (City staff time)
Responsibility:	Planning and Community Development Department
Objective(s):	None identified
Local Economic Benefits:	Improved public health, lower fuel bills
Other Local Co-benefits:	Improved air quality, less traffic congestion, better mobility for some segments of the population

Action TL-1.4a: Coordinate with Mendocino Transit Authority (and/or other transit agencies) to increase transit system ridership with incentives, safety and technology improvements, improved bus stop amenities, partnerships, and investments (e.g., coordinate to increase bus frequency and the number of pick-up locations in Ukiah).

Action TL-1.4b: Promote existing and/or additional "Reduced Fares" for residents (i.e., school children, elderly).

Action TL-1.4c: Encourage residents to use the existing Dial-A-Ride transit.

According to the 2000 United States Census, only 0.8 percent of all residents over the age of 16 reported that they ride public transit to get to work; in Ukiah it is less than half a percent.[25] According to the California Air Pollution Control Officers Association (CAPCOA), typical suburban developments close to major cities have only a 1.3 percent public mode share.[26]

The City's public transit ridership is limited by the City's small size, rural surroundings, distance from major cities, and relatively low population and development density. Mendocino Transit Authority (MTA)'s regional bus service area encompasses roughly 2,800 square miles including the Mendocino coast and inland

[25] U.S. Census Bureau, 2002 and 2007 Economic Census, Available Online: http://quickfacts.census.gov/qfd/states/06/0681134.html, accessed June 14, 2013.

[26] California Air Pollution Control Officers Association (CAPCOA), *Quantifying Greenhouse Gas Mitigation Measures*, Transit System Improvements Measures, p 281, 2010.

communities. The transit system includes a network of long distance, commute and local fixed routes, plus Dial-A-Ride services in Ukiah and Fort Bragg.

- According to the 2006 Mendocino County Regional Bikeway Plan, MTA has plans to develop a transit center in the central Ukiah area. The transit center will serve as a link for all local and regional public transit routes, plus Greyhound, AMTRAK, and the Mendocino Stage. In addition, the transit center will provide bicycle racks for bicyclists connecting to any of these services. An exact location for this project has yet to be determined, but one possibility is the Ukiah Depot site on Perkins Street.
- Improving public transit can significantly reduce emissions by moving a large number of people efficiently and providing more opportunities for community members to choose low-carbon transportation modes instead of single-occupancy vehicle use. Improving public transit also has potential local co-benefits, including better access to transportation for the young, elderly, and disabled, as well as health benefits associated with walking to and from public transit stops.

Goal TL.2  Increase Non-Motorized Travel

A City with well-designed pedestrian and bicycle facilities encourages residents to drive less often, which results in reduction of VMT. Bicycling can replace a significant share of motorized travel, typically 5-15 percent with good facilities. In addition, increasing the use of non-motorized travel such as walking and biking helps reduce traffic congestion, improves air quality, promotes a healthy lifestyle, and can contribute to local economic development efforts.

Conventional transportation impact analysis tends to overlook and undervalue non-motorized transportation modes such as multiple short and non-motorized trips. Non-motorized trips are undercounted because they include off-peak trips, non-work trips, travel by children, recreational travel, and non-motorized links of automobile and public transit trips.[27]

Strategy TL.2.1: Improve Bicycle and Pedestrian Infrastructure

Improve community bicycle and pedestrian pathway infrastructure by providing bicycle support facilities at public locations, updating the bicycle systems to become more bicycle-friendly, and evaluating other opportunities to encourage walkable/bikable corridors.

Priority:	2
Timeframe to start implementation:	In progress
Annual GHG Reduction Potential in 2020 (MT CO2e):	22

[27] Evaluating Non-Motorized Transportation - Benefits and Costs, June 2011, Todd Litman, Victoria Transport Policy Institute, Peter R. Stopher and Stephen P. Greaves (2007), "Household Travel Surveys: Where Are We Going?" Transportation Research A, Vol. 41/5 (www.elsevier.com/locate/tra), June, pp. 367-381.

Estimated Annual Cost to the City in 2020:	Medium to high (City staff time, capital costs for street improvements)
Responsibility:	Planning and Community Development Department Public Works Department
Objective(s):	By 2020: 4 miles of bike lanes added By 2030: 8 miles of bike lanes added
Local Economic Benefits:	Lower fuel bills, improved public health, increased tourism
Other Local Co-benefits:	Improved air quality, less traffic congestion, lower commute times

Action TL-2.1a: Install bicycle support facilities at public locations, transit hubs, and the downtown core.

Action TL-2.1b: Improve the bicycle network to make it friendlier for cyclists (i.e., update and implement the Bicycle and Pedestrian Master Plan).

Action TL-2.1c: Identify street right-of-way reconstruction projects and costs for developing bike paths and lanes.

Action TL-2.1d: Consider a variety of strategies for funding bicycle and pedestrian improvements, such as development density bonuses, expedited planning permits review, development impact fees, etc.

Action TL-2.1e: Evaluate opportunities to encourage walkable/bikable corridors.

Action TL-2.1f: Actively promote walking and biking as safe and healthy modes of travel.

Action TL-2.1g: Consider the use of "sharrows" on selected key street corridors.

Action TL-2.1h: Support and encourage local bicycle special events that promote bicycle use and healthy living, and contribute to the local economy, particularly those that include young people and that contribute to local economic development.

Bicycle improvements provide synergistic effects, where the total impacts are greater than the sum of their individual impacts. A single bicycle lane generally provides little benefit because it will connect few destinations, but a network of integrated bicycle lanes and shared travel lanes can be more beneficial because it provides multiple connections between trip origin and trip destinations, thereby attracting a larger population of potential users with more diverse travel patterns. Therefore, it's generally best to implement and evaluate integrated programs.

Improved pedestrian facilities generally consist of improvements to sidewalks and pedestrian crossings at intersections to create a continuous network. A safe and convenient system of pedestrian facilities can encourage walking.

The City has an adopted Bicycle and Pedestrian Master Plan (1999), which they plan to update in 2014. City zoning codes including those for the Downtown, Neighborhood Commercial, and Heavy Commercial zones, also address bicycle and pedestrian access through policy and requirements including:

- Bicycle Parking: Secure bicycle parking shall be provided at a rate of 0.50 spaces per unit (2 units would require one parking space). Downtown Zoning Code Section 5. Standards for Specific Land Uses)
- Bike/Pedestrian Connections. Bike/pedestrian paths are recommended for areas that lack designated pedestrian/bike connections in order to provide the required circulation pattern, pedestrian orientation, and walkability. (Downtown Zoning Code Section 11.070, B2)

Strategy TL.2.2: Establish Safe Routes to Schools

Increase opportunities for walking and biking by school children to and from school.

Priority:	1
Timeframe to start implementation:	2015-2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	173
Estimated Annual Cost to the City in 2020:	Medium to high (City staff time, capital costs for street improvements)
Responsibility:	Planning and Community Development Department Public Works Department
Objective(s):	By 2020: 50% of intersections and streets to be improved By 2030: 100% of intersections and streets to be improved
Local Economic Benefits:	Lower fuel bills, improved public health
Other Local Co-benefits:	Improved air quality, less traffic congestion, lower commute times

Action TL-2.2a: Enhance pedestrian and bicycle facilities around schools.

Action TL-2.2b: Utilize City resources to encourage and educate parents and students about the benefits of walking and biking to school.

Action TL-2.2c: Implement traffic calming measures on identified Safe Routes to School routes.

Action TL-2.2d: Add safety improvements to City transportation infrastructure along applicable routes.

Action TL-2.2e: Continue to work closely with the Mendocino County Public Health Department to promote walking and biking and healthy alternatives for school children

Safe Routes to School is a national and international movement to create safe, convenient, and fun opportunities for children to bicycle and walk to and from schools. The City will increase opportunities for schoolchildren to walk and bike to and from school by continuing to implement safety improvements to City pedestrian and bicycle facilities. All crosswalks around schools in the City of Ukiah have been marked. The City will also support Ukiah Unified School District efforts to encourage and educate parents/students about the benefits of walking and cycling to school.

Goal TL.3  Increase Motor Vehicle Efficiency

Increasing motor vehicle efficiency has a direct affect on GHG emission; as fuel efficiency rises, GHG emissions per VMT go down. Over the last 30 years, the fuel economy (miles per gallon, or mpg) of new passenger vehicles in the United States has improved significantly, increasing by more than 30 percent. Until very recently, most of the gains occurred in the early years of fuel economy regulation under the Corporate Average Fuel Economy (CAFE) program. Fuel economy improvements were nearly stagnant from

the late 1980s to the early 2000s. Over this period, the technical efficiency (amount of energy needed to move a given vehicle mass) of light-duty vehicles improved, although fuel economy (the amount of gasoline consumed per mile traveled) remained unchanged, as consumer preferences shifted to larger, heavier, and more powerful vehicles. Fuel economy standards for light trucks were increased slightly in 2003, and recent federal vehicle standards adopted in 2010 and 2012 are expected to raise average fuel economy as high as 54.5 mpg for model year 2025.[28]

Beyond improving fuel efficiency in vehicles, another method for reducing GHGs through fuel economy is to switch to electric and hybrid vehicles. A vehicle that operates on electricity only does not emit any tailpipe emissions. A fuel cell vehicle operating on hydrogen emits only water vapor. Plug-in hybrid vehicles that operate on either electricity or gasoline only emit lower tailpipe GHG emissions compared to their gasoline-powered counterparts.[29]

Strategy TL.3.1: Improve Municipal Fleet Fuel Efficiency

Upgrade City fleet vehicles to include more electric, hybrid-electric, and alternative fuel vehicles to reduce emissions associated with City operations.

Priority:	2
Timeframe to start implementation:	2015-2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	45
Estimated Annual Cost to the City in 2020:	Low (City staff time)
Responsibility:	Planning and Community Development Department
Objective(s):	By 2020: 10 City vehicles replaced with electric, hybrid-electric, or alternative fuel vehicles By 2030: 30 City vehicles replaced with electric, hybrid-electric, or alternative fuel vehicles
Local Economic Benefits:	Lower fuel bills
Other Local Co-benefits:	Improved air quality

Action TL-3.1a: Participate in City-wide marketing efforts for Clean Air Days, Bike-to-Work Days, Sunday Streets/Car-Free Sundays, etc.

Action TL-3.1b: Consider setting aside funding and/or pursuing grant funding to replace the City fleet vehicles with additional electric, hybrid-electric, and alternative fuel vehicles.

In 2005, the City Vehicle Fleet Fuel represented approximately 28 percent of the municipal GHG emissions. The use of alternative fuels, electric vehicles, and other cleaner forms of transportation by the City government will set a positive example to the rest of the community and provide leadership in reducing GHG emissions associated with transportation. To promote fuel efficient and alternative vehicle use, the City will strive to develop infrastructure for alternative vehicles and will continue to upgrade the City fleet vehicles with more fuel efficient and alternative fuel vehicles to reduce emissions associated with City

[28] Source: NHTSA, *Summary of Fuel Economy Performance*, 2012. http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/2011_Summary_Report...

[29] EPA, Greenhouse Gas Emissions from a Typical Passenger Vehicle, December 2011.

operations. Ukiah will implement this strategy by continuing to set aside existing budget and by pursuing grant funding to replace the City fleet with additional electric, hybrid-electric, and alternative fuel vehicles.

Solid Waste

- 2020 Adjusted Business-as-Usual GHG Emissions: 23,686 MT CO2e
- Annual GHG emissions reductions by 2020: 1,703 MT CO2e

Emissions associated with the landfilling of solid waste constitute approximately 18 percent of the City's 2020 adjusted BAU GHG emissions forecast. Diverting more solid waste from landfills is an effective way to reduce GHG emissions by avoiding anaerobic decomposition of organic material and recovering the embodied energy in recycled materials. Strategies for reducing the amount of solid waste generated by the community include partnering with the local waste hauler to build on existing diversion programs and incentivizing the community to increase diversion rates.

C&S Waste Systems (C&SWS) holds the City contract for hauling and managing the City's solid waste. C&SWS subsidiary Ukiah Waste Systems is the City's franchise hauler, providing solid waste and curbside recycling collection within the City of Ukiah. Curbside collection containers are provided separately for trash, mixed recycling (paper products, metal, glass, and plastics), and yard (green) waste. For Ukiah trash customers, residential and commercial, there is no charge for recycling and yard waste collection service. Single-stream recyclables are processed at a local materials recovery facility, and yard waste is locally composted. Ukiah has a Pay as You Throw (PAYT) system, which provides an economic incentive to customers to reduce landfill materials and increase recycling. Another C&SWS subsidiary, Solid Waste Systems, operates the Ukiah Transfer Station, for members of the public who wish to self-haul their trash and recyclable materials, including green waste and construction debris. C&SWS recently opened a Material Recovery Facility (MRF) in Ukiah, which processes single-stream recyclables collected by Ukiah Waste Solutions and other C&SWS-affiliated haulers.

Solid waste collected from the Ukiah community is currently hauled to the Eastlake Landfill in Lake County, a distance of approximately 54 miles. A City-owned landfill located on Vichy Springs Road was closed in 2001, but continues to generate methane emissions from existing waste.

Waste Diversion

Energy is expended in the extraction, processing, and transporting of raw materials, and in manufacturing and delivering goods to market. Reuse and recycling helps conserve much of the energy embodied in these goods and materials, which in turn avoids GHG emissions. Sending glass, plastic, and metal to landfill represents a loss of resources as many of these materials can be recycled into other products, thereby reducing the demand for virgin materials in manufacturing and production. In addition to being energy intensive, upstream extraction and processing of raw materials (mining, construction, fuel production, metals processing, etc.) generates enormous volumes of waste material. Forty to seventy times more waste (and associated emissions) is generated from the upstream industrial processes associated with product manufacturing than with their disposal to landfill.[30]

[30] Makower, Joel, Strategies for the Green Economy: Opportunities and Challenges in the New World of Business, McGraw-Hill. 2009.

Composting organic waste material, including food scraps, non-recyclable paper products, and plant material keeps these materials out of out of landfills, where anaerobic decomposition releases methane (CH4) – a powerful GHG. A well-managed composting operation provides a direct reduction of landfill methane emissions while producing a nutrient rich soil amendment that can be used to reduce pesticides and chemical fertilizers, retain water, build soil, and increase food productivity. Compost also helps increase carbon sequestration in soils.

The City decreased its solid waste disposal rate substantially between 2007 and 2010, going from an average of 5.6 pounds per person per day (PPD) in 2007 to 3.2 PPD in 2010. This decrease is the result of a large increase in recycling between 2005 and 2010. Primarily, this was due to improved floor sorting at the Ukiah Transfer Station. Over the past few years the Transfer Station has diverted approximately two-thirds of the 30,000 tons per year it receives, due to floor sorting and adding to the types of materials that it recycles, including porcelain, carpet, carpet padding, asphalt shingles, and various scrap metals. It has also added a buy-back program which incentivizes the recycling of metal. Another reason for a decrease in disposal rates is the economic recession starting in 2008, which resulted in a significant decrease in new construction/remodel projects, and related construction waste. The recession also led to more waste customers downsizing their gray garbage carts.

The city-wide diversion rate for 2010 and 2011 was estimated at 69% (Municipal Services Review, 2012). Pursuant to AB 341 (2011), the State of California is required to divert 75 percent of its solid waste from landfills by 2020. Recycling and organics diversion are the two fundamental tactics recommended for reaching this goal. The City can attain this goal, and contribute to reaching its GHG reduction target, by focusing on improving recycling and composting programs and increasing participation.

Solid Waste Goals and Strategies

Table 4-8 summarizes the Climate Action Plan's solid waste diversion strategies and their estimated GHG reduction impact. Specific energy goals, strategies, and actions are described in the sections that follow. Appendix C provides details on the assumptions and methods used to quantify GHG reductions associated with each strategy.

Table 4-8
Summary of GHG Reduction Impacts for Solid Waste Strategies in 2020 and 2030

	Goal/Supporting Strategy	2020 Annual GHG Reduction Potential (MT CO2e)	2020 Percent of Category	2030 Annual GHG Reduction (MT CO2e)
SW.1	Reduce Solid Waste Sent to Landfill			
SW.1.1	Increase Community Landfill Diversion Rate	1,686	99.0%	2,320
SW.1.2	Increase Municipal Operations Landfill Diversion Rate	17	1.0%	24
SW.2	Reduce Release of Landfill Methane			
SW.2.1	Explore Potential of Flaring Landfill Gas	Not quantified	Not quantified	
	TOTAL	1,703	100%	2,343

Goal SW.1 Reduce Solid Waste Sent to Landfill

The City will prioritize the diversion of waste from landfill as its primary solid waste goal. Increasing waste diversion will entail expanding and improving recycling and composting programs, maximizing the use of technical assistance, and increasing public awareness and education.

Strategy SW.1.1: Increase Community Landfill Diversion Rate

Increase recycling, green waste diversion, and waste reduction associated with the Community; Increase landfill diversion rate to 75% (or higher).

Priority:	1
Timeframe to start implementation:	In progress
Annual GHG Reduction Potential in 2020 (MT CO2e):	1,686
Estimated Annual Cost to the City in 2020:	Medium (City staff time)
Responsibility:	Public Works Department
Objective(s):	By 2020: Community waste diversion 75% or higher By 2030: Community waste diversion 85% or higher
Local Economic Benefits:	Lower cost to the City
Other Local Co-benefits:	Reduce waste, lower energy demand, improve traffic and air quality, educate the public

Action SW-1.1a: Develop a Community Waste Reduction Plan (i.e., Zero Waste Plan).

Action SW-1.1b: Work with the local hauler to increase curbside recycling rate and divert organics (food and/or green waste) from landfill.

Action SW-1.1c: Work with the local hauler and/or solid waste agency to ensure that services for solid waste collection, recycling and disposal meet the needs of the community. Improve composting programs.

Action SW-1.1d: Launch outreach campaigns to increase participation in residential and commercial recycling and composting programs, and to promote waste reduction. Work with the Mendocino Solid Waste Management Authority and the solid waste local hauler to distribute public education materials on solid waste source reduction, recycling and composting, and the proper handling of household hazardous waste.

The City aims to increase its landfill diversion rate to 75% by 2020, through additional recycling, green waste diversion and composting, and waste reduction associated within the community. The City is well positioned to achieve this goal, with a current (2010/2011) diversion rate equivalent of 69%/72%, and with its adoption in March 2013 of the *City of Ukiah Zero Waste Resolution* which calls for achieving zero waste through "action plans and measures that significantly reduce waste and pollution including environmentally preferred product procurement, recycling and composting."

Ukiah will develop a Community Waste Reduction Plan or Zero Waste Plan for residents and businesses to delineate a path for future actions, including ways to encourage residents, businesses, agencies and institutions to use, reuse, and recycle materials judiciously, to compost organic wastes, and to encourage

manufacturers to produce and market less toxic and more durable, repairable, reusable, recycled, and recyclable products. The plan will provide a blueprint for achieving interim goals and a strategy for reaching out to the community. In order to meet the community zero waste goal, a cultural shift will be needed so that both businesses and residents learn to value discards as resources and shift away from the "single use" mentality.

Close coordination with the City's hauler will also be required in order to successfully expand recycling and organics/food collection services to underserved sectors such as small restaurants and multifamily residential units. C&SWS is currently working to consolidate its recycling and composting operations at a new site in Ukiah (the former Thomas pear sheds), but the company has not been successful in securing a permit from the County to compost food waste at that site. Meanwhile, C&SWS recently began a pilot program for collecting food waste from Ukiah businesses and trucking it to a composting facility in Lake County.

The City will also coordinate with the hauler and the Mendocino Solid Waste Management Authority to prepare and distribute educational materials to the public on recycling programs, and to promote solid waste source reduction and benefits of composting. These educational materials could consist of brochures and flyers made available or sent to residents and businesses, and information about recycling programs can be posted on the City's website. The City will also strive to raise consumer awareness about environmentally preferable product alternatives, reducing unnecessary consumption, and promoting the reuse and sharing of goods within the community.

Under California law (AB 341), any commercial business or public entity that generates more than four cubic yards of commercial solid waste per week, or is a multifamily residential dwelling of five units or more, is required to recycle after July 1, 2012. The City will continue to work with C&SWS to ensure the recycling program addresses this requirement, and includes other non-residential entities not in compliance so that recycling is maximized in Ukiah.

Strategy SW.1.2: Increase Municipal Operations Landfill Diversion Rate

Increase recycling, green waste diversion, and waste reduction associated with municipal government operations. Increase municipal operations landfill diversion rate to 75% (or higher).

Priority:	1
Timeframe to start implementation:	2013-2014
Annual GHG Reduction Potential in 2020 (MT CO2e):	17
Estimated Annual Cost to the City in 2020:	Low (City staff time)
Responsibility:	Public Works Department
Objective(s):	By 2020: Municipal waste diversion 75% or higher By 2030: Municipal waste diversion 85% or higher
Local Economic Benefits:	Lower cost to the City
Other Local Co-benefits:	Reduce waste

Action SW-1.2a: Include municipal operations in the Community Waste Reduction Plan or Zero Waste Plan.

Action SW-1.2b: Work with the local hauler to expand recycling and organics diversion at City facilities.

Action SW-1.2c: Consider adopting an environmentally friendly purchasing policy for municipal operations.

Concurrent with the community-wide waste diversion goal, the City will commit to a landfill diversion rate to 75% by 2020 for its own operations. Similar to how the City reduces landfill waste at the community level, the City will achieve its municipal target through additional recycling, green waste diversion, and waste reduction associated with government operations. The City will coordinate with the local hauler to expand recycling and organics diversion at City facilities, and will consider adopting an environmentally friendly purchasing policy for municipal operations. Under this policy, the City would use and purchase recycled products and recycled materials, and encourage its contractors and consultants to do so as well, when practical and financially viable. This policy could also encourage or require the City to make resource conservation an integral part of its waste reduction and recycling programs.

Goal SW.2 Reduce Release of Landfil Methane

As described in Chapter 3, a large portion of the City's solid waste-related emissions come from the City-operated landfill. Closed since 2001, the landfill nevertheless continues to generate methane emissions from existing waste. These emissions will naturally attenuate over time as the waste in place decomposes and releases less landfill gas. However, the City will explore ways to continue to reduce landfill emissions via flaring of methane or other means.

Strategy SW.2.1: Explore Potential of Flaring Landfill Gas

Explore ways to flare the Landfill gas that is currently captured from the closed City landfill

Priority:	3
Timeframe to start implementation:	2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	Not quantified
Estimated Annual Cost to the City in 2020:	Medium (City staff time and potential capital improvements)
Responsibility:	Planning and Community Development Department and Public Works Department
Objective(s):	None identified
Local Economic Benefits:	None identified
Other Local Co-benefits:	Educate the public

Action SW-2.1a: Explore the feasibility of cost-effectively flaring Ukiah's landfill gas.

The City of Ukiah has a perimeter gas extraction system at its closed landfill on Vichy Springs Road, consisting of 17 vertical extraction wells located between the southwestern edge of the waste and the property line. The gas collected in the extraction system is discharged through a vacuum blower. When the system was installed it was determined that there was insufficient quality and quantity of landfill gas to

feasibly operate a landfill gas-to-energy project. However, if the LFG was flared, then methane gas would be converted into CO2, thus greatly reducing the global warming potential (GWP) of the off gas (methane has a GWP potential of 21 compared to 1 for CO2). The City will explore the feasibility of flaring the landfill gas in a cost-effective way.

Water

- 2020 Adjusted Business-as-Usual GHG Emissions: 477 MT CO2e
- Annual GHG emissions reductions by 2020: Not quantified (supporting measures)

Emissions associated with water consumption in Ukiah are due to the energy required to convey water from its source to end users in Ukiah, energy needed to convey wastewater through the City's sewer system, and treatment of wastewater. Water-related emissions are anticipated to constitute less than 1 percent of community-wide emissions in 2020. Since the City has already achieved its 2020 water conservation goals (as set by state law) it is not committing to further reduction in water use per capital by 2020. However, the City will continue to strive for better water efficiency in the community and in its own operation, recognizing that water is a precious and limited resource that must be conserved to meet future demands.

Water Conservation

Water conservation reduces the energy required for upstream water collection, conveyance, and treatment, and reduces the energy requirements and the process emissions associated with wastewater collection and treatment. The energy intensity of water conveyance is dependent on the distance water is transported and elevation changes.

Effective ways of conserving water include incentivizing reductions in commercial/industrial outdoor irrigation, providing rebates for residential water conservation devices, and utilizing recycled water. Water conservation actions have many benefits beyond reducing GHG emissions. In addition to maintaining water as a sustainable resource for future generations, conservation buffers communities from the effects of droughts, saves money, and helps sustain wildlife habitats.

The City takes its responsibility to conserve water seriously and actively supports State policies aimed at reducing water use. The California Urban Water Management Planning Act (UWMP Act) requires every California urban water supplier of more than 3,000 customers to adopt an Urban Water Management Plan (UWMP). In 2009, the State passed the Water Conservation Bill of 2009 (SBX7-7), which requires an updated UWMP every 5 years. It also sets a target of a 20 percent reduction in State-wide water use by 2020, requiring local jurisdictions to act to meet the statewide goal.

The City of Ukiah adopted its most recent UWMP in 2011. The Ukiah UWMP describes 2010 water use and projected water demand in five-year increments through 2035. In 2010, the sectors with the highest water use were multi-family and single family residential (738 acre-feet per year [AFY], each), followed by commercial/institutional (707 AFY), landscape (192 AFY), and industrial (51 AFY). No water use was reported for agriculture or other (fire service). According to the UWMP, Ukiah's average daily water use

ranged from a low of 168 gallons per capita-day (gpcd) in 2010 to a high of 245 gpcd in 1999.[31] The UWMP outlines strategies to meet the 20 percent reduction goal of SBX7-7 through Demand Management Measures, which are incorporated into the strategies below.

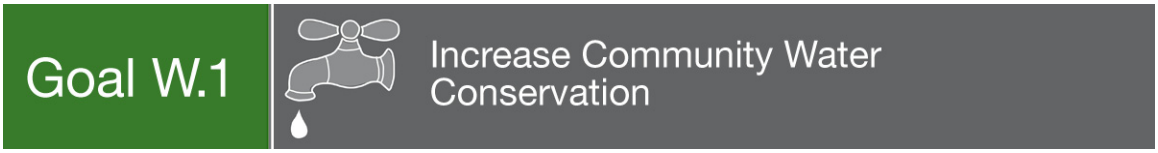
An additional challenge faced by the City is that reducing water consumption through conservation efforts reduces the revenue generated by water "sales" to customers. Reduced revenues can adversely affect operations and maintenance.

Water Goals and Strategies

The following strategies support the goal to reduce community water use. GHG emissions reductions are not estimated for these strategies, as they are considered supporting measures for overall energy efficiency goals, and the reductions associated with the water sector would have a relatively minor impact on overall reductions in the City.

Table 4-9
Summary of GHG Reduction Impacts for Water Conservation Strategies in 2020 and 2030

	Goal/Supporting Strategy	2020 Annual GHG Reduction Potential (MT CO2e)	2020 Percent of Category	2030 Annual GHG Reduction (MT CO2e)
W.1	Increase Community Water Conservation			
W.1.1	Decrease Community Water Consumption	Not quantified	Not quantified	Not quantified
W.1.2	Reduce Municipal Operations Water Consumption	Not quantified	Not quantified	Not quantified
W.1.3	Expand Use of Recycled Water	Not quantified	Not quantified	Not quantified
	TOTAL	NA	NA	NA



Strategy W.1.1: Decrease Community Water Consumption

Reduce community water consumption by 20% by 2020.

Priority:	3
Timeframe to start implementation:	2015-2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	Not quantified
Estimated Annual Cost to the City in 2020:	Low (City staff time)
Responsibility:	Planning and Community Development Department; Public Works Department
Objective(s):	Community water consumption reduced 20% by 2020

[31] City of Ukiah, 2010 Urban Water Management Plan. Published June 2011.

Local Economic Benefits:	Lower community water bills
Other Local Co-benefits:	More reliable local water supply, improved fisheries and aquatic ecosystem health

Action W-1.1a: Consider establishing a rebate program with the City Public Works Department to promote the installation of higher efficiency plumbing fixtures.

Action W-1.1b: As staff and resources allow, prepare and adopt a more water efficient landscaping ordinance.

California's Water Conservation Bill of 2009 (SBx7-7) requires that all water suppliers increase water use efficiency with the overall goal to decrease per-capita consumption within the state by 20 percent from a 2005 baseline. The City of Ukiah 2010 UWMP explains how this target will be met for the City and describes many different programs that the City has implemented, and will continue to promote, for reducing water demand and for making the water conveyance system more efficient. The UWMP requires that retail water agencies develop an implementation plan for compliance with the SBx7-7 water use targets.

The City is currently below its 2020 water targets as expressed in the UWMP. The City intends to continue and develop its water conservation programs, implementing water conservation and water recycling programs to maximize sustainability in meeting future water needs for its customers.

The City will continue its water conservation efforts while striving to reduce water usage even further. Many of the City's ongoing efforts are highlighted in the UWMP and other City documents:

- Continue to perform system-wide leak detection and repair on an ongoing basis. The City calculates system water losses annually and reports this information to Department of Water Resources (DWR). In addition to calculating system losses, the City is in the process of replacing old meters in the system. New meters will provide a more comprehensive portrayal of water use within the City.
- Reduce water consumption in existing residential and commercial buildings by increasing the efficiency of existing plumbing fixtures (as described in Strategy E.1.5 and in the City's Downtown Zoning Code Section 5.030), and by promoting available rebates from utility companies for the installation of higher efficiency plumbing fixtures.
- Consider a survey program for single-family and multi-family residences to identify water use problems, recommend improvements, provide instruction in landscape principles and irrigation timer use, and identify indoor and outdoor leaks.
- Through the City's planning review process the City manages its large landscape water consumers to ensure responsible water use for new developments. The City's Planning and Community Development Department reviews all landscape plans for proposed new developments. Included in the City's Municipal Code is a requirement for all landscape planting to be "those which grow well in Ukiah's climate without extensive irrigation."
- Continue to promote public awareness of water conservation through occasional bill stuffers, distribution of its Annual Water Quality Report, radio broadcasts, and the City website. In addition, City employees are encouraged to discuss conservation measures with customers.
- Continue to enforce the City's water waste ordinance. The City's Municipal Code states "Where negligent or wasteful use of water exists on a customer's premises, seriously affecting the general service, the City may discontinue the service if such conditions are not corrected within five (5) days

after giving customer written notice of intent to do so" (§4.1.7.3571). If the City determines that a customer is wastefully using water, the City first sends a letter to the customer to call attention to their wasteful practice and ask for correction. If the water waste condition is not corrected within five days after the written notice, service may be discontinued if necessary.

Strategy W.1.2: Reduce Municipal Operations Water Consumption

Reduce municipal operations water consumption by 20% by 2020.

Priority:	3
Timeframe to start implementation:	2015-2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	Not quantified
Estimated Annual Cost to the City in 2020:	Low-Medium (City staff time, new plumbing fixtures)
Responsibility:	Planning and Community Development Department; Public Works Department
Objective(s):	Municipal water consumption reduced 20% by 2020
Local Economic Benefits:	Lower water bills
Other Local Co-benefits:	Educate the community, show leadership

Action W-1.2a: Utilize available rebates from utility companies for the installation of higher efficiency plumbing fixtures.

Action W-1.2b: As staff and resources allow, prepare and adopt a water efficient landscaping ordinance.

In addition to community water conservation (Strategy W.1.1) the City will reduce water use at the government operations level by 20% by 2020, as called for under the Water Conservation Act of 2009 (SB7x7). This will include application of the water conservation strategies described under Strategy W.1.2, as applied to all City-operated facilities. The City has the opportunity to be a leader in modeling water efficient behavior including by doing a water loss audit, developing a water conservation plan and annual report, installing water efficient fixtures in municipal facilities, converting landscaping to use native and/or water efficient plants, and publicizing efforts. The City will expand upon past efforts to model water efficient landscaping, such as the landscaping plan at the City's electrical substation on South Orchard Avenue. Landscaping included a "demonstration garden" that shows what residents can grow in this area, as well as a walking path and extra trees. The City will consider converting a portion of its City Hall lawn to a model, drought-tolerant landscape, similar to what the City of Petaluma did at its City Hall. Pelaluma replaced its City Hall's lawn with water-efficient landscaping that acts as a catchment system and includes community gardens with native and edible plants.

Strategy W.1.3: Expand Use of Recycled Water

Implement Recommendations of the 2012 Recycled Water Feasibility Study.

Priority:	2
Timeframe to start implementation:	2015-2016
Annual GHG Reduction Potential in 2020 (MT CO2e):	Not quantified
Estimated Annual Cost to the City in 2020:	Low (City staff time)
Responsibility:	Community Development Department; Public Works Department
Objective(s):	None identified
Local Economic Benefits:	Benefits to local agricultural industry, enhance regional partnerships
Other Local Co-benefits:	Increased water supply reliability

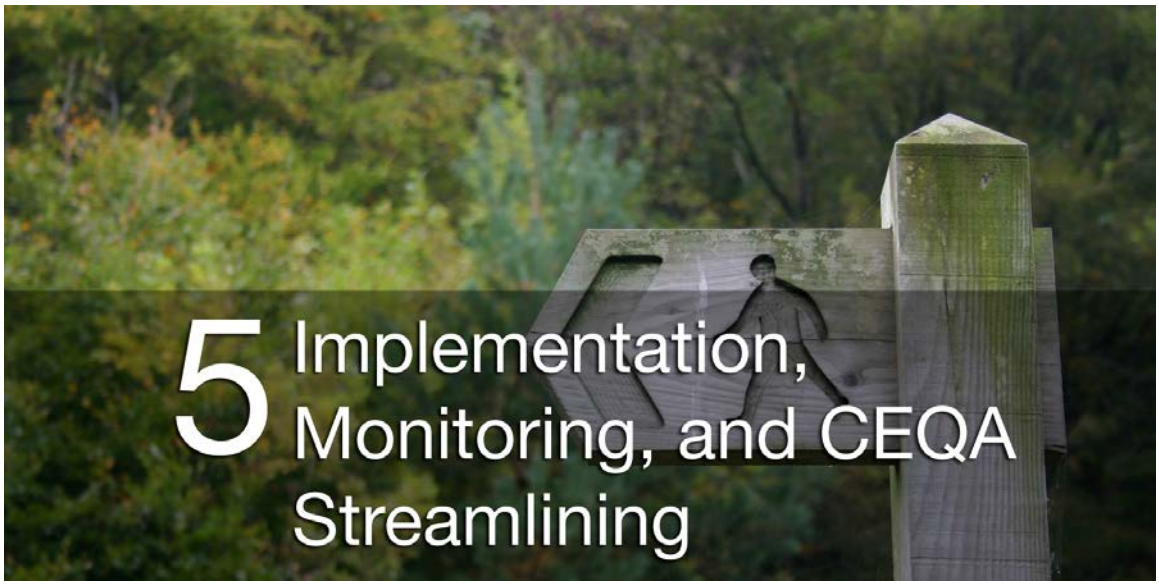
Action W-1.3a: Consider adopting a policy requiring the installation of "purple pipes" in open trenches for both public and private projects if the trenches are within planned routes for recycled water transport.

In 2012, the City completed a Recycled Water Feasibility Study to determine the feasibility of constructing a recycled water system to replace or augment existing water supplies in Ukiah Valley. Recycled water use would offset existing and future water demands for irrigation and frost protection of agricultural land, benefitting the local agricultural industry, reducing demands for limited groundwater and surface water resources, and improving the reliability of the water supply over a wider range of hydrologic conditions. The study examines the feasibility of directing wastewater effluent from the WWTP water to agricultural use, and includes the City's plan for implementing recycled water use in the City of Ukiah and surrounding areas. As the source of recycled water is dependent on the size of the local population, the anticipated increases in Ukiah's population would result in increased wastewater supplies available for recycled water use.

The study identifies potential recycled water use sites including agricultural areas and urban landscaping; evaluates several water recycling alternatives; provides planning level cost estimates; and provides a recommended alternative based on a variety of variables including environmental considerations, regulatory impacts, public acceptance, funding, and difficulty of implementation. Successful implementation of the recycled water project would include:

- Design and construct the recommended alternative.
- Receive firm commitments and Agreements from landowners to use recycled water.
- Obtain permits and clearances from applicable regulatory agencies (RWQCB, CDPH, etc). Also includes the RW Policy Salt/Nutrient Management Plan development.
- Conduct environmental process (CEQA) and develop compliance documents.
- Conduct a Proposition 218 process.
- Adopt a resolution for recycled water use.
- Prepare a cost of service rate study.

The City will continue to move forward with implementation of the recycled water project, and will strive to maintain the implementation schedule outlined in the Recycled Water Feasibility Study (Figure 7.3). The City will investigate the funding sources and considerations outlined in Chapter 8 of the study, to maximize use of existing funding sources, leverage existing resources, and develop regional partnerships that benefit numerous stakeholders.



5 Implementation, Monitoring, and CEQA Streamlining

Overview

This chapter shows how successful implementation of the CAP strategies and actions laid out in Chapter 4 will help the City achieve its 2020 GHG reduction target, and outlines how the City will monitor the progress of the strategies and actions to reduce community-wide GHG. Translating strategies and actions into actual emission reductions will require development of programs, City staff time (or interagency regional work-sharing) for promotion activities, and effective management systems for tracking and monitoring program implementation. Coordination between City departments and collaboration with residents, businesses, regional organizations, and other government agencies will be needed to ensure that programs are well-managed and cost-effective.

The Climate Action Plan relies on behavior change to achieve a significant portion of GHG reductions needed to meet the 2020 emissions target. Community involvement is an essential component of the Climate Action Plan implementation process, as many strategies depend on active participation by residents and businesses. The City will be making a concerted effort to develop and strengthen community education and awareness through various promotional programs. These efforts will be monitored for their cost-effectiveness in influencing residents, businesses, and visitors to reduce their personal carbon footprints. The City's web site will also be updated to communicate program development and gauge the success of Climate Action Plan implementation.

This chapter presents an implementation schedule organized into Near-term (2013 – 2014), Medium–term (2015 – 2016), and Long–term (beyond 2016) actions. The schedule also highlights the City department responsible for spearheading implementation efforts, and the quantifiable objectives for each strategy against which successful implementation will be judged. Actual implementation will depend on a variety of factors, including availability of funding and City staff time, community priorities, and changing environmental demands.

Implementation

For the most part, the City will be responsible for initiating the actions to reduce emissions. However, success for many measures will ultimately depend on public participation. Actions that require active City promotion may require updates to the City website, distribution of physical promotional materials, and other active City outreach activities. The City will develop programs to reach the public, including public forums, workshops, and meetings; these programs will be administered with the intent to foster an open public input and commenting process. Collaboration and coordination with transit agencies (e.g., Mendocino Transit Authority) will be essential to improving and increasing transit ridership, and enhancing mobility and transportation efficiency through better planning.

Further, coordination with outside agencies and private entities is critical for the success of many strategies, including PG&E and Mendocino County Energy Watch (MCEW) for natural gas efficiency programs, the local garbage hauler (Ukiah Waste Solutions) for waste reduction actions, the local and regional water purveyors for water saving actions, and other local jurisdictions for work-sharing partnerships designed to take advantage of the common goals across Mendocino County. Partnering with the Mendocino Air Quality Management District, Mendocino College, the Employers Council of Mendocino County, the Mendocino Council of Governments, and the Chamber of Commerce will also leverage existing efforts to develop a valley wide clean/green industry and jobs development strategy. Dependence on outside agency participation and regional partnerships is mentioned explicitly in the strategy descriptions included in Chapter 4, and the City will continue to explore opportunities for collaboration.

Table 5-1 provides a summary of implementation components for all of the strategies described in Chapter 4, including implementation timeframe, the City department tasked with implementing and monitoring each strategy, and objectives (i.e., the monitoring criteria).

Table 5-1
Implementation Summary Table

	2020 Annual GHG Reductions	Implementation Timeframe	Responsible Department	Objectives
Energy				
E.1.1: Promote Commercial Energy Efficiency	646	2013-2014	Planning and Community Development Department	By 2020: 15% of commercial square footage updated By 2030: 25% of commercial square footage updated
E.1.2: Promote Residential Energy Efficiency	567	2013-2014	Planning and Community Development Department	By 2020: 15% of residential square footage updated By 2030: 25% of residential square footage updated
E.1.3: Improve Municipal Energy Efficiency	76	2015-2016	Planning and Community Development Department	25% of public use building square footage updated by 2020 and 2030
E.1.4: Reduce Urban Heat Islands	2	2015-2016	Planning and Community Development Department; City Building Department	By 2020: 17 housing units and 2 commercial units participating By 2030: 35 housing units and 5 commercial units participating
E.1.5: Promote Commercial and Residential Green Building	23	2015-2016	Planning and Community Development Department; City Building Department	10% of new commercial and residential properties achieve CalGreen Tier 1 for energy efficiency (15% improvement over minimum requirement)
E.2.1 : Promote On-site Renewable Energy for Commercial and Industrial Users	247	2013-2014	Planning and Community Development Department	By 2020: 15% participation By 2030: 30% participation
E.2.2: Promote Small-scale On-site Renewable Energy for Homes	130	2013-2014	Planning and Community Development Department	By 2020: 675 new solar PV systems (10% of homes) By 2030: 1,747 new solar PV systems (25% of homes)
E.2.3: Expand Municipal Renewable Energy	<1	2015-2016	Planning and Community Development Department	By 2020: 4 kW solar PV installation By 2030: 12 kW solar PV installation
E.3.1: Increase Local Education and Outreach	Not quantified	2013-2014	Planning and Community Development Department	None identified
E.3.2 : Expand Regional Renewable Energy Partnerships	Not quantified	2015-2016	Planning and Community Development Department	None identified
Transportation and Land Use				
TL.1.1: Local Commute Trip Reduction	88	2015-2016	Planning and Community Development Department	By 2020: 0.5% reduction in VMT By 2030: up to 1.2% reduction in VMT
TL.1.2: Sustainable Growth Patterns	616	2015-2016	Planning and Community Development Department	2020: 1.2% reduction in VMT 2030: up to % reduction in VMT

	2020 Annual GHG Reductions	Implementation Timeframe	Responsible Department	Objectives
Transportation and Land Use (continued)				
TL.1.3: Regional Transportation Management	Not quantified	2015-2016	Planning and Community Development Department	None identified
TL.1.4: Expand/Improve Public Transit	Not quantified	2015-2016	Planning and Community Development Department	None identified
TL.2.1: Improve Bicycle and Pedestrian Infrastructure	22	2015-2016	Planning and Community Development Department	By 2020: 4 miles of bike lanes added By 2030: 8 miles of bike lanes added
TL.2.2: Safe Routes to Schools	173	2013-2014	Planning and Community Development Department	By 2020: 50% of intersections and streets to be improved By 2030: 100% of intersections and streets to be improved
TL.3.1: Improve Fuel Efficiency for Municipal Fleet	45	2015-2016	Planning and Community Development Department	By 2020: 10 City vehicles replaced with electric vehicles By 2030: 30 City vehicles replaced with electric vehicles
Solid Waste				
SW.1.1: Increase Community Landfill Diversion Rate	1,686	2013-2014	Planning and Community Development Department and Public Works Department	By 2020: Community waste diversion 75% or higher By 2030: Community waste diversion 85% or higher
SW.1.2: Increase Municipal Operations Landfill Diversion Rate	17	2013-2014	Planning and Community Development Department and Public Works Department	By 2020: Municipal waste diversion 75% or higher By 2030: Municipal waste diversion 85% or higher
SW.2.1: Explore ways to flare gas or capture the energy content	Not quantified	2016	Planning and Community Development Department and Public Works Department	None identified
Water				
W.1.1: Decrease Community Water Consumption	Not quantified	2016	Planning and Community Development Department; Public Works Department	Community water consumption reduced 20% by 2020
W.1.2: Reduce Municipal Operations Water Consumption	Not quantified	2016	Community Development Department; Public Works Department	Municipal water consumption reduced 20% by 2020
W.1.3: Expand Use of Recycled Water	Not quantified	2015-2016	Community Development Department; Public Works Department	None identified

Plan Monitoring

City staff will annually present memorandums to the City Manager summarizing progress of the implementation of Climate Action Plan strategies. The report will evaluate the successes and challenges in meeting the goals established in Chapter 4, and the City's 15 percent GHG reduction target. City staff will provide the status of implementation (e.g., initiated, ongoing, completed), assess the effectiveness of the strategies and programs included in the Plan against the established objectives, and recommend adjustments to programs or tactics as needed. The annual report will also assess whether the City's actual growth and development is consistent with the forecasts made in this Climate Action Plan. If necessary, the City shall modify the geographic scope of the inventory and emissions targets accordingly.

An update of the City's GHG inventory and comprehensive revision of the Climate Action Plan should occur at least every five years to monitor progress of GHG reductions against the 2020 target.

Transportation and Land Use: Longer Term Considerations

As introduced in Chapter 2, California's Executive Order S-3-05 established aggressive goals to reduce state-wide GHG emissions to 80 percent below 1990 levels by 2050. AB 32 addresses an interim goal to reduce emissions to 1990 levels by 2020, and defines state GHG policy and regulations through the year 2020. Beyond that, only SB 375 mandates additional GHG reductions, assigning reduction targets to the state's 18 Metropolitan Planning Organizations (MPOs) for emissions from on-road transportation vehicles. Other than the state energy policy calling for all new buildings to be zero net energy[1] (ZNE) performers by 2025, regulation of other sources after 2020 is uncertain, but it is likely that future targets will be discussed and proposed as the AB 32 Scoping Plan undergoes its scheduled revision in 2013.

This Climate Action Plan provides a clear roadmap for the City to achieve GHG reductions consistent with the statewide AB 32 target. Achieving the deep reductions needed to help meet the state's longer term goals will be much more challenging. Such reductions are highly dependent on technological development and strong leadership at the federal and state levels, but they will also require extensive changes to local development patterns and transportation systems. It is appropriate for the City to begin thinking and planning for this challenge now, as profound changes to local land use patterns, transportation modes, and community behavior could require decades of planning, public engagement, and policy development.

As a sector, Transportation and Land Use represents perhaps the biggest challenge to the state's 2050 GHG emission target, and to local efforts to reduce emissions. Though the City of Ukiah has authority over local land use authority, wholesale transformation of disparate neighborhoods and commercial zones into integrated, automobile-independent, "new urbanist" type communities is difficult under the best of circumstances, even when there is community consensus to move in that direction. As the state continues to develop its longer term policies and strategies for reducing emissions, the City of Ukiah will begin its longer-term visioning on how future growth can be accommodated while still reducing GHG emissions.

[1] Defined as no net purchases from the electricity or gas grid.

Over the next several years the City will be embarking on its General Plan Update, providing an excellent opportunity to develop this vision.

This Climate Action Plan provides a framework for a more in-depth discussion on ways to accommodate future growth sustainably and reduce local dependence on single-occupancy vehicle (SOV) travel. As described in Chapter 4, Strategy TL.1.2 (Promote Sustainable Growth Patterns) is intended to increase neighborhood density through infilling, mixed-use developments, and pedestrian- and bicycle-friendly design. However, most of the actions under that strategy are currently based on "encouragement" or voluntary measures. GHG emissions over the long term can be greatly reduced over time by increasingly codifying these measures though municipal codes, ordinances and other regulatory means. Table 5-2 illustrates the difference this can make for two Transportation and Land Use Scenarios though just the year 2030. Scenario A represents implementation of strategies TL.1.1 and TL.1.2 as they are presented in Chapter 4 (i.e., voluntary adoption), while Scenario B represents implementing those same strategies with some level of assurance that the desired outcome will be achieved (e.g., modify the municipal code to achieve increased density and mixed use infill development, rather than "encourage" that same outcome by other means).[2] As shown in the table, Scenario B provides emissions reductions 3 to 14 times higher than Scenario A.

Table 5-2
Comparison of 2030 Annual GHG Reductions from Two Implementation Scenarios for Transportation and Land Use Strategies TL1.1 and TL1.2

Strategy	Scenario A (MT CO2e)	Scenario B (MT CO2e)
TL1.1: Local Commute Trip Reduction	88	1,142
TL.1.2: Promote Sustainable Growth Patterns	616	1,903

Funding Sources and Partnerships

The capacity of the City of Ukiah to implement the Climate Action Plan is limited by the small number of staff at the City and available funding. In addition to the program implementation costs to the City, there will be costs borne by residents and businesses to comply with its requirements.

The GHG reduction strategies in this document were formulated with an understanding that the City has limited staff time and financial resources to implement them. Cost estimates are based on the anticipated impact to the City budget, including any upfront capital investment needed to implement a strategy, ongoing annual costs, and City staff time required. The City's costs for implementation may include the creation or promotion of voluntary programs, continuing administration of those programs, coordination and outreach with other government agencies and businesses, and—in some cases—exploration or study of potential regulatory mechanisms not yet codified. Only a few strategies require up-front capital expenditures by the City.

[2] Estimates of GHG reductions are based on the Fehr & Peers memo of July 12, 2013, entitled "City of Ukiah – Quantitative Analysis of Strategies (2020 and 2030)" – included as Appendix B.2.

The City will use a combination of City staff time, grant funding, direct spending, and collaboration with other agencies and organizations to achieve Climate Action Plan goals. The following funding sources are available or potentially available to assist with achieving these goals

Existing Resources

City Staff

City staff time will be required to successfully implement Climate Action Plan measures. As shown in Table 5-1, Planning and Community Development Department staff will implement the majority of the Climate Action Plan strategies and actions. The Public Works Department and the Electric Utility Department will also assist with the implementation of some strategies. Promotional activities are likely to require significant City staff time, and will require updating the City website, public outreach campaigns (e.g. workshops), dissemination of promotional materials (e.g. flyers), and other forms of public awareness outreach and education.

Work Sharing

Given the rural location and size of the City of Ukiah, and the limited financial resources, City officials will explore work-sharing opportunities with other local and regional and jurisdictions. Under these arrangements, "combined" staff would devote a portion of their time to goals and strategies that are similar or consistent across several jurisdictions, such as promotion of existing energy efficiency rebates to reduce total energy use. These collaborations are expected to also promote cross-pollination of ideas and establish relationships that will be beneficial for future discussions with regional agencies regarding efforts to reduce GHG emissions.

Potential Funding and Partnerships

Federal, state, and regional agencies provide grants and loans, as well as planning assistance, for investments in a variety of climate-related projects. Grants and loans can provide short-term funding for program development and program testing, and could help pay for the staff time required to develop programs, and then establish an alternative financial framework for the program's continued operation after the grant expires.

The City will continue existing partnerships with other organizations such as the North Coast Energy Services (NCES), Mendocino County Energy Watch (MCEW), and others to implement, fund, and finance energy and water conservation projects and programs. Some of the specific, available funding programs are listed below.

Federal

Safe Routes to Schools

Safe Routes to Schools is an international movement focused on increasing the number of children who walk or bicycle to school by funding projects that remove barriers to doing so. These barriers include a lack of infrastructure, safety, and limited programs that promote walking and bicycling. In California, two separate Safe Routes to School programs are available at both the state and federal level, and both programs fund qualifying infrastructure projects.

TEA-21

Federal funding through the TEA-21 (Transportation Equity Act for the 21st Century) program is administered through the state and regional governments. The City of Ukiah is located in the jurisdiction of the regional Mendocino Council of Governments (MCOG) agency. TEA-21 funding would be administered through MCOG. Most of the funding programs are transportation versus recreation oriented, with an emphasis on reducing auto trips and providing an intermodal connection. In most cases, TEA-21 provides matching grants of 80 to 90 percent.

Energy Efficiency Mortgages

The Federal Housing Administration (FHA) offers an Energy Efficient Mortgage Loan program that assists current or future homeowners with lowering their utility bills. This would be accomplished by enabling homeowners to incorporate the cost of adding energy-efficient improvements into their home mortgage. Energy efficient upgrades could be chosen that would allow owners to realize net monthly savings. The goal is to provide owners additional financing for energy efficiency upgrades at a discounted interest rate.

State

California Energy Efficiency Financing

For years, the CEC has provided a loan program that supports local government energy retrofits and some new construction projects. Since 1979, more than $272 million has been allocated to more than 773 recipients, as of March 2012. The program provides low interest loans for feasibility studies and the installation of cost-effective energy projects in schools, hospitals, and local government facilities. The loans are repaid out of the energy cost savings and the program will finance lighting, motors, drives and pumps, building insulation, heating and air conditioning modifications, streetlights and traffic signal efficiency projects, and certain energy generation projects, including renewable energy projects and cogeneration. Loans can cover up to 100% of project costs and there is a maximum loan amount of $3 million.

Strategic Growth Council

In September 2008, California Senate Bill 732 created the Strategic Growth Council, which is a cabinet level committee whose tasks include coordinating the activities of member state agencies to assist state and local entities in the planning of sustainable communities and meeting AB 32 goals, including coordination of Planning Grants and Urban Greening Grants.

Infrastructure State Revolving Fund

The Infrastructure State Revolving Fund Program provides direct low-cost loans for local governmental public infrastructure projects, such as environmental mitigation measures, parks, transit, and solid waste collection and disposal.

Bicycle Transportation Account

The State Bicycle Transportation Account (BTA) is an annual program providing state funds for city and county projects that improve safety and convenience for bicycle commuters. The emphasis is on projects which benefit bicycling for commuting purposes. Funds are allocated to cities and counties on a matching basis that requires the applicant to furnish a minimum of 10 percent of the total project cost, and no applicant shall receive more than 25 percent of the total amount transferred to the BTA in a single fiscal year.

Regional

Continuing existing partnerships with the neighboring jurisdictions within Mendocino County, as well as other regional agencies, will help the City in implementing the CAP strategies.

Mendocino County Energy Watch

Mendocino County Energy Watch (MCEW) provides Mendocino County local governments, special districts, non-profits, small businesses, and residents with energy efficiency, climate and sustainability information and services. A partnership between the Community Development Commission of Mendocino County (CDC) and PG&E, MCEW provides energy assessments, benchmarking for buildings, retrofitting, greenhouse gas emissions inventories, educational classes, and more.[3]

Mendocino Council of Governments

Mendocino Council of Governments (MCOG) is the Regional Transportation Planning Agency (RTPA) for the countywide region. State and federal transportation funds are allocated through Caltrans to MCOG, Mendocino County, and the four incorporated cities within the County, including Ukiah. Most of the federal Economic Stimulus funding programs available for transportation projects in Mendocino County flow through MCOG. MCOG also helps support transportation activities of the Mendocino Transit Authority, North Coast Railroad Authority, local airports, and on state highways, among others. MCOG is responsible for preparing the Regional Transportation Plan, and funded projects are to be consistent with the Plan. Projects involve planning, capital improvements, rehabilitation and maintenance, public transit fleet replacement, and intermodal transit facilities.

MCOG's 2012 Regional Bikeway Plan has been prepared as a countywide document, but is also intended to guide efforts to improve bicycling and walking conditions at the local level. The plan incorporates proposals for bikeway improvements within all jurisdictions of Mendocino County into one document. The Plan identifies funding available for bicycle projects, including the State Bicycle Transportation Account, Transportation Enhancement Program, Regional Improvement Program/STIP Funding, Regional Surface Transportation Program Funds, 2% Local Transportation Fund Bicycle and Pedestrian Program, and Safe Routes to School Program.[4]

Private and Non-Governmental Support

Community-based non-profits, local businesses, and utilities should be considered as resources for direct and indirect support, including funding, for project and program activation and operations. Private investors may provide funding to local governments. For example, energy service companies (ESCOs) can finance the up-front investments in energy efficiency, reimbursed by the local government over a contract period. Private companies may finance solar power installations, and then recoup their investment by selling the resulting power to the building owner.

North Coast Energy Services

North Coast Energy Services (NCES) provides low-income energy assistance and weatherization services to seven California Counties, including Mendocino. NCES customers and clients receive an educational presentation covering general conservation issues, an explanation of the measures installed in the

[3] Mendocino County Energy Watch. Available at: http://mendoenergy.org/

[4] 2012 Mendocino County Regional Bikeway Plan, published June 2012. Available at: http://www.mendocinocog.org/pdf/Bikeway%20Plan/Final_2012_Bike_Plan.pdf

residence or building including future care and maintenance, an analysis of their energy usage, and recommendations for other measures. NCES has provided over 9 million dollars of LiHEAP and Department of Energy funds for home weatherization and rehabilitation and added more than $3.5 million to energy saving improvements to utility sponsored weatherization programs. For the past eight years NCES has been involved with the Housing Preservation program of Rural Development, U.S.D.A. (formerly Farmers Home Administration), providing approximately $1.5 million for major housing rehabilitation to low-income rural residents. This program provides energy reduction measures and a work method that prevents further erosion of the local housing stock.[5]

Renewable Energy Development Institute

The Renewable Energy Development Institute (REDI) is a 501c charitable, educational, and scientific corporation with the primary goal of encouraging widespread use of renewable energy for the public benefit. REDI operates several programs, including: Home Energy Link Program (HELP), provides affordable assistance to install energy-efficient features and reduce energy and heating costs for income-eligible local residents; Small Business Energy Alliance (SBEA), an incentive program that links small businesses and other entities in the region to energy efficiency improvements, funding by California ratepayers and local grants; Economic Localization/Energy Loan Fund (ELF), a micro-loan program to help people with the capital costs of energy-related improvements; Renewable Energy Education, including classes, hands on workshops, conferences and multimedia library archive project; and other programs.[6]

CEQA Project Review

Under the California Environmental Quality Act (CEQA), the effects of GHG emissions should be considered a potentially significant environmental impact. In addressing climate change, CEQA provides a useful mechanism for local agencies to evaluate new development, but may also create inefficiencies for both agency staff and the applicant by assessing routine projects on an individual basis, rather than in the context of city planning. The CEQA Guidelines recognize this, and include a provision for streamlining the analysis of projects that are consistent with a more comprehensive plan for the reduction of GHG emissions (CEQA Guidelines, Section 15183.5). The City of Ukiah Climate Action Plan meets the requirements of CEQA Guidelines Section 15183.5(b)(1) as a plan that analyzes cumulative GHG impacts. The Climate Action Plan uses established protocols, methodologies and forecasts of existing and future land uses to quantify existing and projected future GHG emissions within the plan area. It also establishes a reduction target based on California State law (AB 32), and lays out policies, actions, and performance standards that the City will enact and implement over time to achieve that reduction target.

The Climate Action Plan includes GHG reduction measures that, if fully implemented, would achieve an emissions reduction target that is consistent with and supports the state-mandated reduction target embodied in AB 32. A development project would be consistent with the CAP if it is consistent with the CAP assumptions regarding the amount and type of future development, and is consistent with the GHG reduction measures identified in the CAP. Projects consistent with the CAP, including conformance with

[5] North Coast Energy Services. Available at: http://northcoastenergyservices.com/
[6] Renewable Energy Development Institute website. Available at: http://redinet.org/index.htm .

any performance measures applicable to the project, would not require additional GHG emissions analysis under CEQA Guidelines Sections 15064(h) and 1513.5(b)(2).[7]

In order to assist with determining project consistency with the CAP, a project consistency checklist has been developed, and is included below. The checklist is intended to provide individual projects the opportunity to demonstrate that they are minimizing GHG emissions, while ensuring that new development in the City will achieve its "fair share" of emissions reductions. The CAP provides a range of feasible measures and quantifies their effectiveness to demonstrate that the City's reduction target can be met. The project review checklist screens projects for important GHG reduction measures that, when implemented, will provide the City with confidence the project will not impede the City's ability to meet its 2020 GHG emissions target.

For the checklist to be valid, the City will ensure that total development through 2020 is consistent with the growth assumptions used to develop the GHG emissions forecasts in this plan. 2020 employment is projected to be 13,169 jobs in Ukiah, while 2020 housing units are projected to be 6,762.[8] If a project will result in total jobs or total housing units exceeding these projections, then it must undergo CEQA review for GHG emissions impact.

Table 5-3
Development Project Consistency Checklist

All Projects:

1. Applies to all projects not otherwise exempt under CEQA.
2. Project is consistent with General Plan.
3. Proposed use is consistent with the zoning ordinance.
4. Parking lots include shade trees that provide 50% shade coverage at 15 years of growth (excluding ingress/egress and truck loading/unloading areas).

Residential Projects:

1. Project is consistent with General Plan density.
2. Construction is designed and pre-wired for solar PV (or has solar PV system installed).[9]
3. A project located outside of the Downtown Zoning District shall demonstrate energy efficiency at least 15% beyond Title 24 (CalGreen Tier 1). (E.1.5 and E.1.6) or achieves LEED Silver certification (or higher).
4. Project unit count is consistent with the 2020 emission estimate assumptions, shown in Table 5-4. Note that the yearly number of units can be exceeded if the total number of units in 2020 is equal to or below the 2020 estimate.

Commercial Projects:

1. A project located outside of the Downtown Zoning District shall meet one of the following conditions:
    a. Located within ¼ mile of a transit stop;
    b. Is served by Class III or better bicycle route, and includes secure bicycle parking and showers/locker;[10]

[7] If there is substantial evidence that the effects of a particular project may be cumulatively considerable, notwithstanding the project's compliance with the CAP, CEQA requires that an EIR be prepared.

[8] From the Mendocino Council of Governments (MCOG) traffic model used to estimate future vehicle miles traveled (see Appendix A, Table A-1)

[9] The added cost is minimal, and can result in big cost savings when solar PV is installed. The primary impact is to the design stage, which must accommodate space for inverters and disconnects near the main service panel. Added material cost is limited to running electrical conduit from the roof to the main service panel, and from the main service panel to the future location of the inverter.

c. Offers incentive (preferred parking, financial reimbursement etc.) for carpool

d. Operates vanpool program;

e. Have electric recharge stations.

2. A project outside of the Downtown Zoning District shall demonstrate energy efficiency at least 15% beyond Title 24 (CalGreen Tier 1). (E.1.5 and E.1.6) or achieves LEED Silver certification (or higher).

3. Landscaping complies with state requirements for water-efficient landscaping.

Table 5-4

Estimated Future Housing Units

Year	Estimated Housing Units[1]	Reported Units Per DOF[2]
2010	6523	6488
2011	6545	6491
2012	6567	6523
2013	6589	6523
2014	6611	
2015	6634	
2016	6657	
2017	6679	
2018	6702	
2019	6724	
2020	6747	

(1) Number of housing units assumed in GHG emissions estimates.
(2) Number of actual units as reported by California Department of Finance, Demographics Research Unit Report E-5, May 10, 2013.

[10] As guidance, the City recommends meeting the minimum criteria for LEED Sustainable Sites (SS) credit 4.2 for bicycle storage and changing rooms: For new commercial buildings, bike racks must be provided for 5% or more of all building occupants measured during peak use, and showering facilities must be provided; For residential buildings, there must be covered facilities for bike racks/storage for 15% of the occupants, and showering facilities are not required.

6 Preparing Ukiah for Climate Change

Overview

This chapter presents an overview of the impacts Ukiah is expected to experience due to projected changes in the climate, and what the City can do to begin preparing for them. Despite serious efforts by Ukiah and the State of California to reduce GHG emissions, changes in our climate cannot be avoided entirely over the long term. Even if GHG emissions were reduced to pre-industrial levels today, the GHG emissions that have already been added to the atmosphere will continue to warm the planet for centuries. While mitigation is still the most cost-effective approach to preventing long-term catastrophic impacts of climate change, adaptation efforts are needed to increase the resilience of communities and natural resources to changes expected over the next few decades.

The State of California's planning priorities have increasingly emphasized climate change as a top priority – both the mitigation of GHG emissions and adaptation to a climate already exhibiting changes. This policy shift is likely to be articulated as a priority in new State guidance and grant programs that will be released in the next six months and beyond.

Expected Local Impacts

In California, anticipated climate change impacts include sea level rise; increased periods of drought; and more frequent extreme weather events, including heat waves and severe storms. Secondary effects include projected inundation of the shoreline; more frequent and severe flooding; more frequent and severe wildfires on the urban fringe; a less reliable water supply; altered agricultural productivity; increased incidence of disease and mortality (both from effects of heat waves and from changing patterns of disease distribution); and disruption of local ecosystems.

The recently published *California Planning Adaptation Planning Guide: Understanding Regional Characteristics (July 2012)*[31] designates climate impact regions based on county boundaries in combination with projected climate impacts, existing environmental setting, socioeconomic factors, and regional designations. The City of Ukiah and Mendocino County are located within the North Coast climate impact region. As discussed in

Chapter 2 of this Climate Action Plan, *Climate Change Background and Regulatory Setting*, the *Adaptation Planning Guide* identifies the following climate change impacts.

Temperature increases. January temperatures are predicted to increase by about 2 degrees Fahrenheit by 2050 and up to 5 degrees Fahrenheit by the year 2100 within the North Coast climate impact region. July increases in average temperatures are anticipated to be 3 degrees Fahrenheit and 6 degrees Fahrenheit by the year 2100.

Reduced precipitation and water supply. The North Coast region is expected to experience a subtle decrease in precipitation in most areas throughout the century. The City of Ukiah is projected to see approximately a 10 % decrease in annual precipitation by 2050, and a 20% decrease by 2011. Reduced precipitation will adversely impact the water supply of the City, region, and State. Moreover, in the eastern, higher-elevation portion of the North Coast region, March snow levels will drop to almost zero by the 2090s, a decrease of 2 to 10 inches from 2010 levels. In areas with currently little snow (less than 3 inches), such as Ukiah, accumulated snowfall is projected to be near zero by 2050.

Increased wildfires. The North Coast region is projected to experience substantial increase in fire risk. By 2050, the region will experience modest increases in annual area burned. By 2100, the projected fire risk increases dramatically, with up to eight times the current annual area burned in parts of Mendocino County. Northern Mendocino County is projected to have up to 2.5 times greater wildfire frequency. Wildfire threatens the forestry industry and the property and safety of residents. The projected wildfire frequency is a considerable change from current conditions, meaning communities are less likely to be accustomed to the risks of fire and the measures required to address them. Air pollution from wildfires is of particular concern for the elderly and children under the age of five, because it results in eye and respiratory illnesses, and can exacerbate asthma, allergies, chronic obstructive pulmonary disease (COPD), and other cardiovascular diseases.

Public health and heat. Ukiah is not projected to see a large increase in the number of heat waves, defined regionally as five consecutive days with temperatures as high as 93°F. Little change is expected by 2050 with possibly one to three more heat waves projected in the region. By 2100, projected heat waves are more variable, with predictions of between two and eight more heat waves per year. However, when heat waves do occur, vulnerable populations in Ukiah may be severely affected because of a current lack of adaptive capacity having to do with historically milder temperatures. Frequent heat waves can have the greatest impact on the elderly and children less than five years of age. Mendocino County is one of the state's counties with the highest proportion of elderly living alone.

Adaptation Planning Approach

Effective adaptation planning and management entails dealing with uncertainty. Adaptation is likely to be a long-term process, including immediate action when necessary and allowing adjustments to changing conditions and new knowledge. Effective public engagement and education is critical, along with an inclusive planning process that ensures the resulting actions are feasible and widely accepted. Adaptation will likely be an ongoing process of planning, prioritization and specific project implementation. It is generally accepted that the next few decades provide a period of opportunity to develop adaptation plans and actions.

Five important steps to effective adaptation planning are summarized below:

- Increase Public Awareness; Engage and Educate the Community

Local outreach campaigns to build awareness of the dangers to public health and the benefits of planning, and to promote low-cost and low-GHG adaptation strategies. It is critical that the public understand the magnitude of the challenge and why action is needed. The planning process should be inclusive of all stakeholders. These efforts should leverage similar efforts undertaken at the regional, state, and federal levels.

- Assess Vulnerability

Perform a detailed vulnerability analysis to assess potential climate change impacts to infrastructure, local economy, and natural systems. Both short-term and long-term adaptation strategies should be identified. Level of risk can be categorized in terms of likelihood of damage within the forecasting period and the severity of the damages. Understanding vulnerability to climate change impacts is critical to developing effective adaptation strategies. The vulnerability assessment can also provide a framework for agency and community education and participation, feed into other planning documents, and identify funding needs.

- Establish Goals, Criteria and Planning Principles

Engage with stakeholders to establish planning priorities, decision criteria, and build community support for taking action. Rank physical and natural assets for preservation efforts. Where possible, look for situations where a mitigation action has adaptation co-benefits (e.g., planting trees to reduce urban heat islands while sequestering carbon and providing habitat).

- Develop Adaptation Plan

Identify specific strategies, develop cost estimates, and prioritize actions to increase local resilience of City infrastructure and critical assets, including natural systems like wetlands and urban forests. Look for synergies between natural processes and engineering solutions. An adaptation plan should include a prioritized list of actions (e.g. projects), with a timeline, capital expenditure plan, and a framework for monitoring and adaptive management.

- Ongoing Monitoring and Adaptive Management

Reassess climate change vulnerabilities on a regular basis and modify actions accordingly. This includes monitoring the effectiveness of current policies, strategies and actions, and keeping up with changing science, funding opportunities, and regulatory actions.

Adaptation Planning Strategies

In lieu of conducting a detailed vulnerability assessment, the City has identified the following strategies and actions to consider implementing as it begins planning for climate change adaptation. These strategies and actions are consistent with those identified in the *California Adaptation Planning Guide: Identifying Adaptation Strategies*. While many of the strategies and actions identified in Chapter 4 of this Climate Action Plan contribute to the global effort to prevent further climate change, the adaptation strategies below prepare Ukiah residents and businesses to deal with future climate change impacts. It should be noted that many GHG reduction measures identified in this document also provide adaptation benefits. For example, water conservation, energy efficiency, and increasing the number of urban trees are all strategies with co-benefits that will help Ukiah prepare for climate change impacts.

Impact: Temperature Increases

Strategy 1: Prepare for increases in average temperatures.

Co-benefits: Lower energy demand and bills; lower operating costs of businesses; improved air quality; a safe and healthy community.

Action 1.1: Continue to plant shade trees in new parking lots and other large, paved areas of the City to reduce heat island effects.

Action 1.2: Educate developers and the public on the use of cool roofs and reflective surfaces to reduce heat island effects.

Action 1.3: Develop a heat response plan, and educate the public on the location of designated "cooling centers."

Impact: Reduced Precipitation and Water Supply

Strategy 2: Preserve existing water sources and prepare for variable water supplies.

Co-benefits: Improve water supply reliability; protect water quality.

Action 2.1: Increase capacity for community water storage.

Action 2.2: Pursue funding to implement water reclamation and reuse projects.

Action 2.3: Protect open space areas that are being used for recharging groundwater or have the potential to be used for recharge.

Impact: Increased Risk of Wildfires

Strategy 3: Prepare for increasing numbers of wildfire events.

Co-benefits: Better protection of human health and property; potentially lower insurance premiums.

Action 3.1: Refine emergency preparedness procedures and response to wildfires.

Action 3.2: Partner with regional agencies to monitor and track forest and rangeland health, and susceptibility to fire.

Action 3.3: Develop, adopt, and implement integrated plans for mitigating wildfire impacts in wildland-urban interface areas.

Action 3.4: Encourage 'Fire Safe Design' of new construction and landscape practices.

Action 3.5: Consider prescribed burning as a fuel-reduction tool and coordinate smoke management with the Mendocino County Air Quality Management District.

Impact: Public Health

Strategy 4: Ensure public health hazards are minimized for all segments of the population.

Co-benefits: Improve public health; improve quality of life.

Action 4.1: Work with Mendocino County and other jurisdictions in the county to establish a climate change adaptation and public outreach and education program.

Action 4.2: Incorporate climate change adaptation into emergency preparedness and response plans such as the Mendocino County Multi-Hazard Mitigation Plan, the Mendocino County Emergency Operations Plan, the Ukiah Fire Department Master Plan, and other emergency operations plans to address public health impacts.

Action 4.3: Identify vulnerable communities to various public health impacts associated with climate change, and ensure that Ukiah emergency operations plans address these communities.

Action 4.4: Work with the Mendocino County Air Quality Management District to improve air quality and minimize negative health effects associated with rising temperatures, such as increased ozone concentrations.

Action 4.5: Continue to educate the public on the benefits of disease vector control to protect the health of Ukiah residents.

Impact: Reduced Agricultural Productivity and Food Supply

Strategy 5: Promote local food production and continue to promote conservation of local and regional agricultural land.

Co-benefits: Support local economy; preservation of natural resources.

Action 5.1: Allow and support community gardens and local farmers markets.

Action 5.2: Allow by right beekeeping and backyard chicken coops

Action 5.3: Work with local water agencies and area farmers to improve agricultural water efficiency.

Impact: Biodiversity and Habitat

Strategy 6: Preserve biodiversity and habitats.

Co-benefits: Conserve natural resources.

Action 6.1: Identify and protect locations where native species may shift or lose habitat due to climate change impacts.

Action 6.2: Collaborate with agencies managing public lands such as the Department of Fish and Wildlife to identify, develop, and maintain corridors and linkages between undeveloped lands.

Impact: Infrastructure

Strategy 7: Respond to potential impacts on public infrastructure.

Co-benefits: Lower energy demand and bills, water conservation, community safety.

Action 7.1: Assess climate change impacts on public infrastructure to determine threats to public health, public safety, and the local economy.

Action 7.2: Integrate climate change impacts into infrastructure planning and operations.

31 California Emergency Management Agency and California Natural Resources Agency. California Adaptation Planning Guide, Understanding Regional Characteristics, July 2012.

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7 Conclusion

This Climate Action Plan represents a significant step towards reducing future GHG emissions in the City of Ukiah. Ukiah is well positioned to reach its 2020 reduction target of 15 percent below baseline levels with implementation of the strategies and actions presented in Chapter 4. Local leadership, in conjunction with community engagement and initiatives, will help reduce energy and water use, reduce waste generation, and result in more efficient mobility and land uses. Implementation of this Climate Action Plan will not only reduce GHG emissions, but it will also save residents and businesses money, promote economic development, and improve the quality of life for Ukiah residents and workers.

Because Ukiah is on track to meet its 2020 reduction target with relative ease, the City is in a strong position to begin planning for deeper GHG reductions further out into the future. In particular, the City will now consider GHG emissions as a key consideration in its long-term land use and transportation planning, anticipating a post-2020 regulatory environment and helping the state toward its long-term GHG reduction goals. Ukiah has the opportunity to be a leader among California cities, utilizing progressive thinking and best practices that include consideration of GHG reductions in all City planning decisions.

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Appendix A
GHG Inventory Methodology

ESA

A GHG Inventory Methodology

This appendix describes the methodology used to develop the City of Ukiah Climate Action Plan (CAP) 2005 baseline and 2010 updated inventory of greenhouse gas (GHG) emissions for the greater community and for municipal (i.e., city government) operations.

The purpose of the GHG inventory is to identify sources, distribution, and overall magnitude of GHG emissions that occur within the City and/or are caused by the community member activities. The inventory will enable policy makers to identify opportunities for GHG emissions reduction in the residential, commercial, industrial, and municipal sectors within the community.

The City of Ukiah GHG Inventory was developed using standards established by the ICLEI U.S. Community Protocol (v1.0)[1] and the Local Government Operations Protocol (LGOP) v.1.1.[2] ICLEI has worked with the California Air Resource Board (CARB), BAAQMD, and other state and regional agencies to develop standardized methods for inventorying community emissions. ICLEI, along with CARB and the Climate Registry (TCR), has also co-developed methods for quantifying and reporting GHG emissions from local government sources, which have been incorporated into the LGOP.

In keeping with these protocols, ESA's process for developing a GHG inventory is:

1. Set organizational boundaries
2. Set operational boundaries
3. Identify sources of emissions
4. Collect data on emissions for a representative period of time
5. Calculate GHG emissions from data using robust emissions factors
6. Create an inventory of CO2e emissions that is complete, transparent, and accurate.

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[1] U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, version 1.0, ICLEI, published October 2012. Available at: http://www.icleiusa.org/tools/ghg-protocol/community-protocol

[2] LGOP version 1.1, published May 2010, available at: http://www.theclimateregistry.org/resources/protocols/local-government-operations-protocol/

Establishing the boundaries of an emissions analysis is an important first step in the GHG inventory process. A city exerts varying levels of control or influence over the activities occurring within its borders. At the minimum, community-wide GHG inventory should be defined broadly enough to include all emissions sources that may be significantly influenced by local government actions. These sources tend to be those that are affected by land use decisions, municipal codes, and General Plan policies, and correspondingly are included in a city's GHG reduction measures. In general, the inventory should encompass sources that are within the purview of the city's discretionary actions and regulatory authority, including sources of indirect emissions that can be influenced by the city policies or programs, such as water conservation or waste reduction.

Ukiah's Organizational Boundary

Setting an organizational boundary for a GHG inventory involves identifying the facilities and operations that are to be included. The ICLEI U.S. Community Protocol (2012) defines the organizational boundary as the boundary that determines the operations owned or controlled by the reporting entity, which depends on the consolidation approach taken.

The City of Ukiah's 2005 and 2010 community-wide inventories encompass the GHG emissions resulting from activities taking place within the City's geopolitical boundary, where the local Ukiah government has significant direct or indirect influence. The 2005 and 2010 municipal operations inventories encompass the GHG emissions resulting from actions governed directly by the local government, such as municipal buildings, vehicle fleets, and streetlights.

Ukiah's Operational Boundary

The operational boundary is the sum of all sources of direct and indirect emissions and associated activities that are included in the organizational boundary. The 2005 and 2010 Ukiah community-wide inventories include GHG emissions (carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) from the following sectors. Other GHGs (e.g., industrial gases including hydrofluorocarbons [HFCs], perfluorocarbons [PFCs], and sulphur hexafluoride [SF_6]) are very difficult to quantify and are typically not significant contributors of emissions within a City like Ukiah, and were therefore not included in this inventory.

Community-wide Inventory

For community-wide emissions, the ICLEI U.S. Community Protocol breaks down emissions into two categories.

- Sources: Physical processes inside the jurisdictional boundary that release GHG emissions into the atmosphere (e.g., combustion of gasoline in transportation; combustion of natural gas in electricity generation; methane emissions from a landfill).
- Activities: The use of energy, materials, and/or services by members of the community that result in the creation of GHG emissions either directly (e.g., use of household furnaces and vehicles with internal combustion engines) or indirectly (e.g., use of electricity created through combustion of fossil fuels at a power plant, consumption of goods and services whose production, transport and/or disposal resulted in GHG emissions).

The community-wide inventory includes emissions from the following sectors. As shown below, emissions from most sectors derive from multiple sources and activities:

- Commercial/Industrial Energy: Direct stationary emissions from combustion of natural gas (source and activity), and indirect emissions from the use of electricity by the community (activity);
- Residential Energy: Direct stationary emissions from natural gas combustion(source and activity), and indirect emissions from purchased electricity (activity);
- On-Road Transportation: Emissions from on-road gasoline- and diesel-powered vehicles (source and activity);
- Off-Road Transportation: Emissions from off-road lawn and garden equipment, construction equipment, industrial equipment, and light commercial equipment (activity);
- Agriculture: Emissions from off-road gasoline- and diesel-powered agricultural vehicles (activity);
- Generated Solid Waste: Indirect methane (CH_4) emissions from the anaerobic decomposition of organic material sent to landfill by the community (source);
- Wastewater Treatment: Total Indirect process emissions and fugitive emissions from wastewater treatment processes at the City-operated Wastewater Treatment Plant (activity);
- Water Conveyance: Emissions generated by electricity used in the transport of water (activity);
- Stationary Sources: Emissions generated by the combustion of fossil fuels other than utility-provided natural gas within the community (source); and
- Landfill: Indirect methane (CH_4) emissions from the anaerobic decomposition of organic material sent to the (now closed) City-operated landfill (activity).

Emissions from sources not subject to significant influence by the community were not included in the inventory, such as the upstream impacts of materials used by the community, since the local government has limited means to influence community material uses. The community inventory also excludes emissions sources that meet the following criteria:

- Very small or insignificant sources: This includes sources such as propane-fired cooking grills or acetylene welding torches that contribute very little in terms of overall emissions, and for which accurate and complete data is difficult to obtain. In general, sources can be excluded from the analysis (e.g., are “de minimis”) if, when combined, the excluded emissions from them total less than 5% of the total emissions inventory.
- Emissions that are prohibitively difficult to track with accuracy or lack necessary data to calculate: This criteria is especially relevant where the science is still evolving or the data may not be available (e.g., non-combustion industrial emissions sources such as the use of hydrofluorocarbons).
- Sources located largely outside the jurisdiction’s boundaries, and outside its control or influence: This includes transportation fuel used by intercity air and rail traffic.

Municipal Operations Inventory

For municipal emissions, the LGOP divides the operational boundary into three different scopes, defined as follows:

- Scope 1 emissions are those that come from sources that are owned or controlled by the reporting entity. Such sources include stationary emitters like furnaces and boilers, and mobile emitters like vehicles and construction equipment.
- Scope 2 emissions are indirect GHG emissions related to the consumption of purchased energy (i.e., electricity) that is produced by third-party entities, such as power utilities.
- Scope 3 emissions are other indirect GHG emissions not covered by Scope 2 that are associated with community activities. For a community inventory this generally includes emissions occurring

upstream or downstream of a community activity, such as the methane emissions resulting from degradation of the community's solid waste deposited at a landfill outside of city limits; or the electricity used to pump water to the City from upstream reservoirs. Quantification and reporting of Scope 3 emissions is generally considered optional, but including them in a community-wide inventory is appropriate where there is local control over an activity that has an indirect emissions reduction impact, such as diverting waste from landfills.

The 2005 and 2010 municipal operations inventories include emissions from the following sectors:

- Natural Gas: Direct stationary emissions from natural gas combustion (Scope 1) from building and facilities, excluding from the Wastewater Treatment Plant;
- Electricity: Indirect emissions from purchased electricity for buildings, facilities (including the airport), streetlights, traffic lights, and water pumps operated by the City (Scope 2);
- Vehicle Fleet: Direct emissions from fuel combustion in municipal fleet vehicles (Scope 1);
- Generated Solid Waste: This sector comprises solid waste sent to landfill from government-owned and/or operated facilities (Scope 3);
- Employee Commute: Emissions from the fuel combustion in employee-owned vehicles used by municipal staff travelling to and from work (Scope 3);
- Stationary Sources: Emissions from combustion in stationary generators and other equipment operated by the City government (Scope 1);
- Wastewater Treatment: Indirect process emissions and fugitive emissions from wastewater treatment processes (Scope 3), and direct stationary emissions from natural gas combustion (Scope 1), at the City-operated Wastewater Treatment Plant; and
- Landfill: Indirect methane (CH_4) emissions from the anaerobic decomposition of organic material sent to the (now closed) City-operated landfill (Scope 1).

Emissions Quantification Methodology

ICLEI and the LGOP identify calculation-based methodologies as the most appropriate technique for quantifying GHG emissions, following the basic formula:

GHG Emissions = Activity Data x Emissions Factor

Activity data are the relevant measurements of energy use or other processes that are associated with the emission of GHGs, such as metered annual energy consumption (kWh of electricity and therms of natural gas).

Emission factors are calculated ratios relating GHG emissions to a proxy measure of activity by emissions source. The inventories focus on the three GHGs most relevant and significant to City Government policymaking: CO_2, CH_4, and N_2O. These gases comprise the majority of GHG emissions from the community and city government operations. Most GHG reporting protocols also include methods for estimating three additional GHGs: HFCs, PFCs, and SF_6. However, these GHGs, largely represent fugitive emissions that leak from equipment, are generally not included in a community or city government inventory because the data needed to quantify them is typically incomplete or difficult to obtain.

Community-wide Inventory

Commercial/Industrial and Residential Energy Emissions

Commercial/industrial and Residential energy activity data for 2005 and 2010 consisted of electricity consumption and metered natural gas use.

PG&E provided community-wide natural gas data, in therms, for both years. Direct emissions from natural gas combustion were calculated using standard emission factors for natural gas published by the LGOP.

The City of Ukiah Finance Department (Department) provided community-wide electricity consumption in megawatt hours (MWh) for both 2005 and 2010. The Department also provided a breakdown (by percentage) of the various sources of electricity that contributed to the City's electricity portfolio for each year. This included electricity generated from the following sources:

- Renewables (Biomass and waste, geothermal, small hydroelectric, solar and wind)
- Coal
- Large Hydroelectric
- Natural Gas
- Nuclear

This mix includes electricity generated by the City-operated Lake Mendocino Hydroelectric plant, as well as electricity purchased from individual suppliers including wholesale power suppliers and PG&E. Renewable energy generation and hydroelectric plants provide approximately 80% of Ukiah's power. Indirect emissions from electricity generation were calculated using energy source-specific emission factors,[3] and were adjusted to include emissions from transmission and distribution. Total electricity use was assumed to reflect a transmission and distribution loss of 3.5 percent, based on correspondence with the City's Electric Utility Director.

Transportation (On-road and Off-road) Emissions

As with many cities, vehicle travel in Ukiah is the City's largest single source of GHG emissions. Most methods for estimating transportation emissions are based on vehicle miles traveled (VMT). Community-wide VMT estimates are highly dependent on the accounting rules and analytical tools used.

For Ukiah, Fehr & Peers provided estimates of VMT for on-road vehicular transportation based on the Mendocino Council of Governments (MCOG) travel demand model and origin-destination calculation methods.[4] VMT data were provided for 2010, and future projections were provided for the years 2020, 2030, and 2035. 2005 VMT was conservatively estimated by assuming VMT was the same in 2005 as it was in 2010. CARB's EMFAC2011 model was used to calculate 2005 base year and 2010 CO_2 emission factors. CH_4 and N_2O emissions were calculated with default vehicle mix values and emission factors from ICLEI's U.S. Community Protocol.

To estimate mobile off-road emissions, non-point source off-road emissions were obtained from CARB's OFFROAD2007 Vehicle Model for all of Mendocino County. Off-road emissions sources include lawn and garden equipment, construction equipment, industrial equipment, and light commercial equipment. Emissions were

[3] For this inventory, renewable sources of electricity were assumed to have an emissions factor of zero.

[4] Quantifying emissions associated with the use of travel by the community involves estimating emissions associated with the entire length of in boundary and trans boundary trips, and allocating a portion of those emissions to the community for which emissions are being reported. See Appendix B for more information about VMT calculations for Ukiah.

apportioned to Ukiah based on the City's population as a percentage of overall County population (note: except for lawn and garden equipment, which was apportioned based on number of households).

Agricultural Equipment

CARB's OFFROAD2007 Vehicle Model provided agriculture off-road vehicle emissions for all of Mendocino County for 2005 and 2010. Emissions were apportioned to Ukiah based on the City's percentage of total County population.

Solid Waste Generated

Calrecycle provided community-wide solid waste in annual tons for 2005 and 2010.[5] CH_4 emissions from solid waste were calculated using EPA's LandGEM software[6] using the following assumptions:

- 100-year timeframe for waste decomposition;
- Landfill gas capture rate = 75%;
- Oxidation Rate = 10%
- LandGEM parameters:
  - Methane generation rate (k) = 0.04
  - Potential methane generation capacity (Lo) = 100
  - NMOC concentration = 4000
  - Methane content = 50%

Water Conveyance

Emissions from water conveyance were estimated based on historical water use and average electricity used to convey water from reservoir to tap. The Ukiah 2010 Urban Water Management Plan provides 2005 and 2010 estimates of annual water use in million gallons (MG) of water consumed. The annual electricity required to transport water was calculated using the Northern California Average Conversion factor of 1,811 kWh/MG.[7] Associated GHG emissions were then calculated using a Ukiah-specific emission factor for local electricity that takes into account the City's diverse mix of electricity sources, and high percentage of renewable electricity.

Stationary Sources

The methodology for estimating emissions from stationary sources followed the U.S. ICLEI Community Protocol (2012). Stationary source emissions may include industrial, residential and commercial emissions sources.

For residential emissions, this inventory includes propane/liquefied petroleum gas (LPG) emissions. County-level energy consumption figures for other residential stationary sources (i.e. wood and fuel oil/kerosene) were unavailable from the U.S. Energy Information Administration (EIA). 2010 propane/LPG emissions were estimated based on EIA energy consumption and U.S. Census household data (number of homes utilizing propane/LPG). Propane/LPG consumption was converted into emissions using the LGOP emission factor for

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5 CRiS: CalRecycle Countywide, Regionwide, and Statewise Jurisdiction Diversion Progress Report

6 EPA's Landfill Gas Emissions Model (LandGEM version 3.02, released May 12, 2005) is available at http://www.epa.gov/lmop/publications-tools/

7 California Energy Commission: Refining Estimates of Water Related Energy Use in California. Available at: http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF

CO_2, CH_4, and N_2O emission. Year 2005 emissions were backcast using an average of population and household growth from 2005 to 2010.

Industrial emissions from stationary sources were determined to be *de minimis* based on correspondence with the Mendocino Air Quality District (Chris Brown), and were thus not calculated. Commercial stationary source emissions were not estimated because local-level building characteristics, which are required for estimates of commercial stationary source emissions, were not attainable.

Wastewater Treatment

Ukiah owns and operates a Wastewater Treatment Plant (WWTP). A WWTP supervisor provided information regarding plant processes, standard cubic feet of gas flared from March to December of 2010, and the fraction of CH_4 in biogas (65%). The Ukiah 2010 Urban Water Management Plan provided the 2005 and 2010 population served by the WWTP.

Wastewater emissions were calculated following ICLEI U.S. Community Protocol (2012) methodology, and were based on process data and WWTP service population within Ukiah City boundaries. The nine months of 2010 gas data were extrapolated to represent the entire calendar year, and 2005 levels were estimated commensurate with local population, housing, and employment levels. GHG emissions from wastewater include stationary CH_4 and N_2O stationary emissions from the combustion of digester gas, process N_2O emissions from plant processes, and fugitive N_2O emissions from effluent discharge.

City-operated Landfill

Emissions were quantified for indirect methane (CH_4) emissions from the anaerobic decomposition of organic waste-in-place at the City-owned landfill, (now closed) for years 2005 and 2010. Although the landfill stopped accepting waste in 2000, waste-in-place continues to generate emissions, at annually decreasing rates. The California Air Resource Board's Landfill Emissions Model was used to calculate emissions. The City of Ukiah provided an estimate for total closure year waste-in-place for emissions model inputs.

Municipal Operations Inventory

Electricity

The City Finance Department provided activity data for electricity that includes electricity used in all buildings and facilities, streetlights, and water supply operated by the City of Ukiah, for both 2005 and 2010. This includes electricity used by City-owned and operated buildings at the Ukiah Municipal Airport. Indirect emissions from electricity generation were calculated using a weighted emission factor based on the breakdown of electricity sources within the City's electricity portfolio in 2005 and 2010.

Natural Gas

PG&E provided activity data for natural gas that includes metered natural gas usage for all buildings and facilities operated by the City, including the Ukiah Municipal Airport and the WWTP, for both 2005 and 2010. Emissions from natural gas consumption were calculated using the PG&E emission factor for CO_2, and the LGOP emission factors for CH_4 and N_2O.

Vehicle Fleet

This sector includes emissions from on-road and off-road fuel consumption from vehicles operated by the City of Ukiah, including the City vehicle fleet. The City provided fuel consumption data for gasoline and diesel vehicles for years 2008 and the first seven months of 2012, which was interpolated to estimate fuel consumption for calendar year 2010. Emissions were calculated using CO_2, CH_4, and N_2O emission factors from the LGOP for gasoline and diesel vehicles. Miles per gallon (MPG) factors for gasoline and diesel vehicles were taken from EMFAC 2011 software Mendocino County model run for year 2010. Year 2005 emissions were backcast using the growth rate in City full-time-equivalent (FTE) workers from 2005 to 2010.

Generated Solid Waste

This sector includes solid waste generated by the City government facilities that is sent to landfill. Emissions for the sector were estimated by apportioning community solid waste emissions based on the proportion of city full-time-equivalent (FTE) employees as a proportion of total City population, for years 2005 and 2010.

Employee Commute

This sector comprises emissions from fuel consumption from City government employee vehicle travel. The City conducted a survey to determine travel mode of City employees in 2012. The City collected data on vehicle type, model, make, and year, as well as annual mileage traveled. 2005 and 2010 emissions were back-cast from 2012 emissions levels based on the number of FTEs in each year.

Stationary Sources

Stationary source emissions include emissions from generators operated by the City government. The City provided recent (year 2011 and/or 2012) fuel consumption data for the five generators that burned fuel in 2005 and/or 2010, which were used as proxy data for calendar year 2010. Emissions were calculated from fuel consumption totals using LGOP emission factors for CO_2, CH_4, and N_2O. Year 2005 emissions were backcast using the growth rate in City full-time-equivalent (FTE) workers from 2005 to 2010.

City-owned Wastewater Treatment Plant

Emissions were quantified as described in the Community Wastewater Treatment sector (see above). However, since the municipal government maintains operational control of the Wastewater Treatment Plant, total Plant service population (rather than City population) was used for calculation purposes for this inventory. Year 2005 emissions were backcast using the growth rate in City full-time-equivalent (FTE) workers from 2005 to 2010.

City-owned Landfill

Emissions were quantified as described in the Community Landfill sector (see above).

2020 and 2030 Business-as-Usual Projections

Table 3 in the Ukiah GHG Inventory shows the growth proxies used project future emissions (for years 2020 and 2030) for community-wide and municipal operations, under business-as-usual conditions. Table A-1 shows the specific projections data used for City-wide population, housing, employment, and municipal staff. Annual

growth rates were derived for the periods 2005 to 2010 (to backtrack 2005 emissions when 2005 data was unavailable), as well as 2010 to 2020 and 2010 to 2030, to project future emissions for 2020 and 2030. The sources of data and numbers used are shown in Table A-1.

Table A-1: City of Ukiah Population, Housing, and Employment Projections Data and Growth Rates

Source	2005	2010	2020	2030	Annual Growth Rate, 2005-2010	Annual Growth Rate, 2010-2020	Annual Growth Rate, 2010-2030
Population (# of people)							
California Department of Finance	16,020	16,042	No data	No data	0.03%	N/A	N/A
Ukiah Urban Water Management Plan (UWMP)	No data	15,682	17,323	19,135	N/A	1.00%	2.01%
Employment (# of jobs)							
2010-2011 Mendocino County Economic & Development Profile[a]	7,080	6,700	No data	No data	-1.10%	N/A	N/A
Mendocino Council of Governments (MCOG) Model[b]	No data	12,007	13,169	13,075	N/A	0.93%	0.86%
Housing (# of households)							
California Department of Finance	6,389	6,482	No data	No data	0.29%	N/A	N/A
Mendocino Council of Governments (MCOG) Model	No data	6,512	6,762	6,752	N/A	0.38%	0.36%
Municipal Government Staff (full-time-equivalent employees)							
City of Ukiah Fiscal Year FTE Data[c]	163	171	183 [d]	195 [d]	0.96%	0.67%[e]	0.67% [e]

[a] Internal City labor force only

[b] Data provided by Fehr & Peers VMT Inventory Memo. See Appendix B1

[c] 2005 reflects fiscal year 2005-2006 data; 2010 reflects fiscal year 2010-2011 data

[d] Projected based on the estimated growth rate (0.67%)

[e] Estimated based on prior City full-time employee growth from the fiscal years 2000-01 to 2010-11

Three sectors did not use growth proxies represented in Table A-1: Agricultural Equipment, On-road Transportation, and Landfill. In boundary emissions from Agricultural Equipment were assumed to experience zero growth between 2010 and 2030. Future emissions for On-road Transportation were estimated using 2020 and 2030 VMT projections provided by Fehr and Peers, and emission factors from the EMFAC 2011 Model that do not include effects of the state-wide Low Carbon Fuel Standard (LCFS) and the Pavley Bill (AB 1493), which will reduce GHG emissions from automobiles. For the City-owned Landfill, the California ARB Landfill Emissions Tool was used to calculate emissions for 2020. Because the tool does not provide emissions out to 2030, 2030 emissions were estimated with the EPA's LandGEM software.

Appendix B1

Fehr & Peers, City of Ukiah Vehicle Miles of Travel Inventory

ESA

FEHR PEERS

MEMORANDUM

Date: November 19, 2012

To: Brian Grattidge, ESA

From: Kathrin Tellez, Tien-Tien Chan, and Dennis Lee, Fehr & Peers

Subject: City of Ukiah – Vehicle Miles of Travel (VMT) Inventory

SF12-0638

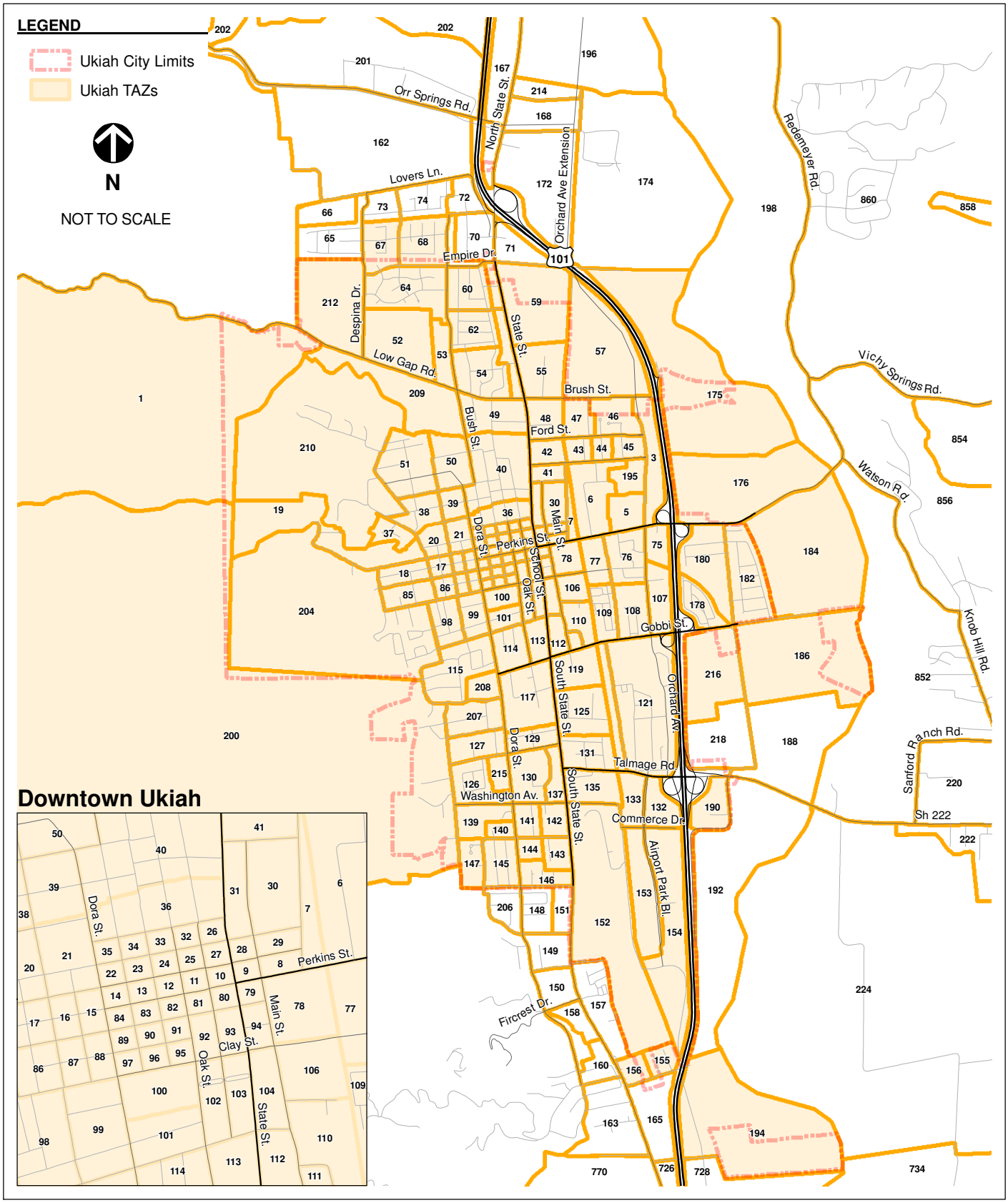
Fehr & Peers has prepared this memorandum describing the technical approach and results of a city-wide inventory of vehicle miles of travel (VMT) for the City of Ukiah Climate Action Plan (CAP) using the Mendocino Council of Governments (MCOG) travel demand model. Estimates of VMT were prepared for the 2009/10 baseline year and the three forecast years of 2020, 2030, and 2035.

MCOG TRAVEL DEMAND MODEL

The Mendocino Council of Governments (MCOG) travel demand model was used to develop VMT estimates. At the time the model was developed, City of Ukiah staff was heavily involved in developing the land use inputs for the model, and particular care was taken to ensure the accuracy of the information and reasonableness of the future forecasts.

LAND USE

Land use information within the MCOG model area is provided at the Traffic Analysis Zone (TAZ) level; the TAZs within the incorporated city boundary of Ukiah from the MCOG model are noted in **Figure 1**. Land use information is provided for a variety of land use types, including seasonal housing (or vacation homes), single and multi-family homes, and employment uses (agricultural, commercial, medical, industrial). Data for the TAZs located in Ukiah are summarized in **Table 1** for 2009/10, 2020 and 2030 for the various land use categories. For 2009/10, the data presented represents the land use total, while the 2020 and 2030 columns show the incremental growth. Land use data, both existing and future, were compiled during the MCOG travel demand model development and confirmed by City of Ukiah staff for this project.



FEHR PEERS

TRAFFIC ANALYSIS ZONES
UKIAH
FIGURE 1

TABLE 1
CITY OF UKIAH LAND USE DATA FROM MCOG MODEL

Land Use Type[1]	2009/10	Growth Increment	
		2020[2]	2030[3]
Seasonal Housing Units	15	0	0
Single Family Units	3,738	49	41
Multi-Family Units	2,759	201	199
K-8 Students	3,139	198	193
High School Students	1,978	125	122
College/University Students	100	0	0
Hotel Rooms	770	25	25
Agricultural and Winery Jobs	81	0	0
Retail Jobs	2,636	388	358
General Office Jobs	2,222	164	150
Medical Jobs	1,610	206	197
Entertainment Jobs	273	4	4
Restaurant Jobs	884	61	53
Industrial Jobs	1,679	43	40
Government Jobs	1,852	296	266

Notes:

1. Housing land uses are represented by the number of dwelling units, educational uses are represented by the number of students, and employment uses are represented by the number of jobs.
2. Represents the increment of growth between 2009/2010 and 2020.
3. Represents the increment of growth between 2021 and 2030.

Source: MCOG Model Land Use Inputs, November 2012.

Roadway Network

The future year models include roadway network improvements that are expected to be in place by 2020 and 2030, as summarized in **Table 2**. Roadway network improvements in the unincorporated areas of the County are noted in Table 2 as those improvements have the potential to affect travel patterns within the City of Ukiah.

TABLE 2
FUTURE ROADWAY IMPROVEMENTS

Roadway	Jurisdiction	Proposed Improvement	Year Built[1]
North State Street	Mendocino County	Widen from 2 to 4 lanes between US 101 and Lake Mendocino Drive	2020
Orr Springs Road	Mendocino County	Extend eastward from North State Street to Orchard Avenue Extension	2020
Orchard Avenue	Mendocino County	Extend northward from Ford Street to Orr Springs Road	2020
Orchard Avenue	Mendocino County	Extend northward from Orr Springs Road to Lake Mendocino Drive	2030
Orchard Avenue	Ukiah	Extend southward from current terminus to Talmage Road	2030
US 101 / Talmage Road (SR-222) Interchange	Ukiah	Reconfigure to partial cloverleaf interchange	2030
Clay Street	Ukiah	Extend eastward from Main Street to Leslie Street	2030
Hensley Creek Road	Mendocino County	Extend eastward from North State Street to Orchard Avenue Extension	2030

Notes:

1. "2020" means the improvement is included in both the 2020 and 2030 roadway networks. Actual year of construction could be any time between 2009/10 and 2020. Similarly, "2030" means the improvement is included only in the 2030 network, and actual year of construction could be any time between 2021 and 2030.

Source: *Final Model Development Report, MCOG Travel Demand Forecasting Model*, October 2010.

Minor changes were made to roadway functional classification in the City of Ukiah as per feedback from City staff. These changes are listed in **Table 3**.

TABLE 3
FUNCTIONAL ROADWAY CLASSIFCATION MODIFICATIONS

Roadway	Description	Previous Functional Class	Updated Functional Class
Dora Street	Firecrest Drive to Grove Avenue	Minor Collector	Urban Arterial
Washington Avenue	Dora Street to Helen Avenue	Major Collector	Local
Observatory Avenue	Dora Street to South State Street	Minor Collector	Local
Dora Avenue	Grove Avenue to Live Oak Avenue	Minor Collector	Local
Standley Street	Main Street to Dora Street	Minor Collector	Urban Arterial
Perkins Street	Main Street to Dora Street	Minor Collector	Urban Arterial
N. Oak Street	Henry Street to Low Gap Road	Local	Major Collector
Empire Drive	Bush Street to State Street	Minor Collector	Local
Brush Street	State Street to US 101	Major Collector	Local
Ford Street	State Street to Orchard Avenue	Minor Collector	Local
Clara Avenue	Mason to Orchard Avenue	Minor Collector	Local
Perkins Street	East of US 101 Ramp	Urban Arterial	Major Collector
Main Street	Gobbi Street to Marshall Street	Major Collector	Local
Clay Street	Main Street to Mason Street	Minor Collector	Local
School Street	Mill Street to Henry Street	Major Collector	Urban Arterial
Hastings Avenue	South State Street to Airport Road	Major Collector	Local
Commerce Drive	East of Airport Road	Major Collector	Local
Airport Park Boulevard	Talmage Frontage Road to Airport Road	Major Collector	Local
Hastings Frontage Road	Talmage Road to end	Major Collector	Local

Source: City of Ukiah Staff, response to data request, October 11, 2012

ANALYSIS PARAMETERS

The following presents the analysis parameters, including methods to calculate the VMT generated by land uses in the City of Ukiah for the base and forecast years.

VEHICLE MILES OF TRAVEL CALCULATIONS

The VMT inventory for Ukiah captures vehicle trips generated by land uses within the City; however, some trips may have an origin or destination outside of the City limits. Per the recommended calculation methods, VMT for Ukiah was calculated from the combination of the following trip lengths:

1. All Internal City-City (I-I) trips: All trips starting and ending in Ukiah.
2. One-half of External-Internal City (X-I) trips: One-half of trips with an origin outside of the City of Ukiah and a destination in Ukiah.
3. One-half of Internal City-External (I-X) trips: One-half of trips with an origin within the City of Ukiah and a destination outside of Ukiah.

Trips without an origin or destination in Ukiah are not included in the VMT estimates associated with activities in Ukiah, as the City has no control over the amount of through traffic on regional roadways such as US 101.

Forecast Years

The MCOG travel demand model was validated to 2009/10 conditions and is able to forecast to 2020 and 2030 conditions. Forecasts of 2035 conditions were made by extrapolating the growth rate between 2009/10 and 2030.

ANALYSIS RESULTS

The results of the VMT estimates using the MCOG travel demand model for the City of Ukiah are presented below.

Vehicle Miles of Travel

A summary of 2009/10, 2020, 2030, and 2035 daily VMT for the City of Ukiah are presented in **Table 4**. This table includes normalization of VMT households and by capita. **Table 5** shows the VMT estimates by 5-mph speed bin for each scenario year.

The results show that VMT is projected to increase between scenario years. This increase is expected as the number of residential units and employment opportunities within the City is planned to increase. VMT per Capita is also expected to increase, which is due to the projection of employment opportunities increasing in Ukiah at a higher rate than residential uses. Over the next 20 years, the number of residential units within the City is expected to increase by approximately 8 percent, while the number of jobs within the City is expected to increase by approximately 20 percent. As there were approximately 1.71 jobs per household in 2009/2010, it is likely that new employment opportunities will draw some workers from residential locations outside the City boundaries.

TABLE 4
CIYT OF UKIAH DAILY VMT CALCULATIONS

Scenario	Daily VMT	Households	Population[1]	Employment	VMT / Capita (Pop + Emp)
Year 2009/10[2]	399,199	6,497	16,113	11,237	14.6
Year 2020[2]	439,657	6,747	16,733	12,399	15.1
Year 2030[2]	488,514	6,987	17,328	13,467	15.9
Year 2035[3]	509,779	7,066	17,524	13,827	16.3

Notes:

1. Population calculated based on average household size from 2010 U.S. Census data.
2. Households and employment based on model land use; VMT based on model.
3. Households, employment, and VMT based on growth rates between 2009/10 and 2030 scenario years.

Source: Profile of General Population and Housing Characteristics: 2010 American FactFinder, U.S. Census Bureau; MCOG Model, as summarized by Fehr & Peers, November 2012.

This completes our VMT inventory for the City of Ukiah CAP. We look forward to working with the Project team to identify strategies that could be effective in reducing VMT growth. If you have any questions, please contact Kathrin Tellez or Tien-Tien Chan.

TABLE 5

CITY OF UKIAH DAILY VEHICLE MILES OF TRAVEL (VMT) DISTRIBUTION BY SPEED BIN

Speed Bin (miles per hour)	Vehicle Miles of Travel Estimates (Daily)							
	2009/10		2020		2030		2035	
	VMT	Percent of Total	VMT	Distribution (%)	VMT	Percent of Total	VMT	Percent of Total
0.0 – 5.00	0	0.0%	0	0.0%	0	0.0%	0	0.0%
5.01 – 10.00	76	0.0%	83	0.0%	87	0.0%	90	0.0%
10.01 – 15.00	18	0.0%	914	0.2%	2,097	0.4%	2,592	0.5%
15.01 – 20.00	2,707	0.7%	3,073	0.7%	4,600	0.9%	5,051	1.0%
20.01 – 25.00	38,552	9.7%	41,505	9.4%	48,146	9.9%	50,430	9.9%
25.01 – 30.00	45,226	11.3%	49,458	11.2%	52,411	10.7%	54,122	10.6%
30.01 – 35.00	85,836	21.5%	91,292	20.8%	95,696	19.6%	98,043	19.2%
35.01 – 40.00	22,057	5.5%	22,054	5.0%	23,429	4.8%	23,756	4.7%
40.01 – 45.00	14,289	3.6%	15,298	3.5%	17,672	3.6%	18,478	3.6%
45.01 – 50.00	2,170	0.5%	3,375	0.8%	12,797	2.6%	15,327	3.0%
50.01 – 55.00	142,864	35.8%	162,098	36.9%	175,524	35.9%	183,300	36.0%
55.01 – 60.00[1]	0	0.0%	0	0.0%	0	0.0%	0	0.0%
60.01 – 65.00	45,404	11.4%	50,506	11.5%	56,055	11.5%	58,591	11.5%
65.01 – 70.00	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	**399,199**	**100.0%**	**439,657**	**100.0%**	**488,514**	**100.0%**	**509,779**	**100.0%**

Notes:

1. Absence of VMT in the 55.01-60.00 mph speed bin is due to network assumptions and congested speed calculations. Congested speeds did not fall in this range.

Source: MCOG Model, as summarized by Fehr & Peers, November 2012.

Appendix B2

Fehr & Peers, City of Ukiah Quantitative Analysis of Strategies (2020 & 2030)

ESA

FEHR PEERS

MEMORANDUM

Date: July 12, 2013

To: Jeff Caton & Lesley Lowe, ESA

From: Kathrin Tellez and Tien-Tien Chan

Subject: City of Ukiah – Quantitative Analysis of Strategies (2020 & 2030)

SF12-0638

This memorandum documents the potential reduction in vehicle miles of travel (VMT) that are expected to occur with implementation of the City of Ukiah Climate Action Plan (CAP) by 2030. Existing and projected future conditions under the future Business as Usual (BAU) scenario were documented in our memorandum dated November 19, 2012 (attached). The Climate Action Plan scenario assumes implementation of candidate measures developed by the consultant team in collaboration with City staff and complied by ESA. The CAP strategies that have the potential to reduce vehicle miles of travel are documented within this memorandum.

CONCLUSIONS

The actual effectiveness of many of the CAP measures is dependent on factors outside the control of the City. To recognize this uncertainty, a range of expected reductions has been calculated. The CAP transportation measures reduce overall daily VMT in year 2020 between 3,500 to 11,000 miles (0.8 to 2.5 percent reduction), as compared to 2020 BAU scenario. In year 2030, the measures reduce overall daily VMT by 5,400 to 15,600 miles (1.1 to 3.2 percent reduction), as compared to the 2030 BAU scenario. In year 2020, CAP VMT per capita is estimated to range between 14.7 and 15.0, compared to a BAU scenario of 15.1. In year 2030, CAP VMT per capita is estimated to range between 15.4 and 15.7, compared to a BAU scenario of 15.9.

ANALYSIS METHODOLOGY

Based on the limitations of the regional MCOG travel demand model to respond to CAP transportation strategies, such as traffic calming and complete streets ordinances, the model was

not used to estimate VMT reductions from transportation strategies. Quantification was conducted using off-model tools and factors.

TDM+ is an off-model spreadsheet tool developed by Fehr & Peers and based on a major report, Quantifying Greenhouse Gas Mitigation Measures. This report, authored by the California Air Pollution Control Officers Association (CAPCOA) and Fehr & Peers, documents a groundbreaking and comprehensive set of guidelines for assessing and quantifying reductions in vehicle miles traveled resulting from a number of common TDM strategies. Fehr & Peers conducted an extensive literature review for the transportation related strategies addressed in that report to provide accurate and reliable quantification methods to be used throughout California. Working with BAAQMD, the evaluation methods were locally validated by comparison to the actual performance of trip reduction strategies in the San Francisco Bay Area. The TDM+ tool was applied to the transportation strategies identified for the City of Ukiah. The calculations were additionally refined to provide more accuracy based on the context of the strategy and environment.

CLIMATE ACTION PLAN VMT CALCULATIONS

The strategies developed by the Project team and listed in **Table 1** were applied to the TDM+ tool to estimate percent VMT reductions for year 2020 and year 2030. Detailed assumptions and calculations are documented in **Table A1**. As the implementation actions are in draft form and strategy detail will be determined in the future, we provided the estimated results using a range of effectiveness for both the 2020 and 2030 CAP scenario years. The low end of the range should be used for strategies that are based on encouragement and the higher range of effectiveness should be used for strategies that have an implementation plan or will be required.

Strategy TL1.1 Local Commute Trip Reduction utilizes a combination of the Commute Trip Program Voluntary and Mandatory from the TDM+ tool to estimate the range of effectiveness. Strategy TL1.2 Sustainable Growth Patterns utilizes a combination of TDM+ tool strategies (Pedestrian Network, Diversity, Parking Supply Limits, and Traffic Calming) to estimate the range of effectiveness. Calculations and assumptions are detailed in **Table A1**.

TABLE 1: TRANSPORTATION AND LAND USE STRATEGIES		
#	**GHG Goal/ Reduction Strategy**	**Implementing Action**
TL1.1	Local Commute Trip Reduction: Support local employer-based trip reduction programs to reduce single-occupancy vehicle travel to and from Ukiah.	Consider implementing local commute trip reduction requirements in the municipal code. Could require larger employers (50+ employees) to establish TDM programs to reduce single-occupancy vehicle trips. Can include 9/80 work weeks, carpooling, telecommuting, car sharing, bike sharing, shuttles, vanpooling, guaranteed ride home.
		Consider a coordinated TDM program with several large employers to share costs and also travel pool (e.g. vanpooling, carpooling and/or shuttles for the Medical Center and other key employment centers)
		As Staff and resources allow, develop a City Program (with incentives) to encourage employers to implement effective voluntary trip reduction programs.
		Promote telecommuting and alternative work schedules for City employees.
TL1.2	Sustainable Growth Patterns: Increase neighborhood density (including infilling), mixed-use developments, and increase community pedestrian-friendly design.	Consider adopting a Complete Streets Ordinance that directs the City to meet the needs of all of its transportation users.
		Continue to consider modifications to the municipal code to achieve smart growth objectives (i.e. increase density and mixed-use infill development)
		Implement SmartCode or form-based code to increase mixed use and pedestrian connectivity in urban core near transit.
		Consider requiring residential subdivision projects to provide for a certain percentage of below market rate housing
		Promote and encourage downtown revitalization and the vitality of small local businesses in the downtown core area.
		"Encourage "smart growth" development by eliminating or reducing minimum parking requirements, creating maximum parking requirements, and providing shared parking."
		Implement traffic calming measures within the downtown core
		Promote and encourage clean energy and green jobs/industries within the City and in its Sphere of Influence.
		Develop a Plan for creating urban open spaces and natural resources enhancement to complement the compact infill development and mixed use growth strategy.

Source: ESA, 2013.

Table 2 presents the results of the transportation strategy reductions calculations. By year 2030, Strategy TL1.1 (Local Commute Trip Reduction) may see a 0.2 to 1.2 percent reduction in VMT and Strategy TL1.2 (Sustainable Growth Patterns) may see a 0.9 to 2.0 percent reduction in VMT. This results in an overall percent reduction in VMT of 1.1 to 3.2 percent. This is equal to a daily reduction of 5,400 to 15,600 vehicle miles.

TABLE 2: TRANSPORTATION STRATEGIES REDUCTION SUMMARY

	Year 2020 % VMT Reduction		Year 2030 % VMT Reduction	
Strategy	**Low**	**High**	**Low**	**High**
TL1.1 Local Commute Trip Reduction	0.1%	0.9%	0.2%	1.2%
TL1.2 Sustainable Growth Patterns	0.7%	1.6%	0.9%	2.0%
Total	0.8%	2.5%	1.1%	3.2%
Daily VMT Reduction	3,517	10,991	5,374	15,632

Source: Fehr & Peers, 2013.

Table 3 compares daily VMT per capita for the BAU scenarios to the CAP scenarios (which assume implementation of the transportation strategies). In year 2030, VMT per capita is estimated to be 15.4 to 15.7, slightly lower than the BAU scenario of 15.9 VMT per capita.

TABLE 3: UKIAH VMT PER CAPITA

Scenario	Daily VMT[1]	Population + Employment	VMT / Capita
Year 2009/10	399,200	27,350	14.6
Year 2020 BAU	439,700	29,132	15.1
Year 2020 CAP	428,700 – 436,100	29,132	14.7 – 15.0
Year 2030 BAU	488,500	30,795	15.9
Year 2030 CAP	472,900 – 483,100	30,795	15.4 – 15.7

Notes:
1. Daily VMT numbers are rounded.

Source: Fehr & Peers, 2013.

TRANSPORTATION STRATEGIES – ADDITIONAL DISCUSSION

Strategy TL1.1 Local Commute Trip Reduction (CTR)

The low and high range estimates of Strategy TL1.1 represent the both the comprehensiveness of the trip reduction program and whether the program is voluntary or mandatory. The CTR program will provide employees with assistance in using alternative modes of travel, and provide both "carrots" and "sticks" to encourage employees. The CTR program should include all of the following to apply the effectiveness reported:

- Carpooling encouragement
- Ride-matching assistance
- Preferential carpool parking
- Flexible work schedules for carpools
- Half time transportation coordinator
- Vanpool assistance
- Bicycle end-trip facilities (parking, showers and lockers)

Other strategies may also be included as part of a CTR program, including: new employee orientation of trip reduction and alternative mode options, event promotions and publications, flexible work schedule for all employees, transit subsidies, parking cash-out or priced parking, shuttles, emergency ride home, and improved on-site amenities.

If a program is mandatory (representing the high end of the reduction estimates), the City should implement a CTR ordinance. The intent of the ordinance will be to reduce drive-alone travel mode share and encourage alternative modes of travel. The critical components of this strategy are:

- Established performance standards (e.g. trip reduction requirements)
- Required implementation
- Regular monitoring and reporting

Regular monitoring and reporting will be required to assess the project's status in meeting the ordinance goals. In addition, in order to apply the high end effectiveness of the VMT reductions, the program should include the following additional strategies:

- Parking cash out
- Employer sponsored shuttles to transit station
- Employer sponsored bus
- Transit subsidies

TABLE A1: TRANSPORTATION STRATEGY CALCULATION DETAIL							
#	**Strategy / Action**	**TDM+ Tool Strategy and CAPCOA Calculation Detail**	**Calculation Reference**	**Input Notes**	**Assumption Notes**	**Low %[1]**	**High %[1]**
TL1.1	Local Commute Trip Reduction: Support local employer-based trip reduction programs to reduce single-occupancy vehicle travel to and from Ukiah.	CTR Program – Voluntary VMT Reduction = A * B Where: A = % reduction in commute VMT (from [1]); B = % employees eligible Detail: A: 5.2% (low density suburb), 5.4% (suburban center), 6.2% (urban) annual reduction in commute VMT (from [1])	[1]Cambridge Systematics. Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions. Technical Appendices. Prepared for the Urban Land Institute. (Table 5.13)	Voluntary program will be low end	2020 applicable to new employment growth = (12,399 - 11,237)/12,399 = 10% (growth from 2010 to 2020) (from Inventory Memo) 2030 applicable to new employment growth = (13,467 - 11,237)/13,467 = 17% (growth from 2010 to 2030) (from Inventory Memo)	0.1% [0.2%]	N/A
		CTR Program – Mandatory % VMT Reduction = A * B Where A = % shift in vehicle mode share of commute trips (from [1]); B = % employees eligible; C = Adjustment from vehicle mode share to commute VMT Detail: A: 21% reduction in vehicle mode share (from [1]); C: 1.0	[1]Nelson/Nygaard (2008). South San Francisco Mode Share and Parking Report for Genentech, Inc.	Mandatory program will be high end	2020 applicable to new employment growth (10%) + 10% of existing employment = 20% 2030 applicable to new employment growth (17%) + 10% of existing employment = 27%	N/A	0.9% [1.2%]

TABLE A1: TRANSPORTATION STRATEGY CALCULATION DETAIL							
#	**Strategy / Action**	**TDM+ Tool Strategy and CAPCOA Calculation Detail**	**Calculation Reference**	**Input Notes**	**Assumption Notes**	**Low %[1]**	**High %[1]**
TL1.2	Sustainable Growth Patterns: Increase neighborhood density (including infilling), mixed-use developments, and increase community pedestrian-friendly design.	Aggregation of strategy reductions below.	--	--	--	0.7% [0.9%]	1.6% [2.0%]
	Consider adopting a Complete Streets Ordinance that directs the City to meet the needs of all of its transportation users.	Pedestrian Network 2% reduction (Within Project Site and Connecting Off-Site; Urban/Suburban) 1% reduction (Within Project Site; Urban/Suburban) < 1% reduction (Within Project Site and Connecting Off-Site; Rural)	Center for Clean Air Policy (CCAP) Transportation Emission Guidebook. 1000 Friends of Oregon (1997) "Making the Connections: A Summary of the LUTRAQ Project" (p. 16)	Low = within project site High = within and connecting off-site	Looking at TAZ map (Figure 1 of Inventory Memo) - downtown core is estimated at 10% of City.	0.1% [0.1%]	0.2% [0.2%]

TABLE A1: TRANSPORTATION STRATEGY CALCULATION DETAIL

#	Strategy / Action	TDM+ Tool Strategy and CAPCOA Calculation Detail	Calculation Reference	Input Notes	Assumption Notes	Low %[1]	High %[1]
	Continue to consider modifications to the municipal code to achieve smart growth objectives (i.e. increase density and mixed-use infill development)	Diversity % VMT Reduction = Land Use * B [not to exceed 30%] Where Land Use = Percentage increase in land use index versus single use development = (land use index – 0.15)/0.15 (see CAPCOA report for detail) Land use index = -a / ln(6) (from [2]) a = summation (from i=1 to 6) of ai x ln (ai) ai = building floor area of land use i / total square feet of area considered o a1 = single family residential o a2 = multifamily residential o a3 = commercial o a4 = industrial o a5 = institutional o a6 = park if land use is not present and ai is equal to 0, set ai equal to 0.01 B = elasticity of VMT with respect to land use index (0.09 from [1]) not to exceed 500% increase	[1] Ewing, R., and Cervero, R., "Travel and the Built Environment - A Meta-Analysis." Journal of the American Planning Association, <to be published> (2010). Table 4. [2] Song, Y., and Knaap, G., "Measuring the effects of mixed land uses on housing values." Regional Science and Urban Economics 34 (2004) 663-680. (p. 669) http://urban.csuohio.edu/~sugie/papers/RSUE/RSUE2005_Measuring%20the%20effects%20of%20mixed%20land%20use.pdf	Assumed a 50/40/10 split of multi-fam housing/ commercial/ park	<u>2020</u> new households b/w 2010 and 2020 is 6,747-6,497 = 250 (or 3.7% of total household population in 2020). Source = F&P's inventory memo. Low = 1% (1/4 of all new housing within downtown core and mixed use) High = 2% (or 50% new housing within downtown and mixed use) <u>2030</u> new households b/w 2010 and 2030 is 6,987-6,497 = 490 (or 7% of total household population in 2030). Source = F&P's inventory memo. Low = 2% (1/4 of all new housing within downtown core and mixed use) High = 3.5% (or 50% new housing within downtown and mixed use)	0.3% [0.5%]	0.5% [1.0%]
	Implement SmartCode or form-based code to increase mixed use and pedestrian connectivity in urban core near transit.						

TABLE A1: TRANSPORTATION STRATEGY CALCULATION DETAIL

#	Strategy / Action	TDM+ Tool Strategy and CAPCOA Calculation Detail	Calculation Reference	Input Notes	Assumption Notes	Low %[1]	High %[1]
	Encourage "smart growth" development by eliminating or reducing minimum parking requirements, creating maximum parking requirements, and providing shared parking.	Parking Supply Limits % VMT Reduction =(Actual parking provision ITE parking generation rate) / ITE parking generation rate x 0.5	[1] Nelson\Nygaard, 2005. Crediting Low-Traffic Developments (p. 16) http://www.montgomeryplanning.org/transportation/documents/TripGenerationAnalysisUsingURBEMIS.pdf	Low = 5% reduction of parking High = 15% reduction of parking	Looking at TAZ map (Figure 1 of Inventory Memo) - downtown core is estimated at 10% of City.	0.3% [0.3%]	0.8% [0.8%]
	Implement traffic calming measures within the downtown core	Traffic Calming – see CAPCOA document for calculation detail	[1] Cambridge Systematics. Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions.(p. B-25) [2] Sacramento Metropolitan Air Quality Management District (SMAQMD) Recommended Guidance for Land Use Emission Reductions. (p.13)	Low = assumed 50%/50% High = assumed 100%/100%	Looking at TAZ map (Figure 1 of Inventory Memo) - downtown core is estimated at 10% of City.	0.05% [0.05%]	0.1% [0.1%]

Notes:

1. Year 2020 % VMT Reduction [Year 2030 % VMT Reduction]

Source: Fehr & Peers, 2013.

Appendix C
Calculations Quantifying Costs and Emissions Reductions

Energy Strategies

Summary Table

Code	Strategy Name	GHG Reduction in 2020 (MT CO2)	% of Total Reductions in 2020	GHG Reduction in 2030 (MT CO2)	Relative GHG Benefit	Relative Cost	Implementation Priority
Goal E.1: Increase Building Energy Efficiency							
Strategy E.1.1	Promote Commercial Energy Efficiency	646	38.2%	1,085	High	Med	1
Strategy E.1.2	Promote Residential Energy Efficiency	567	33.5%	964	high	med	1
Strategy E.1.3	Improve Municipal Energy Efficiency	76	4.5%	107	med	med	2
Strategy E.1.4	Reduce Urban Heat Islands	2	0.1%	16	low	low	2
Strategy E.1.5	Promote Commercial and Residential Green Building	23	1.4%	53	low	low	2
Goal E.2: Promote On-site Renewable Energy							
Strategy E.2.1	Promote Cost-Effective Renewable Energy for Commercial and Industrial Users	247	14.6%	817	high	low	1
Strategy E.2.2	Promote Cost-Effective Renewable Energy for Homes	130	7.7%	337	high	low	1
Strategy E.2.3	Expand Municipal Renewable Energy	0.2	0.0%	1	low	low	2
Goal E.3: Increase Outreach, Education, and Collaboration							
Strategy E.3.1	Increase Local Education and Outreach	NA		-			
Strategy E.3.2	Establish Regional Renewable Energy Partnerships	NA		-			
	Totals:	**1,692**	**100.0%**	**3,381**			

Prioritization of Community Strategies

		Costs		
		Low	Medium	High
Benefits	High	1	1	2
	Medium	1	2	3
	Low	2	3	3

Energy Strategy Common Factors

Note: Pale Yellow fields denote common factors that are not subject to being tweaked by the City. Green fields denote factors that can be modified based on the City's commitment to an action or set of actions.

	#	Unit	Direct Data Source
Basic Unit Factors			
Hours in a year	8,760		
Hours of daylight in a year	2,920		
Pounds per Metric Ton	2,204.6		
Kwh per Mwh	1,000		
lbs of CO2 emissions from 1 therm of natural gas	11.70		
GHG Emission Factors			
Ukiah Utilities, Electric Services Division 2005 CO2 Electricity emission factor	55.8257	kg CO2/MWh	Derived from City-provided electricity consumption data
Ukiah Utilities, Electric Services Division 2005 CH4 Electricity emission factor	0.0352	kg CH4/MWh	Derived from City-provided electricity consumption data
Ukiah Utilities, Electric Services Division 2005 N2O Electricity emission factor	0.0005	kg N2O/MWh	Derived from City-provided electricity consumption data
Ukiah Utilities, Electric Services Division 2010 CO2 Electricity emission factor	43.7381	kg CO2/MWh	Derived from City-provided electricity consumption data
Ukiah Utilities, Electric Services Division 2010 CH4 Electricity emission factor	0.0224	kg CH4/MWh	Derived from City-provided electricity consumption data
Ukiah Utilities, Electric Services Division 2010 N2O Electricity emission factor	0.0004	kg N2O/MWh	Derived from City-provided electricity consumption data
CO2 Natural Gas emission factor	53.0200	kg CO2/MMBtu	LGOP, Table G.1, 'Pipeline (US Weighted average)'
CH4 Natural Gas emission factor	0.0050	kg CH4/MMBtu	LGOP, Table G.3, 'Commercial' and 'Residential'
N2O Natural Gas emission factor	0.0001	kg N2O/MMBtu	LGOP, Table G.3, 'Commercial' and 'Residential'
Projected City Growth Factors			
Average Square Feet Per Residential Unit (Existing Housing Stock)	1,448	square ft	See California Statewide Residential Appliance Saturation Study, page 10
Average Square Feet Per Residential Unit (New Housing Stock)	2,061	square ft	See California Statewide Residential Appliance Saturation Study, page 10
2005 Residential Square Feet	9,251,272	square ft	Housing units*Average Sq. Ft. Per Residential Unit
2020 Residential Square Feet	9,989,110	square ft	Housing units*Average Sq. Ft. Per Residential Unit
2030 Residential Square Feet	10,483,750	square ft	Housing units*Average Sq. Ft. Per Residential Unit
2005 Industrial Square Feet	1,679,000		Jobs*ITE Square Feet per Job Figures
2020 Industrial Square Feet	1,743,843		Based on Projected Employment Projections of 2005 figure
2030 Industrial Square Feet	1,924,480		Based on Projected Employment Projections of 2005 figure
2005 Commercial Square Feet	3,254,833		# of Jobs*ITE Square Feet per Job Figures
2020 Commercial Square Feet	3,380,534		Based on Projected Employment Projections of 2005 figure
2030 Commercial Square Feet	3,874,788		Based on Projected Employment Projections of 2005 figure
2005 Public Use Square Feet	617,333		Jobs*ITE Square Feet per Job Figures
2020 Public Use Square Feet	641,175		Based on Projected Employment Projections of 2005 figure
2030 Public Use Square Feet	734,918		Based on Projected Employment Projections of 2005 figure
2005 Total Non-Residential Square Feet	5,551,167	square ft	Source: GP EIR: 435,000 sf of industrial, 237,000 sf of commercial, and 360,000 sf of public uses.
2020 Total Non-Residential Square Feet	5,765,551	square ft	Based on Projected Employment Projections of 2005 figure
2030 Total Non-Residential Square Feet	6,362,779	square ft	Based on Projected Employment Projections of 2005 figure
Total square feet of newly constructed residential space from 2005 to 2020	737,838	square ft	
Total square feet of newly constructed residential space from 2005 to 2030	1,232,478	square ft	
Total sq. feet of newly constructed commercial space from 2005 to 2020	214,385	square ft	
Total sq. feet of newly constructed commercial space from 2005 to 2030	811,613	square ft	
Total # of housing units in 2005	6,389	Housing Units	Source: California Department of Finance
Total # of housing units in 2020	6,747	Housing Units	Based on Projected Housing Growth from 2005 to 2020, with data from the MCOG Model Data (See Fehr & Peers VMT Inventory Memo, Table 1)
Total # of housing units in 2030	6,987	Housing Units	Based on Projected Housing Growth from 2005 to 2020, with data from the MCOG Model Data (See Fehr & Peers VMT Inventory Memo, Table 1)
Total # of commerical units in 2005	914	units	US Economic Census, Average of 2002 and 2007 totals (936 in 2002; 891 in 2007)
Total # of commercial units in 2020	949	units	Population growth increase from 2005
Total # of commercial units in 2030	1,047	units	
City of Ukiah Square Mileage	4.72	sq. mile	Source: City of Ukiah MSR (for year 2011)
City of Ukiah Acres in 2005	3,021	Acres	Assumes City does not grow in size from 2005 by 2020
City of Ukiah Acres in 2020	3,021	Acres	Assumes City does not grow in size from 2005 by 2030
City of Ukiah Acres in 2030	3,021	Acres	
Housing Units per Acre in 2005	2.12	units per acre	
Housing Units per Acre in 2020	2.23	units per acre	
Housing Units per Acre in 2030	2.31	units per acre	
City of Ukiah (Derived) Energy Intensity Factors			
Ukiah electric use intensity factor for res. buildings in kWh/sq ft.	4.10	kwh/square foot	Data Provided by the City (2010 kWh data)
Ukiah natural gas intensity factor for res. buildings in therms/sq ft.	0.29	therms/square feet	Data provided by PG&E (2010 therms data)
Ukiah electric use intensity factor for non-residential buildings in kWh/sq ft.	13.05	kwh/square foot	Data Provided by the City (2010 kWh data)
Ukiah natural gas use intensity factor for non-residential buildings in therms/sq ft.	0.31	therms/square feet	Data provided by PG&E (2010 therms data)
Cost Factors			
BLS U.S. Department of Labor: Average Mendocino County Salary	$ 40,768.00	Salary	based on Bureau of Labor Statistics U.S. Department of Labor, County Employement and Wages (News Release). Released on March 28, 2012.
BLS U.S. Department of Labor: Average Mendocino County Hourly Rate	$ 20.22	Hourly Rate	based on Bureau of Labor Statistics U.S. Department of Labor, County Employement and Wages (News Release). Released on March 28, 2012.

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Strategy GHG and Cost Analysis Worksheet: E.1.1

Strategy Name	**Promote Commercial Energy Efficiency**
Emissions Category	Energy
Strategy Description	**Action E-1.1a:** Promote existing energy audits, rebates, energy efficiency programs offered by City of Ukiah Electric Department to improve energy efficiency in commercial buildings. **Action E-1.1b:** Develop a low-cost local education campaign to promote benchmarking and cost-effective commercial energy efficiency improvements. **Action E-1.1c:** Outreach to the business community to encourage energy audits and point of sale energy use disclosure, and energy efficiency upgrades; As Staff and resources allow, develop a local "Green Business" program to promote energy efficiency actions. **Note:** Electricity savings below are calculated by using actual kWh saved through City energy efficiency efforts from 2007-2012; natural gas savings below are calculated conversion factors and assumptions on commercial square footage affected in accordance with this strategy.

2020 GHG Reduction Potential	High	[low = <20 ; med = 20 to 100; high = >100]	#REF!
Annual cost by 2020 (to City)	Med	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff tim	

Key Assumptions for Resource Savings and GHG Calculations

Description	#	Unit	Equation Variable	
(Existing as of year 2005) Commercial Square Feet Upgraded by 2020[1]	832,675	square ft.	Csf_{2020}	Assumed 15% of 2005 existing commercial square footage
(Existing as of year 2005) Commercial Square Feet Upgraded by 2030[2]	1,387,792	square ft.	Csf_{2030}	Assumed 25% of 2005 existing commercial square footage
Post-2005 Commercial Square Feet Upgraded by 2020	18,855	square ft.	Csg_{2020}	Assumed 15% of new post-2005 commercial square footage
Post-2005 Commercial Square Feet Upgraded by 2030	154,989	square ft.	Csg_{2030}	Assumed 25% of new post-2005 commercial square footage
Target Percentage of Natural Gas Energy Savings for Existing Businesses[3]	25.0%	%	N	
Target Percentage of Natural Gas Energy Savings for Post-2005 Businesses[4]	10.0%	%	M	
Ukiah natural gas use intensity factor for non-residential buildings in therms/sq ft.	0.31	therms/square feet	Cn	
Ukiah Utilities, Electric Services Division 2010 CO2 Electricity emission factor	43.74	kg CO2/MWh	Efa	Derived from City-provided electricity consumption data
CO2 Natural Gas emission factor	53.02	kg CO2/MMBtu	Efb	
Annual Non-residential kWh Savings by 2020[5]	6,820,462	kWh	K_{2020}	
Annual Non-residential kWh Savings by 2030[6]	11,083,250	kWh	K_{2030}	

[1] Based on NRDC estimates of the long-term, annual energy reduction impact of individual performance benchmarking: http://www.pmcworld.com/client/sunnyvale/documents/meetings/2011/101911/Horizon%2010-19-11%20Appendix%20B%20Technical%20Appendix.pdf

[2] Extrapolated from City-provided 2007-2012 non-residential energy consumption data.

[3] Based on NRDC estimates of the long-term, annual energy reduction impact of individual performance benchmarking: http://www.pmcworld.com/client/sunnyvale/documents/meetings/2011/101911/Horizon%2010-19-11%20Appendix%20B%20Technical%20Appendix.pdf

[4] Based on NRDC estimates of the long-term, annual energy reduction impact of individual performance benchmarking: http://www.pmcworld.com/client/sunnyvale/documents/meetings/2011/101911/Horizon%2010-19-11%20Appendix%20B%20Technical%20Appendix.pdf

[5] Figures from City-provided 2007-2012 non-residential energy consumption data.

[6] Figures from City-provided 2007-2012 non-residential energy consumption data.

1. Resource Savings:

Commercial Energy Efficiency Rebates, Programs, and Benchmarking for Existing Buildings:

Electricity Energy Savings (kWh)= K

Commercial Natural Gas Savings (therms)= (N × Csf × Cn)+(M x Csg x Cn) x F

Total commercial electricity savings by 2020=	6,820,462	kwh/year
Total commercial natural gas savings by 2020=	65,612	therms /year
Total commercial electricity savings by 2030=	11,083,250	kwh/year
Total commercial natural gas savings by 2030=	113,213	therms /year

2. GHG Calculations:

Total Emissions Savings (MT)= (Se/1000*Efa/1000)+(Sg/10*Efb/1000)

Se = total electricity savings (kWh)

Sg= total natural gas savings (therms)

1000 kWh/MWh

1000 kg/MT

GHG Emissions Savings by 2020=	646	metric tons CO2
GHG Emissions Savings by 2030=	1,085	metric tons CO2

Strategy GHG and Cost Analysis Worksheet: E.1.2

Strategy Name	**Promote Residential Energy Efficiency**
Emissions Category	Energy
Strategy Description	**Action E-1.2a:** Promote existing energy audits, rebates, energy efficiency programs offered by City of Ukiah Electric and Water Departments to improve energy efficiency in commercial buildings. **Action E-1.2b:** Develop a low-cost local education campaign for cost-effective residential energy efficiency improvements. **Action E-1.2c:** Outreach to residential property owners to encourage energy audits, benchmarking, and energy efficiency upgrades. **Action E-1.2d:** Outreach to local realtors to help communicate the value of energy improvements to prospective home buyers and sellers. **Note:** Electricity savings below are calculated by using actual kWh saved through City energy efficiency efforts from 2007-2012; natural gas savings below are calculated conversion factors and assumptions on commercial square footage affected in accordance with this strategy.

2020 GHG Reduction Potential	high	[low = <20 ; med = 20 to 100; high = >100]	#DIV/0!
Annual cost by 2020 (to City)	med	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff tim	

Key Assumptions for Resource Savings and GHG Calculations

Description	#	Unit	Equation Variable	
(Existing as of year 2005) Commercial Square Feet Upgraded by 2020[2]	1,387,691	square ft.	Csf_{2020}	Assumed 15% of 2005 existing commercial square footage
(Existing as of year 2005) Commercial Square Feet Upgraded by 2030[2]	2,312,818	square ft.	Csf_{2030}	Assumed 25% of 2005 existing commercial square footage
Post-2005 Commercial Square Feet Upgraded by 2020	110,676	square ft.	Csg_{2020}	Assumed 15% of new post-2005 commercial square footage
Post-2005 Commercial Square Feet Upgraded by 2030	308,120	square ft.	Csg_{2030}	Assumed 25% of new post-2005 commercial square footage
Target Percentage of Natural Gas Energy Savings for Existing Residences[1]	25.0%	%	N	
Target Percentage of Natural Gas Energy Savings for Post-2005 Residences[1]	10.0%	%	M	
Ukiah natural gas intensity factor for res. buildings in therms/sq ft.	0.29	feet	Cn	Derived from utility-provided natural gas consumption data
Ukiah Utilities, Electric Services Division 2010 CO2 Electricity emission factor	43.74	kg CO2/MWh	Efa	Derived from City-provided electricity consumption data
CO2 Natural Gas emission factor	53.02	kg CO2/MMBtu	Efb	
Annual Residential kWh Savings by 2020[3]	202,659.91	kWh	K_{2020}	
Annual Residential kWh Savings by 2030[4]	329,322.35	kWh	K_{2030}	

[1]Based on NRDC estimates of the long-term, annual energy reduction impact of individual performance benchmarking: http://www.pmcworld.com/client/sunnyvale/documents/meetings/2011/101911/Horizon%2010-19-11%20Appendix%20B%20Technical%20Appendix.pdf

[2]Extrapolated from City-provided 2007-2012 residential energy consumption data

[3]Extrapolated from City-provided 2007-2012 residential energy consumption data

[4]Extrapolated from City-provided 2007-2012 residential energy consumption data

2020 GHG Reduction Potential	[low = <20 ; med = 20 to 100; high = >100]
Cost by 2020 (to City)	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider first cost, annual cost, staff tim

1. Resource Savings:

Residential Energy Efficiency Rebates, Programs, and Benchmarking for Existing Buildings:
Electricity Energy Savings (kWh)= K
residential Natural Gas Savings (therms)= (N × Csf × Cn)+(M x Csg x Cn) x F

Total residential electricity savings by 2020=	202,660	kwh/year
Total residential natural gas savings by 2020=	105,322	therms /year
Total residential electricity savings by 2030=	329,322	kwh/year
Total residential natural gas savings by 2030=	179,176	therms /year

2. GHG Calculations:

Total Emissions Savings (MT)= (Se/1000*Efa/1000)+(Sg/10*Efb/1000)

Se = total electricity savings (kWh)		
Sg= total natural gas savings (therms)		
1000 kWh/MWh		
1000 kg/MT		
Annual GHG Emissions Savings by 2020=	567	metric tons CO2
Annual GHG Emissions Savings by 2030=	964	metric tons CO2

Strategy GHG and Cost Analysis Worksheet: E.1.3

Strategy Name	**Improve Municipal Energy Efficiency**
Emissions Category	Energy
Strategy Description	**Action E-1.3a:** Perform energy audits of existing municipal buildings; **Action E-1.3b:** As funding allows, install more energy efficient street lighting, such as LEDs; **Action E-1.3c:** Consider requiring that all new municipal construction achieve 15% above 2013 Title 24 Standards. **Note:** Resource savings calculations below take into account an interpretation of the impact of Action E-3.1a (within the*Total Square feet of Upgraded Municipal Space* figures and *Proportion of Buildings that are assumed to be 15% more energy efficient than existing Title 24* figure that make up the Increase Municipal Energy Efficiency equation).

2020 GHG Reduction Potential	med	[low = <20 ; med = 20 to 100; high = >100]	#DIV/0!
Annual cost by 2020 (to City)	med	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff tim

Key Assumptions for Resource Savings and GHG Calculations

Description	#	Unit	Equation Variable	
Total square feet of upgraded municipal space from 2005 to 2020	160,294	square ft	NCa	Assume 25% of Public Use Buildings
Total square feet of upgraded municipal space from 2005 to 2030	183,730	square ft	NCb	Assume 25% of Public Buildings
% Electricity Savings (by 2020)[1]	10.0%	percent	Sb_{2020}	Average % electricity savings by 2020
% Electricity Savings (by 2030)[2]	15.0%	percent	Sb_{2030}	Average % electricity savings by 2030
% Natural Gas Savings (by 2020)[3]	25.0%	percent	Sa_{2020}	Average % natural gas savings by 2020
% Natural Gas Savings (by 2030)[4]	30.0%	percent	Sa_{2030}	Average % natural gas savings by 2030
Ukiah electric use intensity factor for non-residential buildings in kWh/sq ft.	13.05	kwh/square foot	E	
Ukiah natural gas use intensity factor for non-residential buildings in therms/sq ft.	0.31	therms/square foot	N	
Ukiah Utilities, Electric Services Division 2010 CO2 Electricity emission factor	43.74	Metric Tons/MWh	Efa	
CO2 Natural Gas emission factor	53.02	kg CO2/MMBtu	Efb	

[1]Based on NRDC estimates of the long-term, annual energy reduction impact of individual performance benchmarking: http://www.pmcworld.com/client/sunnyvale/documents/meetings/2011/101911/Horizon%2010-19-11%20Appendix%20B%20Technical%20Appendix.pdf

[2]Based on NRDC estimates of the long-term, annual energy reduction impact of individual performance benchmarking: http://www.pmcworld.com/client/sunnyvale/documents/meetings/2011/101911/Horizon%2010-19-11%20Appendix%20B%20Technical%20Appendix.pdf

[3]Based on NRDC estimates of the long-term, annual energy reduction impact of individual performance benchmarking: http://www.pmcworld.com/client/sunnyvale/documents/meetings/2011/101911/Horizon%2010-19-11%20Appendix%20B%20Technical%20Appendix.pdf

[4]Based on NRDC estimates of the long-term, annual energy reduction impact of individual performance benchmarking: http://www.pmcworld.com/client/sunnyvale/documents/meetings/2011/101911/Horizon%2010-19-11%20Appendix%20B%20Technical%20Appendix.pdf

1. Resource Savings:

Increase Municipal Energy Efficiency:
Total Electricity Savings (kWh) = Nca x E x Sb x F
Total Natural Gas Savings (therms)= Ncb x N x Sa x F

Total annual residential electricity savings by 2020=	209,256	kwh/year
Total annual residential natural gas savings by 2020=	12,517	therms /year
Total annual residential electricity savings by 2030=	359,776	kwh/year
Total annual residential natural gas savings by 2030=	17,217	therms /year

2. GHG Calculations:

Total Emissions Savings (MT)= (Se/1000*Efa/1000)+(Sg/10*Efb/1000)

Se = total electricity savings (kWh)
Sg= total natural gas savings (therms)
1000 kWh/MWh
1000 kg/MT

Total GHG Emissions Savings by 2020=	76	metric tons CO2
Total GHG Emissions Savings by 2030=	107	metric tons CO2

Strategy GHG and Cost Analysis Worksheet E.1.4

Strategy Name	**Reduce Urban Heat Islands**
Emissions Category	Energy
Strategy Description	**Action E-1.4a:** Implement the existing Master Tree list; consider establishing and monitoring a voluntary shade tree program. Strongly encourage the protection of mature trees on private property and in the community, **Action E-1.4b:** Promote light-colored paving material for roads and parking areas, cool roofs, and shade trees for parking lots and buildings. **Action E-1.4c:** Implement City policy and zoning ordinance promoting shading of parking lots using trees; promote installation of parking canopies (preferable with solar PV panels) to shade parking lots. **Action E-1.4d:** Consider setting up a fund to subsidize the purchase of shade trees for homeowners. Continue to support the efforts of Releaf and the Ukiah Tree Advisory Group. **Note:** Resource savings calculations below take into account an interpretation of the impact of all of the above actions (within the *Number of Housing Units Participating in Program* figures that make up the Voluntary Shade Tree Program equation). GHG savings calculations also take into account the *total number of trees planted per year* to determine carbon biomass sequestration savings.

2020 GHG Reduction Potential	low	[low = <20 ; med = 20 to 100; high = >100]
Annual cost by 2020 (to City)	low	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff time

Key Assumptions for Resource Savings and GHG Calculations

Description	#	Unit	Equation Variable
Projected Residential Electricity Use in 2020	40,914,088	kwh/year	Re_{2020}
Projected Residential Natural Gas Use in 2020	2,938,843	therms/year	Rg_{2020}
Number of Housing Units in 2020	6,747	housing units	H_{2020}
Number of Housing Units participating in program by 2020[1]	17	housing units	Hp_{2020}
Projected Commercial Electricity Use in 2020	75,266,697	kwh/year	Ce_{2020}
Projected Commercial Natural Gas Use in 2020	1,800,915	therms/year	Cg_{2020}
Number of Commercial Units in 2020	949	comm. units	C_{2020}
Number of Commercial Units participating in program by 2020[2]	2	comm. units	Cp_{2020}
3% Reduction in energy use for residences (based on SMUD Calculator)	3%		0.03
Projected Residential Electricity Use in 2030	42,940,069	kwh/year	Re_{2030}
Projected Residential Natural Gas Use in 2030	3,084,369	therms/year	Rg_{2030}
Number of Housing Units in 2030	6,987	housing units	H_{2030}
Number of Housing Units participating in program by 2030[3]	35	housing units	HP_{2030}
Projected Commercial Electricity Use in 2030	83,063,241		Ce_{2030}
Projected Commercial Natural Gas Use in 2030	1,987,464	therms/year	Cg_{2030}
Number of Commercial Units in 2030	1,047	comm. units	C_{2020}
Number of Commercial Units participating in program by 2030[4]	5	comm. units	CP_{2030}
10% Reduction in energy use for offices/retail (based on SMUD Calculator)	10%		0.1
Ukiah Utilities, Electric Services Division 2010 CO2 Electricity emission factor	44	Metric Tons/MWh	Efa
CO2 Natural Gas emission factor	53	kg CO2/MMBtu	Efb

[1]Assumed 1/4 of 1 percent of all housing units conservative estimate
[2]Assumed 1/4 of 1 percent of all commercial units conservative estimate
[3]Assumed 1/2 of 1 percent of all housing units conservative estimate
[4]Assumed 1/2 of 1 percent of all commercial units conservative estimate

Data Sources for Resource Savings and GHG Calculations

SMUD Shade Tree Benefit Calculator https://usage.smud.org/treebenefit/iDefault.aspx
"The simulations predicted annual total energy savings of about 3–5% from combined direct and indirect effects for old and new gas-heated single-family and rowhouse residences. This number increased to 10% for offices (SIC) and 12% for retail stores (sic)"

LBNL 2001 - Shade trees reduce building energy use and CO2 emissions from power plants
"We estimate that a tree planted in Los Angeles avoids the combustion of 18 kg of carbon per tree annually"

EPA http://www.epa.gov/heatisland/resources/pdf/toronto_energysavings.pdf

Strategy GHG and Cost Analysis Worksheet E.1.4 (continued)

1. Resource Savings:

Voluntary Shade Tree Program:

Electricity savings residential by 2020 = Re_{2020}/H_{2020} x HP_{2020} x 0.95 x F
Natural gas savings residential by 2020 = Rg_{2020}/H_{2020} x HP_{2020} x 0.95
Electricity savings commercial by 2020 = Ce_{2020}/C_{2020} x CP_{2020} x 0.95 x F
Natural gas savings commercial by 2020 = Cg_{2020}/C_{2020} x CP_{2020} x 0.95
Electricity savings residential by 2030 = Re_{2030}/H_{2030} x HP_{2030} x 0.90 x F
Natural gas savings residential by 2030 = Rg_{2030}/H_{2030} x HP_{2030} x 0.90
Electricity savings commercial by 2030 = Ce_{2030}/C_{2030} x CP_{2030} x 0.90 x F
Natural gas savings commercial by 2030 = Cg_{2030}/C_{2030} x CP_{2030} x 0.90

Total residential electricity savings by 2020=	3,069	kwh/year	Total electricity savings by 2020=	8,714	kwh/year
Total residential natural gas savings by 2020=	220	therms/year	Total natural gas savings by 2020=	355	therms/year
Total commercial electricity savings by 2020=	5,645	kwh/year			
Total commercial natural gas savings by 2020=	135	therms/year			
Total residential electricity savings by 2030=	21,470	kwh/year	Total electricity savings by 2030=	63,002	kwh/year
Total residential natural gas savings by 2030=	1,542	therms/year	Total natural gas savings by 2030=	2,536	therms/year
Total commercial electricity savings by 2030=	41,532	kwh/year			
Total commercial natural gas savings by 2030=	994	therms/year			

2. GHG Calculations:

Total Emissions Savings (MT)= (Se/1000*Efa/1000)+(Sg/10*Efb/1000)

Se =	total electricity savings (kWh)	
Sg=	total natural gas savings (therms)	
1000	kWh/MWh	
1000	kg/MT	
Total GHG Emissions Savings by 2020=	2	metric tons CO2
Total GHG Emissions Savings by 2030=	16	metric tons CO2

Strategy GHG and Cost Analysis Worksheet: E.1.5a

Strategy Name	**Promote Commercial and Residential Green Building**
Emissions Category	Energy
Strategy Description	**Action E-1.5a:** Provide incentives, such as permit streamlining and increased outreach, to expand green building and energy efficient design for new commercial and residential development. **Note:** Resource savings calculations below take into account an interpretation of the overall impact of the strategy (within the *Proportion of commercial properties that are assumed to be affected by this strategy* percentage that make up the Promote Commercial Green Building Policy equation).

Key Assumptions for Resource Savings and GHG Calculations			
Description	**#**	**Unit**	**Equation Variable**
Total square feet of new residential space from 2005 to 2020	125,701	square ft	Nc_{2020}
Total square feet of new residential commercial space from 2005 to	619,955	square ft	Nc_{2030}
Average % Natural Gas Savings per building by 2020*	15.0%	percent	Sa
Average % Electricity Savings per building by 2020	15.0%	percent	Sb
Proportion of new commercial properties assumed to be affected by the strategy	10.0%	percent	B
Ukiah electric use intensity factor for non-residential buildings in	13.05	kwh/square foot	E
Ukiah natural gas use intensity factor for non-residential buildings in therms/sq ft.	0.31	therms/square feet	N
Ukiah Utilities, Electric Services Division 2010 CO2 Electricity emission	43.74	Metric Tons/MWh	Efa
CO2 Natural Gas emission factor	53.02	kg CO2/MMBtu	Efb

*Assuming 15% improvement based on achieving Tier 1 Calgreen status (15% below), on average.

2020 GHG Reduction Potential	low	[low = <20 ; med = 20 to 100; high = >100]
Annual cost by 2020 (to City)	low	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff time

1. Resource Savings:

Promote Commercial Green Building Policy:

Total Electricity Savings by 2020 (kWh) = (Nc_{2020} × E x Sb x B) x F

Total Natural Gas Savings by 2020 (therms)= (Nc_{2020} x N x Sa x B) x F

Total Electricity Savings by 2030 (kWh) = (Nc_{2030} × E x Sb x B) x F

Total Natural Gas Savings by 2030: (therms) = (Nc_{2030} x N x Sa x B) x F

Total electricity savings by 2020=	24,615	kwh
Total natural gas savings by 2020=	589	therms
Total electricity savings by 2030=	121,398	kwh
Total natural gas savings by 2030=	2,905	therms

2. GHG Calculations:

Total Emissions Savings (MT)= (Se/1000*Efa/1000)+(Sg/10*Efb/1000)

Se = total electricity savings (kWh)

Sg= total natural gas savings (therms)

1000 kWh/MWh

1000 kg/MT

Total GHG Emissions Savings by 2020=	4	metric tons CO2
Total GHG Emissions Savings by 2030=	21	metric tons CO2

Strategy GHG and Cost Analysis Worksheet: E.1.5b

Strategy Name	**Promote Residential Green Building Policy**
Emissions Category	Energy
Strategy Description	**Action E-1.5b:** Provide incentives, such as permit streamlining and increased outreach, to expand green building and energy efficient design for new commercial and residential development. **Note:** Resource savings calculations below take into account an interpretation of the overall impact of the strategy (within the *Proportion of residential properties that are assumed to be affected by this strategy* percentage that make up the Promote Residential Green Building Policy equation).

2020 GHG Reduction Potential	low	[low = <20 ; med = 20 to 100; high = >100]	#DIV/0!
Annual cost by 2020 (to City)	low	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff time	

Key Assumptions for Resource Savings and GHG Calculations

Description	#	Unit	Equation Variable
Total square feet of new construction commercial space from 2005 to	737,838	square ft	Nc_{2020}
Total square feet of new construction commercial space from 2005 to	1,232,478	square ft	Nc_{2030}
Average % Natural Gas Savings per building by 2020*	15.0%	percent	Sa
Average % Electricity Savings per building by 2020*	15.0%	percent	Sb
Proportion of new commercial properties that are assumed to be affected by the strategy	10.0%	percent	B
Ukiah electric use intensity factor for res. buildings in kWh/sq ft.	4.10	kwh/square foot	E
Ukiah natural gas intensity factor for res. buildings in therms/sq ft.	0.29	therms/square feet	N
Ukiah Utilities, Electric Services Division 2010 CO2 Electricity emission factor	43.74	Metric Tons/MWh	Efa
CO2 Natural Gas emission factor	53.02	kg CO2/MMBtu	Efb

*Assuming 15% improvement based on achieving Tier 1 Calgreen status (15% below), on average.

1. Resource Savings:

Promote Commercial Green Building Policy:

Total Electricity Savings by 2020 (kWh) = (Nc_{2020} × E x Sb x B) x F

Total Natural Gas Savings by 2020 (therms)= (Nc_{2020} x N x Sa x B) x F

Total Electricity Savings by 2030 (kWh) = (Nc_{2030} × E x Sb x B) x F

Total Natural Gas Savings by 2030: (therms) = (Nc_{2030} x N x Sa x B) x F

Total electricity savings by 2020=	45,331	kwh
Total natural gas savings by 2020=	3,256	therms
Total electricity savings by 2030=	75,721	kwh
Total natural gas savings by 2030=	5,439	therms

2. GHG Calculations:

Total Emissions Savings (MT)= (Se/1000*Efa/1000)+(Sg/10*Efb/1000)

Se =	total electricity savings (kWh)
Sg=	total natural gas savings (therms)
1000	kWh/MWh
1000	kg/MT

Total GHG Emissions Savings by 2020=	19	metric tons CO2
Total GHG Emissions Savings by 2030=	32	metric tons CO2

Strategy GHG and Cost Analysis Worksheet: E.2.1

Strategy Name	**Promote Small-scale On-site Renewable Energy for Commercial and Industrial Users**
Emissions Category	Energy
Strategy Description	**Action E-2.1a:** Continue the City Utility's PV Buy-Down Program (rebates for PV systems) for commercial and industrial customers. **Action E-2.1b:** Support streamlined permit procedures and/or establish minimum PV installation requirements for new commercial facilities of a certain size (e.g., for facilities larger than 3,000 square feet). **Note:** Resource savings calculations below take into account an interpretation of the impact of all of the above actions (within the *Building participation rate* and *% of Total electricity savings* factors that makes up the Promote On-site Renewable Energy for Commercial and Industrial Users equation).

2020 GHG Reduction Potential	high	[low = <20 ; med = 20 to 100; high = >100]
Annual cost by 2020 (to City)	low	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff time

Key Assumptions for Resource Savings and GHG Calculations

Description	#	Unit	Equation Variable	
Non-residential Space by 2020	5,765,551	square ft	NC_a	
Non-residential Space by 2030	6,362,779	square ft	NC_b	
Building participation Rate in 2020	15.0%		P	
Building participation Rate in 2030	30.0%		P	
% Total Electricity Savings by 2020	50%	percent	S_a	Assumed proportion of electricity reduced in participating buildings.
% Total Electricity Savings by 2030	75%	percent	S_b	Assumed proportion of electricity reduced in participating buildings.
Ukiah electric use intensity factor for non-residential buildings in kWh/sq ft.	13.05	kwh/square foot	N	
Ukiah Utilities, Electric Services Division 2010 CO2 Electricity emission factor	43.74	Metric Tons/MWh	Efa	

1. Resource Savings:

Promote On-site Renewable Energy for Commercial and Industrial Users:
Energy Savings (kWh): Nca x P x S x N x F

Total electricity savings by 2020=	5,645,002	kwh
Total electricity savings by 2030=	18,689,229	

2. GHG Calculations:

Total Emissions Savings (MT)= (Se/1000*Efa/1000)

Se = total electricity savings (kWh)

1000 kWh/MWh

1000 kg/MT

Total GHG Emissions Savings by 2020=	247	metric tons CO2
Total GHG Emissions Savings by 2030=	817	metric tons CO2

Strategy GHG and Cost Analysis Worksheet: E.2.2

Strategy Name	**Promote Small-scale On-site Renewable Energy for Homes**
Emissions Category	Energy
Strategy Description	**Action E-2.2a:** Continue the City Utility's PV Buy-Down Program (rebates for PV systems) for residential customers. **Action E-2.2b:** Require pre-wiring for solar systems in new building development. **Action E-2.2c:** Streamline permit processes, and promote existing financial incentives for renewable systems. **Action E-2.2d:** Provide public education about various options (including power purchasing agreements - PPAs), **Note:** Resource savings calculations below take into account an interpretation of the impact of all of the above actions (within the *Number of New Solar PV Systems* that make up the Promote Small-scale On-site Renewable Energy for Homes equation).

2020 GHG Reduction Potential	high	[low = <20 ; med = 20 to 100; high = >100]
Annual cost by 2020 (to City)	low	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff time

Key Assumptions for Resource Savings and GHG Calculations

Description	#	Unit	Equation Variable
Average solar installation size[1]	4	kW	P
Number of New Solar PV Systems by 2020[2]	675	systems	S_{2020}
Number of New Solar PV Systems by 2030[3]	1,747	systems	S_{2020}
Hours of daylight in a year (assume six hours of sunlight per day)	1,380	hrs/yr	H
Performance Ratio	80%		R
Ukiah Utilities, Electric Services Division 2010 CO2 Electricity emission factor	43.74	Metric Tons/MWh	Efa

[1]California Solar Initiative Average Solar Installation Size: http://www.pge.com/includes/docs/pdfs/myhome/saveenergymoney/solarenergy/solar_consumer_guide.pdf (pg. 8)

[2]Assumed 10% of homes

[3]Assumed 25% of homes

Data Sources for Resource Savings and GHG Calculations

Residential and commercial electric and natural gas rates. http://www.pge.com/about/news/topics/ratereduction.shtml

Solar capacity factor. http://en.wikipedia.org/wiki/Solar_power_in_California

1. Resource Savings:

Promote Small-scale On-site Renewable Energy for Homes:

Energy Savings (kWh): P x S x H x R x F

Total electricity savings by 2020=	2,979,475	kwh
Total commercial electricity savings by 2030=	7,713,648	kwh

2. GHG Calculations:

Total Emissions Savings (MT)= (Se/1000*Efa/1000)

Se = total electricity savings (kWh)

1000 kWh/MWh

1000 kg/MT

Total GHG Emissions Savings by 2020=	130	metric tons CO2
Total GHG Emissions Savings by 2030=	337	metric tons CO2

Strategy GHG and Cost Analysis Worksheet: E.2.3

Strategy Name	**Expand Municipal Renewable Energy**
Emissions Category	Energy
Strategy Description	**Action E-2.3a:** Evaluate existing installed renewable energy capacity and set future installed goal. **Note: R**esource savings calculations below take into account impact of Action E-3.2a (within the *Aggregate Solar Installation Size* figure that makes up the Increase Municipal Renewable Energy equation).

2020 GHG Reduction Potential	low	[low = <20 ; med = 20 to 100; high = >100]
Annual cost by 2020 (to City)	low	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff time

Key Assumptions for Resource Savings and GHG Calculations

Description	#	Unit	Equation Variable
Aggregate Solar Installation Size by 2020	4	kW	P
Aggregate Solar Installation Size by 2030	12	kW	P
Hours of daylight in a year (assume six hours of sunlight per day)	1,380	hrs/yr	H
Performance Ratio	80%		R
Ukiah Utilities, Electric Services Division 2010 CO2 Electricity emission factor	43.74	Metric Tons/MWh	Efa

Data Sources for Resource Savings and GHG Calculations

New Oakdale development square footage projections: Oakdale General Plan Update 2012

Projection of GHG Emissions for California Utilities: http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/GHG_Emission_Factor_Guidance.pdf

Residential and commercial electric and natural gas rates. http://www.pge.com/about/news/topics/ratereduction.shtml

1. Resource Savings:

Increase Municipal Renewable Energy:

Electricity Savings (kWh): P x H x R x F

Total electricity savings by 2020=	4,416	kwh
Total electricity savings by 2030=	13,248	kwh

2. GHG Calculations:

Total Emissions Savings (MT)= (Se/1000*Efa/1000)

Se = total electricity savings (kWh)

1000 kWh/MWh

1000 kg/MT

Total GHG Emissions Savings by 2020=	0.2	metric tons CO2
Total GHG Emissions Savings by 2030=	1	metric tons CO2

Strategy GHG and Cost Analysis Worksheet: E.3.1

Strategy Name	**Increase Local Education and Outreach**
Emissions Category	Energy
Strategy Description	**Action E-3.1a:** Promote existing residential and nonresidential energy efficiency programs, and rebates for solar PV; consider establishing a Committee on Energy and the Environment to assist in promotion activities and/or develop and operate a local public education and/or a direct financing program. **Action E-3.1b:** Increase City staff knowledge and training opportunities related to energy efficiency and renewable energy, and dedicate staff time to outreach and education regarding existing programs and financing mechanisms. **Action E-3.1c:** Collaborate with local groups and interested organizations to facilitate community outreach and education. **Action E-3.1d:** Develop a low-cost local education campaign to promote nonresidential energy efficiency improvements, and conduct at least two events per year to educate the community about energy efficiency options.

Note: No emissions quantified for this strategy.

Strategy GHG and Cost Analysis Worksheet: E.3.2

Strategy Name	Establish Regional Renewable Energy Partnerships
Emissions Category	Energy
Strategy Description	**Action E-3.2a:** Promote existing residential and nonresidential energy efficiency programs and rebates for solar PV; consider establishing a Committee on Energy and the Environment to assist in promotion activities and/or develop and operate a local public education. **Action E-3.2b:** Work with the County and other cities in the region, Mendocino College, and other organizations, to explore strategies for developing renewable energy resources and to develop a valley-wide clean/green industry and jobs development strategy. ***Note:*** *Resource savings calculations below take into account an interpretation of the impact of Action E-2.3a (within the Average Solar Installation Size and Number of New Solar PV Systems* that make up the Establish Regional Renewable Energy Partnerships equation).

Key Assumptions for Resource Savings and GHG Calculations			
Description	**#**	**Unit**	**Equation Variable**
Average solar installation size[1]	4	kW	P
Number of new solar systems by 2020	0	systems	S_{2020}
Number of new solar systems by 2030	0	systems	S_{2020}
Performance Ratio	80%		R
Hours of daylight in a year (assume six hours of sunlight per day)	2,920	hrs/yr	H

[1]California Solar Initiative Average Solar Installation Size: http://www.pge.com/includes/docs/pdfs/myhome/saveenergymoney/solarenergy/solar_consumer_guide.pdf (pg. 8

Data Sources for Resource Savings and GHG Calculations
Residential and commercial electric and natural gas rates. http://www.pge.com/about/news/topics/ratereduction.shtml
Solar capacity factor. http://en.wikipedia.org/wiki/Solar_power_in_California

1. Resource Savings:

Establish Regional Renewable Energy Partnerships:		
Energy Savings (kWh): S x P x R x E x H		
Total electricity savings by 2020=	0	
Total commercial electricity savings by 2030=	0	kwh

2. GHG Calculations:

Total Emissions Savings (MT)= (Se/1000×0.13)		
Se = total electricity savings (kWh)		
1000 = conversion factor for kWh to MWh (electricity equation) or from kg to metric tons (natural gas equation)		
55.83 projected PG&E emission factor in 2020		
Total GHG Emissions Savings by 2020=	0	metric tons CO2
Total GHG Emissions Savings by 2030=	0	metric tons CO2

Transportation and Land Use

Summary Table

Code	Strategy Name	GHG Reduction in 2020 (MT CO2)	% of Total Reductions in 2020	GHG Reduction in 2030 (MT CO2)	Relative GHG Benefit	Relative Cost	Implementation Priority
1. Reduce Single-Occupancy Vehicle Travel							
Strategy TL.1.1	Local Commute Trip Reduction	88	9.3%	190	med	med	2
Strategy TL.1.2	Sustainable Growth Patterns	616	65.2%	857	high	high	2
Strategy TL.1.3	Regional Transportation Management	-	0.0%	-			
Strategy TL.1.4	Public Transit Expansion	-	0.0%	-			
2. Increase Non-motorized Travel							
Strategy TL.2.1	Improve Bicycle and Pedestrian Infrastructure	22	2.3%	37	med	med	2
Strategy TL.2.2	Establish Safe Routes to School	173	18.4%	375	high	med	1
3. Increase Motor Vehicle Efficiency							
Strategy TL.3.1	Improve Municipal Fleet Fuel Efficiency	45	4.7%	131	med	low	2
	Totals:	**944**	**100%**	**1,590**			

Prioritization of Community Strategies

		Costs		
		Low	Medium	High
Benefits	High	1	1	2
	Medium	1	2	3
	Low	2	3	3

Transportation Common Factors

Note: Pale Yellow fields denote common factors that are not subject to being tweaked by the City. Green fields denote factors that can be modified based on the City's commitment to an action or set of actions.

	#	Unit	Direct Data Source
Basic Unit Factors			
Hours in a year	8,760	hrs/yr	
Elasticity of VMT with respect to density (from: Boarnet and Handy, 2010)	0.07		Boarnet and Handy, 2010 (See CAPCOA guidance - CAPCOA: Quantifying Greenhouse Gas Mitigation Measures).
Mendocino County Annual Tons CO2/day (EMFAC 2011) for 2020	2,017	Tons CO2/day	EMFAC 2011
Mendocino County Annual VMT/day (EMFAC 2011) for 2020	3,173,549	VMT/day	EMFAC 2011
Mendocino County Annual Tons CO2/day (EMFAC 2011) for 2030	2,174	Tons CO2/day	EMFAC 2011
Mendocino County Annual VMT/day (EMFAC 2011) for 2030	3,513,109	VMT/day	EMFAC 2011
Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020	0.0005766	MT CO2/VMT	Derived from Annual VMT/day and Annual Tons/day (from EMFAC); multipled by MT/short ton.
Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2030	0.0005614	MT CO2/VMT	
Metric Tons per Short Ton	0.91	MT/Ton	
VMT			
Total Annual VMT in 2005	140,333,086	VMT/year	Reverse projected based on an averge of population, housing, and employment growth factors.
Total Annual VMT in 2010	138,522,053	VMT/year	Source: Fehr & Peers
Total Annual VMT in 2020	152,560,979	VMT/year	Source: Fehr & Peers
Total Annual VMT in 2030	169,514,358	VMT/year	Source: Fehr & Peers
Total Annual VMT in 2035	176,893,313	VMT/year	Source: Fehr & Peers
Total Commute VMT in 2005	38,872,265	VMT/year	Nationwide, 27.7% of all VMT are commute trips (USDOT, Summary of Travel Trends 2009, Table 24, p. 44
Total Commute VMT in 2020	42,259,391	VMT/year	Nationwide, 27.7% of all VMT are commute trips (USDOT, Summary of Travel Trends 2009, Table 24, p. 44
Total Commute VMT in 2030	46,955,477	VMT/year	Nationwide, 27.7% of all VMT are commute trips (USDOT, Summary of Travel Trends 2009, Table 24, p. 44
Total Commute VMT in 2035	48,999,448	VMT/year	Nationwide, 27.7% of all VMT are commute trips (USDOT, Summary of Travel Trends 2009, Table 24, p. 44
Total Highway VMT in 2005	85,055,883	VMT/year	In 2005, 60.61 percent of all VMT in Stanislaus was on state highways (Caltrans MVSTAFF05, Appendix B
Total Highway VMT in 2020	92,467,209	VMT/year	In 2005, 60.61 percent of all VMT in Stanislaus was on state highways (Caltrans MVSTAFF05, Appendix B
Total Highway VMT in 2030	102,742,652	VMT/year	In 2005, 60.61 percent of all VMT in Stanislaus was on state highways (Caltrans MVSTAFF05, Appendix B
Total Highway VMT in 2035	107,215,037	VMT/year	In 2005, 60.61 percent of all VMT in Stanislaus was on state highways (Caltrans MVSTAFF05, Appendix B
GHG Emission Factors			
Ukiah Utilities, Electric Services Division 2005 Electricity emission factor (lbs/kWh)	16.3601	kg CO2/MMBtu	Derived from City-provided electricity consumption data
Ukiah Utilities, Electric Services Division 2005 Electricity emission factor (MT/MWh)	0.0103	kg CH4/MMBTU	Derived from City-provided electricity consumption data
Ukiah Utilities, Electric Services Division 2005 Electricity emission factor (lbs/MWh)	0.0002	kg N2O/MMBTU	Derived from City-provided electricity consumption data
Ukiah Utilities, Electric Services Division 2010 Electricity emission factor (lbs/kWh)	12.8178	kg CO2/MMBtu	Derived from City-provided electricity consumption data
Ukiah Utilities, Electric Services Division 2010 Electricity emission factor (MT/MWh)	0.0066	kg CH4/MMBTU	Derived from City-provided electricity consumption data
Ukiah Utilities, Electric Services Division 2010 Electricity emission factor (lbs/MWh)	0.0001	kg N2O/MMBTU	Derived from City-provided electricity consumption data
Natural Gas emission factor (kg/MMBtu)	53.0200	kg CO2/MMBtu	LGOP, Table G.1, 'Pipeline (US Weighted average)'
Natural Gas emission factor (kg/MMBtu)	0.0050	kg CH4/MMBTU	LGOP, Table G.3, 'Commercial' and 'Residential'
Natural Gas emission factor (kg/MMBtu)	0.0001	kg N2O/MMBTu	LGOP, Table G.3, 'Commercial' and 'Residential'
Projected City Growth Factors			
City of Ukiah Square Mileage	4.72	sq. mile	Source: City of Ukiah MSR (Year 2011)
City of Ukiah Acres in 2005	3,021	Acres	Assumes City does not grow in size from 2005 by 2020
City of Ukiah Acres in 2020	3,021	Acres	Assumes City does not grow in size from 2005 by 2030
City of Ukiah Acres in 2030	3,021	Acres	
Total # of housing units in 2005	6,389	Housing Units	Source: California Department of Finance
Total # of housing units in 2020	6,747	Housing Units	Based on Projected Housing Growth from 2005 to 2020, with data from the MCOG Model Data (See Fehr & Peers VMT Inventory Memo, Table 1)
Total # of housing units in 2030	6,987	Housing Units	Based on Projected Housing Growth from 2005 to 2020, with data from the MCOG Model Data (See Fehr & Peers VMT Inventory Memo, Table 1)
Housing Units per Acre in 2005	2.12	units per acre	Housing/City Acreage
Housing Units per Acre in 2020	2.23	units per acre	Housing/City Acreage
Housing Units per Acre in 2030	2.31	units per acre	Housing/City Acreage
2005 Residential Square Feet	9,251,272	square ft	Number of Housing Units*Average Sq. Ft. Per Residential Unit
2020 Residential Square Feet	9,989,110	square ft	Number of Housing Units*Average Sq. Ft. Per Residential Unit
2030 Residential Square Feet	10,483,750	square ft	Number of Housing Units*Average Sq. Ft. Per Residential Unit
Cost Factors			
BLS U.S. Department of Labor: Average Mendocino County Salary	$ 40,768.00	Salary	based on Bureau of Labor Statistics U.S. Department of Labor, County Employement and Wages (News Release). Released on March 28, 2012.
BLS U.S. Department of Labor: Average Mendocino County Hourly Rate	$ 20.22	Hourly Rate	based on Bureau of Labor Statistics U.S. Department of Labor, County Employement and Wages (News Release). Released on March 28, 2012.
Other			
Year 2005 Ukiah Average Gasoline Vehicle Fleet Fuel Economy (MPG)	19.44		Source: EMFAC 2011
Year 2005 Ukiah Average Diesel Vehicle Fleet Fuel Economy (MPG)	6.99		Source: EMFAC 2011
Year 2005 Ukiah Average Overall Vehicle Fleet Fuel Economy (MPG)	18.57		Source: EMFAC 2011. Note: Assuming 93% gasoline, 7% diesel, per the ICLEI 2012 U.S. Community Protocol, Appendix D, Table TR.1.3: Default Vehicle mix values
Year 2020 Ukiah Average Gasoline Vehicle Fleet Fuel Economy (MPG)	18.88		Source: EMFAC 2011
Year 2020 Ukiah Average Diesel Vehicle Fleet Fuel Economy (MPG)	8.00		Source: EMFAC 2011
Year 2020 Ukiah Average Overall Vehicle Fleet Fuel Economy (MPG)	18.12		Source: EMFAC 2011. Note: Assuming 93% gasoline, 7% diesel, per the ICLEI 2012 U.S. Community Protocol, Appendix D, Table TR.1.3: Default Vehicle mix values
Year 2005 Ukiah Annual Average VMT per Vehicle	12,082		See U.S. DOT Federal Highway Administration, Highway Statistics 2005 Table: http://www.fhwa.dot.gov/policy/ohim/hs05/htm/vm1.htm
Year 2020 Ukiah Annual Average VMT per Vehicle	12,082		Assuming same as in 2005

GHG and Cost Analysis Worksheet: TL.1.1

Strategy Name	**Local Commute Trip Reduction**
Emissions Category	Transportation and Land Use
Strategy Description	**Action TL-1.1a:** Consider implementing local commute trip reduction requirements in the municipal code. This could require larger employers (50+ employees) to establish TDM programs to reduce single-occupancy vehicle trips, which may include 9/80 work weeks, carpooling, telecommuting, car sharing, bike sharing, shuttles, vanpooling, guaranteed rides home, etc. **Action TL-1.1b:** Consider a coordinated TDM program covering large employers and concentrations of smaller employers (e.g., shopping malls) to share costs and also travel pool (e.g. vanpooling, carpooling and/or shuttles for the Medical Center and other key employers). **Action TL-1.1c:** As staff and resources allow, develop a City Program (with incentives) to encourage private sector employers to implement effective voluntary trip reduction programs. **Action TL-1.1d:** Promote telecommuting and alternative work schedules for City employees. **Note:** Fehr & Peers Calculated VMT Reduction.

2020 GHG Reduction Potential	med	[low = <20 ; med = 20 to 100; high = >100]
Annual cost by 2020 (to City)	med	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff time

Key Assumptions for Resource Savings and GHG Calculations

Based on the limitations of the regional MCOG travel demand model to respond to CAP transportation strategies, such as traffic calming and complete streets ordinances, the model was not used to estimate VMT reductions from transportation strategies. Quantification was conducted using off-model tools and factors, including CAPCOA guidelines and TDM+, a spreadsheet tool developed by Fehr & Peers. See Fehr & Peers memo of 6/28/13, entitle "City of Ukiah – Quantitative Analysis of Strategies," for details.

A range of efectiveness for this strategy was considered; The low end of the range should be used if the strategy is based on prmotion & encouragement while the higher range of effectiveness should be used if the strategy has an implementation plan or will be required.

Description	#	Unit	Equation Variable	
Year 2020 'Low' VMT Reduction	0.1%	%	Y	Source: Fehr & Peers Transportation Strategies Memo
Year 2020 'High' VMT Reduction	0.9%	%	Z	Source: Fehr & Peers Transportation Strategies Memo
Year 2035 'Low' VMT Reduction	0.2%	%	Y	Source: Fehr & Peers Transportation Strategies Memo
Year 2035 'High' VMT Reduction	1.3%	%	Z	Source: Fehr & Peers Transportation Strategies Memo
Total Annual VMT in 2020	152,560,979		T	
Total Annual VMT in 2030	169,514,358		T	
Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020	0.000577	MT CO2/VMT	Cef	
Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2030	0.000561	MT CO2/VMT	Cef	

Assuming an average of Fehr & Peers 'Low' and 'High' scenarios for VMT reduction

1. Resource Savings:

Sustainable Growth Patterns: VMT Reduction = Average(Y, Z) x T		
Low VMT Reduction by 2020=	152,561	VMT
Low VMT Reduction by 2035=	339,029	VMT
High VMT Reduction by 2020=	1,373,049	VMT
High VMT Reduction by 2035=	2,203,687	VMT
Average VMT Reduction by 2020=	762,805	VMT
Average VMT Reduction by 2035=	1,271,358	VMT

2. GHG Calculations:

Total Emissions Savings (MT)= VMT Reduction x Cef		
Low GHG Savings by 2020=	88	metric tons CO2
Low GHG Savings by 2035=	190	metric tons CO2
High GHG Savings by 2020=	792	metric tons CO2
High GHG Savings by 2035=	1237	metric tons CO2
Average GHG Savings by 2020=	440	metric tons CO2
Average GHG Savings by 2035=	714	metric tons CO2

GHG and Cost Analysis Worksheet: TL.1.2

Strategy Name	**Sustainable Growth Patterns**
Emissions Category	Transportation and Land Use
Strategy Description	**Action TL-1.2a:** Consider adopting a Complete Streets Ordinance that directs the City to meet the needs of all of its transportation users. **Action TL-1.2b:** Continue to consider modifications to the municipal code to achieve smart growth objectives (i.e., increase density and mixed-use infill development). **Action TL-1.2c:** Implement SmartCode or form-based code to increase mixed use and pedestrian connectivity in urban core near transit. **Action TL-1.2d:** Promote and encourage downtown revitalization and the vitality of small local businesses in the downtown core area. **Action TL-1.2e:** Encourage smart growth development by eliminating or reducing minimum parking requirements, creating maximum parking requirements, and providing shared parking. **Action TL-1.2f:** Implement traffic calming measures within the downtown core, such as curb extensions (bulb-outs) and rumble strips. **Action TL-1.2g**: Promote and encourage clean energy and green jobs/industries with within the City and in its Sphere of Influence. **Action TL-1.2h:** Develop a plan for creating urban open spaces and natural resources enhancement to complement the compact infill development and mixed use growth strategy. Note: Fehr & Peers Calculated VMT Reduction.
2020 GHG Reduction Potential high	[low = <20 ; med = 20 to 100; high = >100]
Annual cost by 2020 (to City) high	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff time

Key Assumptions for Resource Savings and GHG Calculations

Based on the limitations of the regional MCOG travel demand model to respond to CAP transportation strategies, such as traffic calming and complete streets ordinances, the model was not used to estimate VMT reductions from transportation strategies. Quantification was conducted using off-model tools and factors, including CAPCOA guidelines and TDM+, a spreadsheet tool developed by Fehr & Peers. See Fehr & Peers memo of 6/28/13, entitle "City of Ukiah – Quantitative Analysis of Strategies," for details.

A range of efectiveness for this strategy was considered; The low end of the range should be used if the strategy is based on prmotion & encouragement while the higher range of effectiveness should be used if the strategy has an implementation plan or will be required.

Description	#	Unit	Equation Variable	
Year 2020 'Low' VMT Reduction	0.7%	%	Y	Source: Fehr & Peers Transportation Strategies Memo
Year 2020 'High' VMT Reduction	1.6%	%	Z	Source: Fehr & Peers Transportation Strategies Memo
Year 2035 'Low' VMT Reduction	0.9%	%	Y	Source: Fehr & Peers Transportation Strategies Memo
Year 2035 'High' VMT Reduction	2.1%	%	Z	Source: Fehr & Peers Transportation Strategies Memo
Total Annual VMT in 2020	152,560,979		T	
Total Annual VMT in 2030	169,514,358		T	
Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020	0.000577	MT CO2/VMT	Cef	
Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2035	0.000561	MT CO2/VMT	Cef	

Assuming an average of Fehr & Peers 'Low' and 'High' scenarios for VMT reduction

1. Resource Savings:

Sustainable Growth Patterns: VMT Reduction = Average(Y, Z) x T		
Low VMT Reduction by 2020=	1,067,927	VMT
Low VMT Reduction by 2035=	1,525,629	VMT
High VMT Reduction by 2020=	2,440,976	VMT
High VMT Reduction by 2035=	3,559,802	VMT
Average VMT Reduction by 2020=	1,754,451	VMT
Average VMT Reduction by 2035=	2,542,715	VMT

2. GHG Calculations:

Total Emissions Savings (MT)= VMT Reduction x Cef		
Low GHG Savings by 2020=	616	metric tons CO2
Low GHG Savings by 2035=	857	metric tons CO2
High GHG Savings by 2020=	1408	metric tons CO2
High GHG Savings by 2035=	1999	metric tons CO2
Average GHG Savings by 2020=	1012	metric tons CO2
Average GHG Savings by 2035=	1428	metric tons CO2

GHG and Cost Analysis Worksheet: T.1.3

Strategy Name	**Regional Transportation Management**
Emissions Category	Transportation and Land Use
Strategy Description	**Action TL-1.3a:** Coordinate with Mendocino County and cities within the County to encourage alternatives to SOV travel.

Note: Supporting Strategy - not quantified.

GHG and Cost Analysis Worksheet: T.1.4

Strategy Name	**Public Transit Expansion**
Emissions Category	Transportation and Land Use
Strategy Description	**Action TL-1.4a:** Coordinate with Mendocino Transit Authority (and/or other transit agencies) to increase transit system ridership with incentives, safety and technology improvements, improved bus stop amenities, partnerships, and investments (e.g., coordinate to increase bus frequency and the number of pick-up locations in Ukiah). **Action TL-1.4b:** Promote existing and/or additional "Reduced Fares" for residents (i.e., school children, elderly). **Action TL-1.4c:** Encourage residents to use the existing Dial-A-Ride transit.

Note: Supporting Strategy - not quantified.

GHG and Cost Analysis Worksheet: TL.2.1

Strategy Name	**Improve Bicycle and Pedestrian Infrastructure**
Emissions Category	Transportation and Land Use
Strategy Description	**Action TL-2.1a:** Install bicycle support facilities at public locations, transit hubs, and the downtown core. **Action TL-2.1b:** Improve the bicycle network to make it friendlier for cyclists (i.e., update and implement the Bicycle and Pedestrian Master Plan). **Action TL-2.1c:** Identify street right-of-way reconstruction projects and costs for developing bike paths and lanes. **Action TL-2.1d:** Consider a variety of strategies for funding bicycle and pedestrian improvements, such as development density bonuses, expedited planning permits review, development impact fees, etc. **Action TL-2.1e:** Evaluate opportunities to encourage walkable/bikable corridors. **Action TL-2.1f:** Actively promote walking and biking as safe and healthy modes of travel. **Action TL-2.1g:** Consider the use of "sharrows" on selected key street corridors. **Action TL-2.1h:** Support and encourage local bicycle special events that promote bicycle use and healthy living, and contribute to the local economy, particularly those that include young people and that contribute to local economic development. **Note:** The Resource savings calculation below takes into account an interpretation of the impact of all of the above actions (within the *Miles of Bike Lanes Added* figure in the Bike Lane Expansion equation).

2020 GHG Reduction Potential	med	[low = <20 ; med = 20 to 100; high = >100]
Annual cost by 2020 (to City)	med	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff time

Key Assumptions for Resource Savings and GHG Calculations

Description	#	Unit	Equation Variable	
Commute VMT in 2020	42,259,391	VMT/year	V_{2020}	
Commute VMT in 2030	46,955,477	VMT/year	V_{2030}	
Miles of Bike Lanes Added between 2005 and 2020	4			Estimate based on current City of Ukiah bike network expansion trends a
Miles of Bike Lanes Added between 2005 and 2030	8			Estimate based on current City of Ukiah bike network expansion trends a
Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020	0.000577	MT CO2/VMT	Cef	
Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2030	0.000561	MT CO2/VMT	Cef	

Data Sources for Resource Savings and GHG Calculations

CAPCOA Quantifying Greenhouse Gas Mitigation Measures (Measure TRT-4 and SDT-6).

EMFAC 2011 model run, Mendocino County.

1. Resource Savings:

Bike Lane Expansion:
VMT Reduction =
For 2 miles of added bike lane: 0.05% GHG reduction
For 4 miles of added bike lane: 0.09 GHG reduction
For 8 miles of added bike lane: 0.14% GHG reduction
[Equation provided by CAPCOA (SDT-6)]

Assume maximum number of bike lanes added, yielding 0.14% VMT Reduction

VMT Reduction by 2020=	38,033	VMT
VMT Reduction by 2030=	65,738	VMT

2. GHG Calculations:

Total Emissions Savings (MT)= VMT Reduction x Cef

Total GHG Emissions Savings by 2020=	22	metric tons CO2
Total GHG Emissions Savings by 2030=	37	metric tons CO2

GHG and Cost Analysis Worksheet: TL.2.2

Strategy Name	**Establish Safe Routes to Schools**
Emissions Category	Transportation and Land Use
Strategy Description	**Action TL-2.2a:** Enhance pedestrian and bicycle facilities around schools. **Action TL-2.2b:** Utilize City resources to encourage and educate parents and students about the benefits of walking and biking to school. **Action TL-2.2c**: Implement traffic calming measures on identified Safe Routes to School routes. **Action TL-2.2d:** Add safety improvements to City transportation infrastructure along applicable routes. **Action TL-2.2e:** Continue to work closely with the Mendocino County Public Health Department to promote walking and biking and healthy alternatives for school children **Note:** The Resource savings calculation below takes into account an interpretation of the impact of Action T-2.2a (within the *Intersections with New Improvements* percentage and the *Streets with New Improvements* percentage that make up the Street Improvements equation).
2020 GHG Reduction Potential	high [low = <20 ; med = 20 to 100; high = >100]
Annual cost by 2020 (to City)	med [low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff time

Key Assumptions for Resource Savings and GHG Calculations

Description	#	Unit	Equation Variable
Total VMT in 2020 minus Highway VMT in 2020	60,093,770	VMT/year	V_{2020}
Total VMT in 2030 minus Highway VMT in 2030	66,771,706	VMT/year	V_{2030}
% of intersections w/ new improvements in 2020 from 2005*	50%	%	See Table
% of Streets w/ new improvements in 2020 from 2005*	50%	%	See Table
% of intersections w/ new improvements in 2030 from 2005*	100%	%	See Table
% of Streets w/ new improvements in 2030 from 2005*	100%	%	See Table
Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020	0.000577	MT CO2/VMT	Cef_{2020}
Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2035	0.000561	MT CO2/VMT	Cef_{2030}

*Note: new improvements could include (but are not limited to) enhanced striping, bike lane additions, and inexpensive improvements to instrastructure safety (for example, by adding cones to dangerous streets or intersections).

Data Sources for Resource Savings and GHG Calculations

CAPCOA Quantifying Greenhouse Gas Mitigation Measures (Measure SDT-2).

EMFAC 2011 model run, Mendocino County.

1. Resource Savings:

Street Improvements: VMT Reduction = VMT x % Reduction in VMT (see CAPCOA SDT-2)

		% of Streets w/ Improvements			
		25%	**50%**	**75%**	**100%**
		% Reduction in Commute VMT			
% of intersections w/ improvements	**25%**	0.25%	0.25%	0.50%	0.50%
	50%	0.25%	0.50%	0.50%	0.75%
	75%		0.50%	0.75%	0.75%
	100%	0.50%	0.75%	0.75%	1.00%

VMT Reduction by 2020=	300,469	VMT
VMT Reduction by 2030=	667,717	VMT

2. GHG Calculations:

Total Emissions Savings (MT)= VMT Reduction x Cef

Total GHG Emissions Savings by 2020=	173	metric tons CO2
Total GHG Emissions Savings by 2030=	375	metric tons CO2

GHG and Cost Analysis Worksheet: Strategy TL.3.1

Strategy Name	**Improve Fuel Efficiency for Municipal Fleet**
Emissions Category	Transportation and Land Use
Strategy Description	**Action TL-3.1a:** Participate in City-wide marketing efforts for Clean Air Days, Bike-to-Work Days, Sunday Streets/Car-Free Sundays, etc. **Action TL-3.1b:** Consider setting aside funding and/or pursuing grant funding to replace the City fleet vehicles with additional electric, hybrid-electric, and alternative fuel vehicles. **Note:** Resource savings calculations below take into account an interpretation of the impact of all of the above actions (with the *Degree of Implementation* figures and the *Expected Average New Alternative/Hybrid Vehicle Fuel Economy* figure that make up the Improve Fuel Efficiency for Municipal Fleet equation).

2020 GHG Reduction Potential	med	[low = <20 ; med = 20 to 100; high = >100]
Annual cost by 2020 (to City)	low	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff time

Key Assumptions for Resource Savings and GHG Calculations

Description	#	Unit	Equation Variable
Degree of Implementation (# of City vehicles replaced w/ an electric powered model) between 2005 and 2020	10		D_a
Degree of Implementation (# of vehicles replaced w/ an electric powered model) between 2005 and 2030	30		D_b
Average Annual VMT per vehicle	12,082		A
Existing Fuel Economy	19.4		E
Expected Average New Alternative/Hybrid Vehicle Fuel Economy	54.5		F
Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2020	0.000577	MT CO2/VMT	Cef
Emission Factor; Annual MT CO2 per VMT (EMFAC 2011) for 2030	0.000561	MT CO2/VMT	Cef

Data Sources for Resource Savings and GHG Calculations

SEEC Community Inventory Tool, Reduction Measure: Transportation - Hybrid Vehicles. Available at: https://c.na5.visual.force.com/apex/ForecastMeasure

EMFAC 2011 model run, Mendocino County.

1. Resource Savings:

Improve Fuel Efficiency for Municipal Fleet:
VMT Reduction = D x A x (1-(E/F)) x R

VMT Reduction by 2020=	77,717	VMT
VMT Reduction by 2030=	233,151	VMT

2. GHG Calculations:

Total Emissions Savings (MT)= VMT Reduction x Cef

Total GHG Emissions Savings by 2020=	45	metric tons CO2
Total GHG Emissions Savings by 2030=	131	metric tons CO2

Solid Waste Strategies

Summary Table

		CO2 (MT)					
Code	**Strategy Name**	**GHG Reduction by 2020**	**% of Total Reductions in 2020**	**GHG Reduction by 2030**	**Relative GHG Benefit**	**Relative Cost**	**Implementation Priority**
Goal SW.1: Reduce Solid Waste Sent to Landfill							
Strategy SW.1.1	Increase Community Landfill Diversion Rate	1,686	99.0%	2,320	high	med	1
Strategy SW.1.2	Increase Municipal Operations Landfill Diversion Rate	17	1.0%	24	low	low	2
Goal SW.2: Reduce Municipal Operations Solid Waste Sent to Landfill							
	Explore Potential of Flaring Landfill Gas	NA		NA	NA	NA	
	Totals:	**1,703**	**100%**	**2,343**			

Prioritization of Community Strategies

		Costs		
		Low	Medium	High
Benefits	High	1	1	2
	Medium	1	2	3
	Low	2	3	3

Strategy GHG and Cost Analysis Worksheet: SW.1.1

Solid Waste Strategies

Strategy Name	**Increase Community Landfill Diversion Rate**
Emissions Category	Solid Waste
Strategy Description	**Action SW1.1a:** Develop a Community Waste Reduction Plan (i.e., Zero Waste Plan). **Action SW1.1b:** Work with the local hauler to increase curbside recycling rate and divert organics (food and/or green waste) from landfill. **Action SW1.1c:** Work with the local hauler and/or solid waste agency to ensure that services for solid waste collection, recycling and disposal meet the needs of the community. Improve composting programs. **Action SW1.1d:** Launch outreach campaigns to increase participation in residential and commercial recycling and composting programs, and to promote waste reduction. Work with the Mendocino Solid Waste Management Authority and the solid waste local hauler to distribute public education materials on solid waste source reduction, recycling and composting, and the proper handling of household hazardous waste. **Note:** Resource savings calculations below take into account an interpretation of all of the above actions (*within the Goal Diversion Rate factors)* in the Increase Community Landfill Diversion Rate equation.

2020 GHG Reduction Potential	high	[low = <20 ; med = 20 to 100; high = >100]
Annual cost by 2020 (to City)	med	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff time

Key Assumptions for Resource Savings and GHG Calculations

Description	#	Unit	Equation Variable
2005 Community Diversion Rate[1]	42%	%	
2005 Community Waste Generation Total (all waste, landfilled and not)[2]	30,686	Tons	
2005-2020 Estimate Growth in Waste Generation[3]	0.58%		
2020 Community Goal Diversion Rate	75%	%	
2020 Community Waste Generation Estimate (all waste, landfilled and not)	32,403	Tons	
2005-2020 Estimate Growth in Waste Generation[4]	0.55%		
2030 Community Goal Diversion Rate	85%	%	
2030 Community Waste Generation Total (all waste, landfilled and not)	34,216	Tons	
Factor: MT CO2e per ton of waste sent to landfill[5]	0.158		

[1]Note: 2006 used as a proxy year for 2005, since year 2005 diversion rate data was not available from CalRecycle)

[2]Source: http://www.calrecycle.ca.gov/LGCentral/reports/diversionprogram/JurisdictionDiversionDetail.aspx?JurisdictionID=548&Year=2007

[3]An average of expected population, employment, and household growth.

[4]An average of expected population, employment, and household growth.

[5]See Community Inventory Solid Waste sector for more detail. Based on Landgem run with Ukiah-specific parameters.

Increase Community Landfill Diversion Rate:

1. Landfill tons Savings:	1. Total Solid Waste Savings between (tons) =		
	Solid Waste saved between 2005 and 2020 (tons) =	10,693	tons
	Solid Waste saved between 2005 and 2030 (tons) =	14,713	tons
2. GHG Savings:	2. Total Solid Waste Savings in terms of MT CO2e =		
	Solid Waste saved between 2005 and 2020 (MT CO2e)	1,686	metric tons CO2e
	Solid Waste saved between 2005 and 2030 (MT CO2e) =	2,320	metric tons CO2e

Strategy GHG and Cost Analysis Worksheet: SW.1.2

Solid Waste Strategies

Strategy Name	**Increase Municipal Operations Landfill Diversion Rate**
Emissions Category	Solid Waste
Strategy Description	**Action SW1.2a:** Include municipal operations in the Community Waste Reduction Plan or Zero Waste Plan. **Action SW1.2b:** Work with the local hauler to expand recycling and organics diversion at City facilities. **Action SW1.2c:** Consider adopting an environmentally friendly purchasing policy for municipal operations. **Note:** Resource savings calculations below take into account an interpretation of all of the above actions (*within the Goal Diversion Rate factors)* in the Increase Municipal Operations Landfill Diversion Rate equation.

2020 GHG Reduction Potential	low	[low = <20 ; med = 20 to 100; high = >100]
Annual cost by 2020 (to City)	low	[low - <$10K ; med = $10K - $50K; high = >$50K] - Consider cost to CIty budget (first cost, annual cost) and staff time

Key Assumptions for Resource Savings and GHG Calculations

Description	#	Unit	Equation Variable
2006 Community Diversion Rate (used a proxy for municipal operations)[1]	42%	%	
2005 Estimated Municipal Operations Emissions from Solid Waste	48.04	MT CO2e	
2005-2020 Estimate Growth in Waste Generation[2]	0.7%		
2020 Estimated Municipal Operations Emissions from Solid Waste	51.34		
2005-2030 Estimate Growth in Waste Generation[3]	0.7%		
2020 Estimated Municipal Operations Emissions from Solid Waste	54.87		
2020 Goal Community Diversion Rate (used a proxy for municipal operations)	75%	%	
2030 Goal Community Diversion Rate (used a proxy for municipal operations)	85%	%	

[1]2006 used as a proxy year for 2005, since year 2005 diversion rate data was not available from CalRecycle)

[2]An average of expected population, employment, and household growth; same as used to project community solid waste emissions from 2010-2020 in the community inventory.

[3]An average of expected population, employment, and household growth; same as used to project community solid waste emissions from 2010-2020 in the community inventory.

Increase Municipal Operations Landfill Diversion Rate:

1. GHG Savings:

Solid Waste saved between 2005 and 2020 (MT CO2e) =	17	metric tons CO2e
Solid Waste saved between 2005 and 2030 (MT CO2e) =	24	metric tons CO2e

Appendix D

City of Ukiah Climate Action Plan Workshop, Public Survey and Results

ESA

City of Ukiah - Climate Action Plan Workshop (4/24/13)

Public Survey *(and Results)*

Help us understand how Ukiah can best accomplish its greenhouse gas reduction and climate change resilience goals!

Please complete the following survey (~10 minutes), and return it by May 23rd to:

City of Ukiah Climate Action Plan Project
c/o Jeff Caton, Environmental Science Associates
550 Kearny Street, Suite 800
San Francisco, CA 94108

You can also complete this survey online at: https://www.surveymonkey.com/s/RM9X6GP. Pass it on!

City of Ukiah Strategy	**Do you support this strategy?**			**Add Your Ideas and Feedback** *(e.g., What is missing; What is preventing you from currently using this strategy?)*
KINDS OF STRATEGIES	**Yes**	**Unsure**	**No**	**Comments**
Provide **outreach and education** to the community to encourage sustainable behaviors, and connect residents to existing resources and programs.	58	8	36	
Use **incentives** (financial, permit streamlining, public recognition, etc.) to foster beneficial actions and encourage sustainable practices.	50	12	38	
Develop **guidelines and programs** to encourage change (for example, a City program that expands bike lanes or secure bike parking).	44	9	48	
Change **City ordinances or municipal codes** (for example, an update to the building code that would require more efficient new buildings).	31	18	52	
TRANSPORTATION AND LAND USE	**Yes**	**Unsure**	**No**	**Comments**
Improve or expand alternative commute options:				
Carpooling	36	15		
Public Transit	48	6	40	
Bike-sharing	20	20	53	
Telecommuting	37	15	43	
Guaranteed Ride Home Program	22	28	43	
Improve Bicycle and Pedestrian Infrastructure:				
Add safety improvements and traffic calming measures.	36	15	41	
Implement city-wide bike share program.	18	18	56	
Add additional bike routes and strategically placed bike racks.	45	11	36	

City of Ukiah Strategy	Do you support this strategy?			Add Your Ideas and Feedback *(e.g., What is missing; What is preventing you from currently using this strategy?)*
TRANSPORTATION AND LAND USE	**Yes**	**Unsure**	**No**	**Comments**
Safe Routes to Schools: Increase opportunities for walking and cycling by schoolchildren to and from school.	65	8	22	
More public transit and/or better access to transit.	41	9	45	
More smart growth: higher density, mixed-use developments located near transit and city center; minimize development in outlying areas.	35	19	43	
Support and promote local businesses and local food to reduce goods transport.	53	9	34	
Increase City investment in alternative vehicle infrastructure (for example, electric vehicle charging stations).	26	14	56	
ENERGY	**Yes**	**Unsure**	**No**	**Comments**
Incentivize higher energy efficiency in new buildings (commercial and residential) through permit fast-tracking and local recognition/awards.	50	11	29	
Increase outreach and promotion of Ukiah Public Utilities' existing financing and rebate programs for renewable energy and residential and commercial energy efficiency.	58	8	23	
Revise municipal code for new commercial buildings to require higher energy efficiency standards than the state building code.	19	13	57	
Revise municipal code for new residential buildings to require higher energy efficiency standards than the state building code.	14	15	61	
Develop a local "Green Business" program or outreach campaign to promote energy efficiency in commercial buildings.	39	13	38	
Use point-of-sale energy use disclosure or energy efficiency audit to motivate efficiency upgrades, for residential and commercial buildings.	18	17	54	
Reduce urban heat island effects through municipal ordinance for light covered pavements and shade tree coverage.	34	12	44	
Promote small-scale on-site solar energy systems for homes.	43	9	38	
Promote small-scale on-site solar energy systems for commercial and industrial sites.	45	9	34	
Promote clean energy economy and associated "green collar" job development.	37	16	37	
Join Mendocino County's residential Property Assessed Clean Energy (PACE) program that allows home owners to finance energy improvements through loans that are paid back as a surcharge on property tax bill.	39	14	37	

City of Ukiah Strategy	Do you support this strategy?			Add Your Ideas and Feedback *(e.g., What is missing; What is preventing you from currently using this strategy?)*
SOLID WASTE	**Yes**	**Unsure**	**No**	**Comments**
Develop and implement a Zero Waste Plan to divert as much solid waste as possible from landfill. (City Zero Waste Resolution No. 2013-06 was adopted March 6, 2013.)	41	14	31	
Work with the local hauler and/or solid waste agency to ensure the right mix of services is available to maximize recycling and the collection & processing of food waste and other organics.	61	9	17	
Improve and/or expand composting programs.	54	11	23	
Improve diversion and reuse of construction waste.	54	11	23	
Expand collection of organics and food waste for beneficial use (e.g., energy or compost).	55	12	21	
Assess the feasibility of flaring the landfill gas (methane) currently extracted at the City-owned landfill (now closed) to reduce the global warming potential of the gas.	35	23	28	
Adopt an environmentally friendly purchasing policy for municipal operations, to maximize recycled content and minimize materials sent to landfill.	42	13	32	
WATER	**Yes**	**Unsure**	**No**	**Comments**
Increase public education and outreach on the need for water conservation, and ways to conserve water.	45	6	35	
Promote rebates for water efficient plumbing fixtures for commercial and residential buildings.	53	8	23	
Adopt a water efficient landscaping ordinance.	27	16	43	
Promote installation of purple (i.e., recycled water) pipes for public and private projects.	45	21	20	
Expand use of recycled water.	57	18	11	
PREPARING FOR CLIMATE CHANGE	**Yes**	**Unsure**	**No**	**Comments**
Increase Public Awareness: engage and educate the community about the expected impacts and need for better planning.	40	9	34	
Partner or collaborate with State and regional agencies, and other communities to assess climate change vulnerabilities and develop strategies and funding mechanisms for adaptation.	28	16	40	
Perform a detailed vulnerability analysis to assess potential local climate change impacts to infrastructure, economy, vulnerable communities and natural systems.	20	17	48	
Develop a standalone Climate Change Adaptation Plan that contains vulnerability analysis and adaptation strategies appropriate for Ukiah. Include cost estimates and prioritize actions to increase local resilience of City infrastructure and critical assets, including natural systems like wetlands and urban forests.	18	15	51	

City of Ukiah Strategy	Do you support this strategy?			Add Your Ideas and Feedback *(e.g., What is missing; What is preventing you from currently using this strategy?)*
PREPARING FOR CLIMATE CHANGE (cont.)	**Yes**	**Unsure**	**No**	**Comments**
Amend Ukiah General Plan to codify goals, objectives, and polices related to climate change adaptation.	19	15	49	
Amend the Mendocino County Multi-Hazard Mitigation Plan to include climate change hazards and adaptation strategies for Ukiah related to wildfires, flooding, coastal storms and erosion, drought, and heat emergencies.	28	13	43	
Participate in the North Coast Integrated Regional Water Management (IRWM) process to further adaptation strategy development and implementation. IRWM is potential source of funding.	28	23	33	
Take specific actions now, including:				
Provide water recycling education programs for residences and commercial buildings, including grey-water systems and water efficient landscaping.	48	8	29	
Support water reclamation and reuse projects, and increase capacity for community water storage.	60	6	19	
Establish cooling centers, especially for vulnerable populations.	21	13	51	
Reduce urban heat islands through use of cool roofs and lightly colored pavements (energy efficiency co-benefit), and targeted tree planting in large paved areas.	33	8	44	
Implement measures to reduce risk of urban fires and wildfires.	46	10	29	
Build communications and public warning system and response plans for extreme heat and weather events.	26	14	44	
Integrate local flood management plans with adaptation planning.	35	17	33	
Promote conservation of local and nearby agricultural land.	44	11	30	
Evaluate existing energy efficiency and demand-response programs for their effectiveness at reducing peak electricity demand during extreme heat events.	40	15	29	
Additional	**Yes**	**Unsure**	**No**	
I am a Ukiah Resident	59			
I am a Ukiah Business Owner	30			
I work in Ukiah	61			
Skipped Question	24			