City of Fort Bragg

DRAFT
Climate Action Plan

2012

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Acronyms

CBSC	California Building Standards Commission
CACP	Clean Air Climate Protection
CAP	Climate Action Plan
CCP	Cities for Climate Protection
GHG	greenhouse gas
HVAC	Heating, ventilating, and air conditioning
ICLEI	Local Governments for Sustainability[1]
HPS	high-pressure sodium
kWh	Kilowatt hours
LEED	Leadership in Energy and Environmental Design
LED	Light emitting diode
LPG	Liquid petroleum gas
$MTCO_2E$	metric tonnes of carbon dioxide equivalent
PG&E	Pacific Gas and Electric
PV	photovoltaic
VMT	vehicle miles traveled

[1] Formerly the International Council for Local Environmental Initiatives

Introduction

1.1 Climate Change and the City of Fort Bragg

For the past several years the City of Fort Bragg has been planning and implementing strategies to reduce our carbon impact. The science, policy directives, and potential options to address climate change are constantly evolving. This Climate Action Plan provides a tool to guide the community's direction in responsibly addressing climate change and greenhouse gas reductions.

1.1.1 Global Impacts of Climate Change[2]

Global climate change is one of the defining issues of the 21st Century. Science has shown that industrialization and our modern way of life, with its reliance on the combustion of fossil fuels have significantly increased the amount of carbon dioxide and other greenhouse gases (GHGs) in our atmosphere. We are beginning to understand the implications of these greenhouse gas emissions for our planet: namely, warmer days and nights; more intense storms; changing seasons; more severe droughts; melting glaciers; and rising oceans. The impacts of these physical changes on the Earth's inhabitants are less well understood; however, scientists, citizens, and leaders around the world have identified a range of concerns, including compromised freshwater supplies, reduced agricultural production, major species extinction, and significant risks to coastal communities and major population centers from rising sea levels and stronger hurricanes.[3]

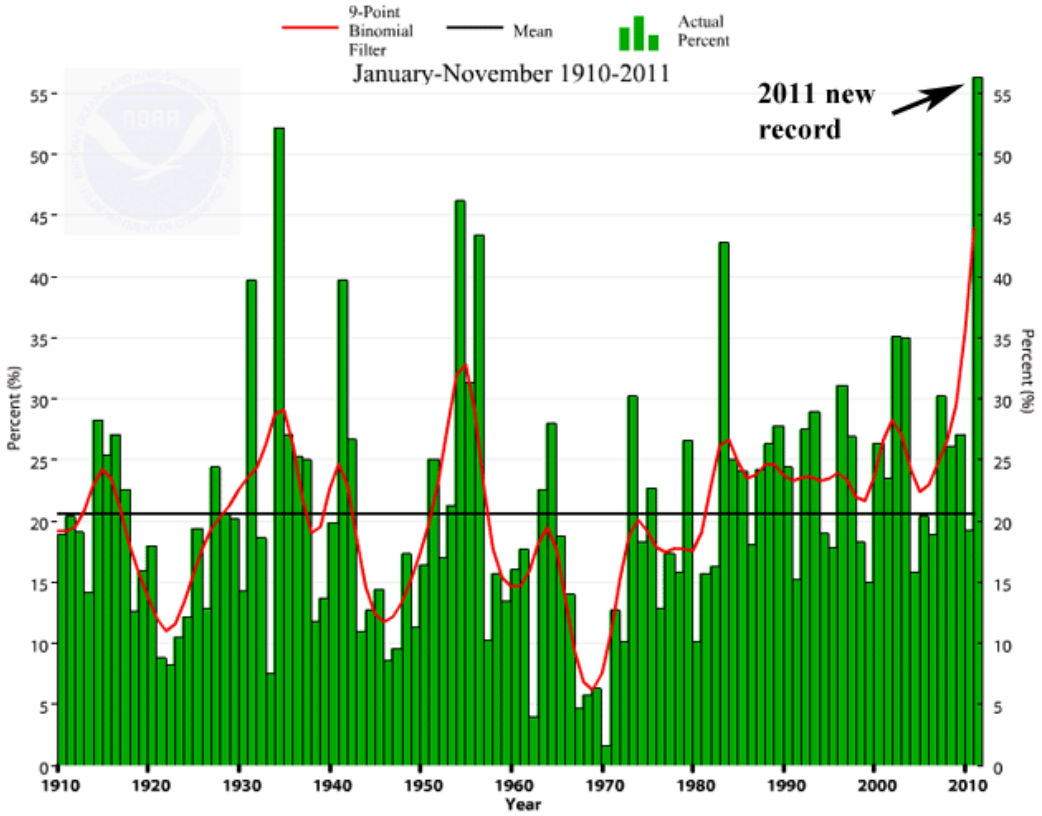
The Intergovernmental Panel on Climate Change (IPCC) has stated in its 2007 Synthesis Report that:

> 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.

The year 2011 showed the greatest weather extremes in our history. Approximately 56 percent of the country was either in drought or flood during some portion of the year. The nation suffered 14 weather disasters, each causing $1 billion or more in damage during 2011 (the old record was nine).[4] Figure 1 below, provided by the National Oceanic and Atmospheric Administration (NOAA) shows the percentage of the US in drought or extreme wet conditions for the past 100 years.

[2] Much of the discussion regarding global impacts of climate change comes from the City of Santa Cruz Climate Action Plan, and is used with their permission.
[3] *Mayor's Greenprint* Denver Advisory Council, 2007
[4] *What NASA's Blue Marble Photo Reveals About Climate Change*, Mother Jones, 2012

Figure 1: Percent of U.S. in Severe Drought or Extremely Wet



Since 1957, there have been fewer cold days and nights and an increase in hot days and nights. The temperature increase is widespread over the globe and is greater at higher northern latitudes. Average Arctic temperatures have increased at almost twice the global average rate in the past 100 years. Since 1961, observations show that the average temperature of the global ocean has increased to depths of at least 3000m. The IPCC has linked this seemingly small increase in global temperature to a wide array of changes to our natural world including a widespread decrease in the amount of snow cover and thickness and range of glaciers across the globe. Since 1978, the Arctic ice cap has decreased in size by about 3% per year with an average summer decrease of 7.4%. A 10% decrease in global snow cover and earlier spring thaws of rivers and lakes in the northern hemisphere have also been observed. Over the past 50 years, heat waves and serious rain events have been more common and in the past 30 years, there has been an increase in the number of northern Atlantic tropical storms. Global average sea level rose at an average of about 3.1 mm per year from 1993 to 2003.[5]

Regional Climate Changes. Latitude is a good starting point for considering how changes in climate will affect a region. For example, while warming is expected everywhere on Earth, the amount of projected warming generally increases from the tropics to the poles in the Northern Hemisphere. Precipitation is more complex, but also has some latitude-dependent features. At latitudes adjacent to the polar regions, precipitation is projected to increase, while decreases are projected in many regions

[5] Intergovernmental Panel on Climate Change. Climate Change 2007: Synthesis Report

adjacent to the tropics. Increases in tropical precipitation are projected during rainy seasons (e.g., monsoons), and over the tropical Pacific in particular. Changes in regional climatic conditions will result in the following trends:

1. **Higher temperatures overall.** High temperatures are to blame for an increase in heat-related deaths and illness, rising seas, increased storm intensity, and many of the other dangerous consequences of climate change, During the 20th century, the Earth's average temperature rose one degree Fahrenheit to its highest level in the past four centuries – believed to be the fastest rise in a thousand years. Scientists project that if emissions of heat-trapping carbon emissions aren't reduced, average surface temperatures could increase by a net of 3 to 10 degrees Fahrenheit by the end of the century. However the net increase in temperature will manifest variably around the globe: a one-degree increase may be found in one place, a 12-degree increase in another place, and yet other areas may become much colder.
2. **Rising Sea Levels**. Sea levels have risen between four and eight inches in the past 100 years. Current projections suggest that sea levels could continue to rise between 4 inches and 36 inches over the next 100 years. A 36-inch increase in sea levels would swamp *every* city on the East Coast of the United States, from Miami to Boston. Worldwide, approximately 100 million people live within three feet of sea level.
3. **Increased frequency of 100-year events.** Events that used to happen on a 100 year cycle (drought, high temperature, low temperature, rainfall, etc) are anticipated to happen on a ten year cycle. As temperatures rise globally, droughts will become more frequent and more severe, with potentially devastating consequences for agriculture, water supply and human health. This phenomenon has already been observed in some parts of Asia and Africa, where droughts have become longer and more intense and contributed to increasing rates of desertification. Hot temperatures and dry conditions also increase the likelihood of forest fires. In the conifer forests of the western United States, earlier snowmelts, longer summers and an increase in spring and summer temperatures have increased fire frequency by 400 percent and have increased the amount of land burned by 650 percent since 1970.
4. **Increase rates of species extinction**, which are already the highest in the earth's history, and corresponding decreased biological diversity and decreased biome stability. The rapid nature of climate change is likely to exceed the ability of many species to migrate or adjust. Experts predict that one-fourth (25%) of Earth's species will be headed for extinction by 2050 if the warming trend continues at its current rate.
5. **Increases in ocean acidification** which reduces the amount of carbonate ions in the water, which many shell-building organisms combine with calcium to create the calcium carbonate that they use to build their shells and skeletons, will impact the ocean food chain as many juvenile life forms of mollusks and phytoplankton require calcium carbonate to mature and thereby reproduce.
6. **Economic losses.** Climate change affects businesses and economies at home and around the world. Climate change could cost between 5 and 20 percent of the annual global gross domestic product, according to a British government report. Some examples follow. In southern New England lobster catches have plummeted because of heat stresses and growing parasite threats due to rising sea temperatures. Ski resorts have difficulty obtaining bank loans because of declining snow. More intense hurricanes and downpours cause billions of dollars

in damage to property and infrastructure. Declining crop yields due to prolonged drought and high temperatures, especially in Africa, put hundreds of thousands of people at risk for starvation. High sea temperatures also threaten the survival of coral reefs, which generate an estimated $375 billion per year in goods and services.

1.1.2 Causes of Climate Change

In its recently released Fourth Assessment Report, the Intergovernmental Panel on Climate Change, a group of 1,300 independent scientific experts from countries all over the world under the auspices of the United Nations, concluded there's a more than 90 percent probability that human activities over the past 250 years have warmed our planet.

The industrial activities that our modern civilization depends upon have raised atmospheric carbon dioxide levels from 280 parts per million to 379 parts per million in the last 150 years. The panel also concluded there's a better than 90 percent probability that human-produced greenhouse gases such as carbon dioxide, methane and nitrous oxide have caused much of the observed increase in Earth's temperatures over the past 50 years.

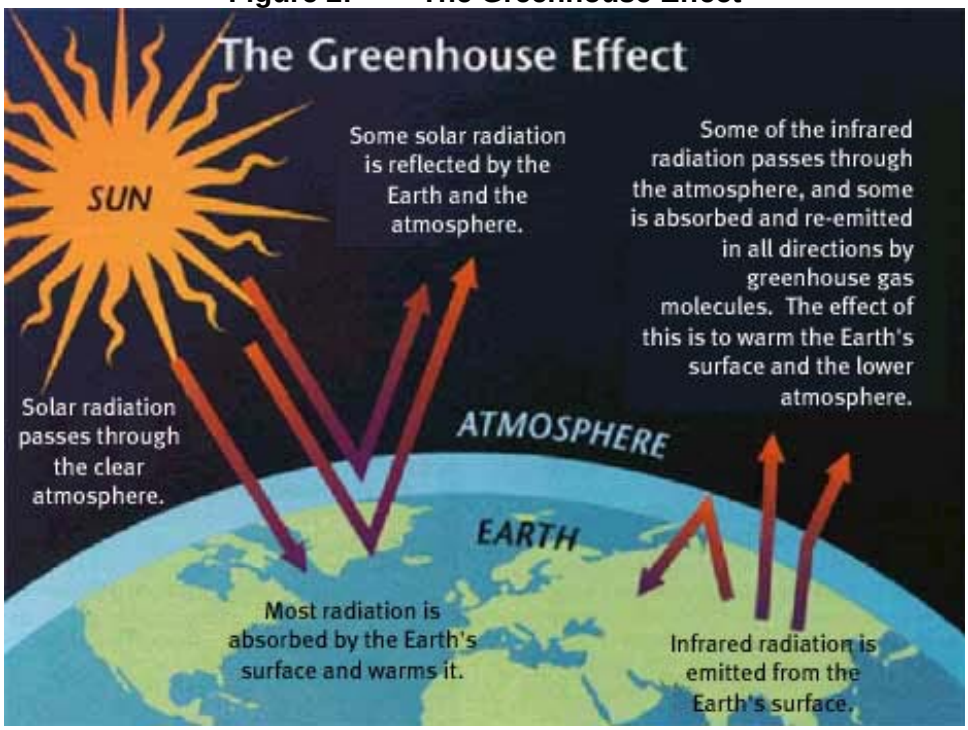
They said the rate of increase in global warming due to these gases is very likely to be unprecedented within the past 10,000 years or more. The panel's full Summary for Policymakers report is online at: http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf (NASA 2012).[6]

The addition of carbon dioxide, the main greenhouse gas, into the atmosphere through burning oil, natural gas and coal along with the depletion of our dense forests, which act as natural carbon dioxide sinks, lead to an unnaturally high concentration of greenhouse gases that in turn intensify the natural greenhouse effect on earth. The greenhouse effect is essential to life. Without it, our planet would have an average temperature of about 14°F, as opposed to a comfortable 60°F.

Like the glass in a greenhouse or a car on a hot day, the Earth's atmosphere forms an insulating blanket that traps some of the sun's light rays as heat. Adding greenhouse gases into the atmosphere or destroying natural sinks of these gases increases this effect and causes the globe to trap more heat than it would naturally.

[6] NASA 2012. Global Climate Change: Causes. http://climate.nasa.gov/causes/ Earth Sciences Communications Team at NASA's Jet Propulsion Labrotory/California Institute of Technology

Figure 2: The Greenhouse Effect



Human interference with the greenhouse effect should not be news to citizens of the new millennium. In 1953 Dr. Gilbert N. Plass of Johns Hopkins University published reports that warned of the pending rise in temperature if humans continued to burn fossil fuels. Dr. Plass predicted an atmospheric doubling of the concentration of carbon dioxide (CO2) by 2080, from 312 parts per million (ppm) to roughly 620 ppm, and we are on track, if not ahead of his predictions (June 2011 concentrations were 393.69ppm up from 389.9ppm in Feb. 2010).

Beginning in the late 1950s, Dr. Charles Keeling began collecting “pristine” atmospheric samples -- starting in Big Sur, California and later moving his study sites to Mauna Loa, Hawaii and Antarctica -- to measure the concentration of CO2 (carbon dioxide) in the atmosphere. His studies showed the expected annual rise and fall of CO2 concentrations from the seasonal respiration and photosynthesis cycles of plants, but many were shocked to notice, after several years, that the concentration of CO2 was rising at about 1 ppm globally per year. Ever since Keeling’s work began in the late fifties, CO2 concentration in the atmosphere has been tracked all over the world with the same results.

If humanity continues burning fossil-fuels at the current rate of acceleration, we will exhaust the reserves over the next few centuries and CO2 will rise to levels of over 1,500 ppm. Unless we make serious efforts now to curb our dependence on fossil fuels the current and next generation will find themselves in a race between an exhausting fuel resource (peak oil) and an ever rising concentration of CO2 within the atmosphere. The question is not “can we find another energy option?” but “how can we make a successful transition to a future in which energy will be more scarce and expensive?”

1.1.3 The Carbon Cycle

It is important to consider the Earth's carbon cycle when evaluating GHG reduction strategies. Briefly, carbon dioxide is removed from the atmosphere and stored as plant biomass through photosynthesis. That plant biomass is either stored within the plants or released through plant respiration, animal consumption and respiration, or through the decay of the plant material. The effects of this cycle of photosynthesis and respiration can be seen at a global level as semi-annual fluctuations in carbon dioxide. This seasonal change in CO2 is the result of increased uptake of CO2 from the atmosphere during the northern hemisphere spring and later release through respiration and decay in the northern fall.[7] The burning of fossil fuels disrupts the carbon cycle by adding additional carbon to the atmosphere that was previously isolated underground and not part of the photosynthesis/respiration cycle. This newly available carbon may be captured and respired indefinitely and becomes part of the new carbon cycle norm. Only when carbon is removed from the cycle through burial of organic debris or calcification by marine organisms is it part of a "sink" and removed from the global carbon cycle.

1.1.4 Non-Linear Tipping Points

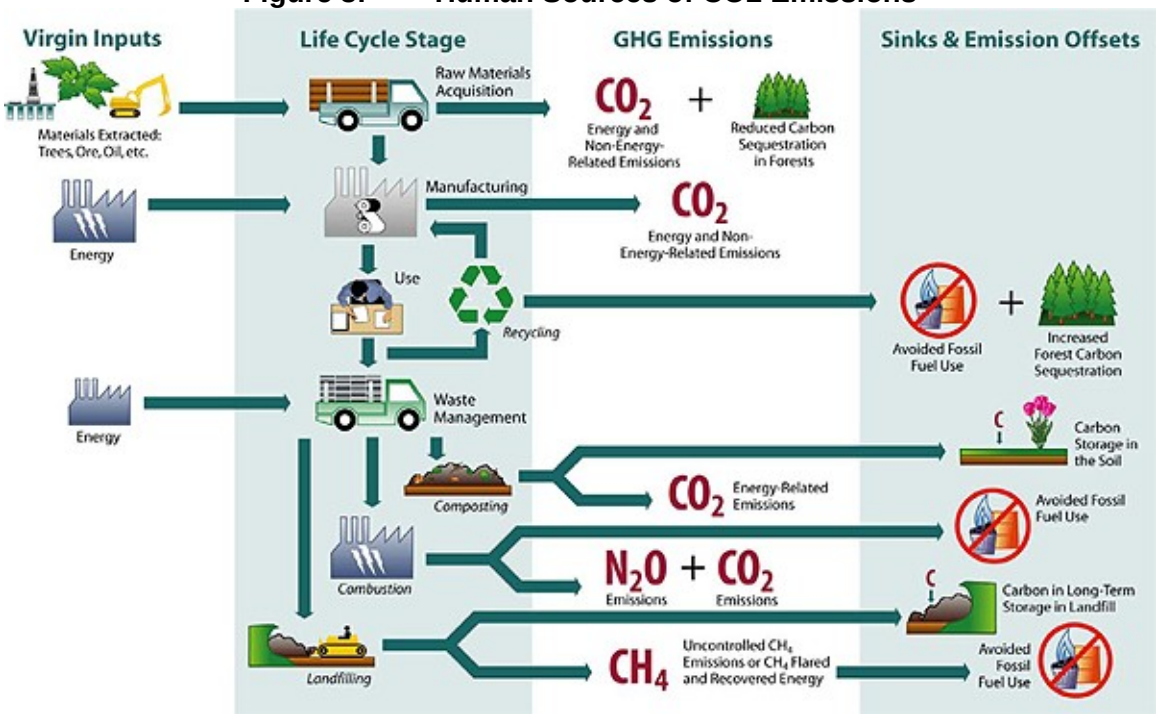
Many current climate change reports predict a linear increase in temperatures and changes in storm intensity and sea level rise. However, there are some models that suggest there are key thresholds in temperature and atmospheric CO2 concentrations that, when reached, would lead to exponential increases in the rate of variable climatic changes. For instance, increases in temperatures in arctic permafrost could lead to accelerated melting and significant and rapid releases of methane that would cause non-linear rises in atmospheric greenhouse gas concentrations. These uncertainties regarding the possible non-linear responses of climate variables to increased carbon concentrations suggest that current reports may under-represent the true worst case scenarios as well as the urgency of the crisis. This under-representation may be detrimental for decision-makers, community leaders, and others tasked with minimizing risk through aggressive reductions in emissions and adaptation.

1.1.5 Human Causes of Climate Change

The burning of fossil fuels, deforestation, and the methane gas emissions from landfills and livestock are significant contributors to the observed increases in surface and oceanic temperatures, increased rates of sea level rise, ocean acidification, melting of sub-alpine glaciers, and many other effects of climate change. As shown in the Figure below, many human activities add CO2 to the planet's atmosphere.

[7] Northern hemisphere hosts a significant portion of the earths land mass and consequently plant biomass.

Figure 3: Human Sources of CO2 Emissions



Fossil Fuel Use

Fossil fuels (coal, natural gas, gasoline, oil etc.) formed over millions of years from ancient carbon-based life forms and consequently are a very limited resource. Our society has grown dependent on fossil fuels – which emit large amounts of carbon dioxide and methane into the atmosphere during combustion – since the industrial revolution due to their high energy density, portability and ease of use. Over 75% of the world's yearly greenhouse gas emissions are from the combustion of fossil fuels. China and the United States are the largest contributors to fossil fuel emissions.

Loss of Natural Habitat

Land use changes that result in the loss of natural habitat contribute significantly to climate change. Large scale deforestation through human clearing for grazing and plantation farming (as in the Philippines for bio-diesel) and forest fires are currently responsible for 17% of global GHG emissions.

In addition, since 1850, California has lost 80% of its coastal wetlands, 96% of its interior wetlands, and 99% of its valley grasslands.[8] Each of these natural systems captured and stored carbon. Over decades or centuries, these same ecosystems can recapture carbon if they are restored or allowed to reestablish.

Methane Release from Organic Material

The anaerobic (without oxygen) decomposition of organic material such as plant material and food waste occurs in landfills, wastewater digesters, wetlands and other places

[8] California Natural Resources Agency, State of the State Wetlands Report, 2010

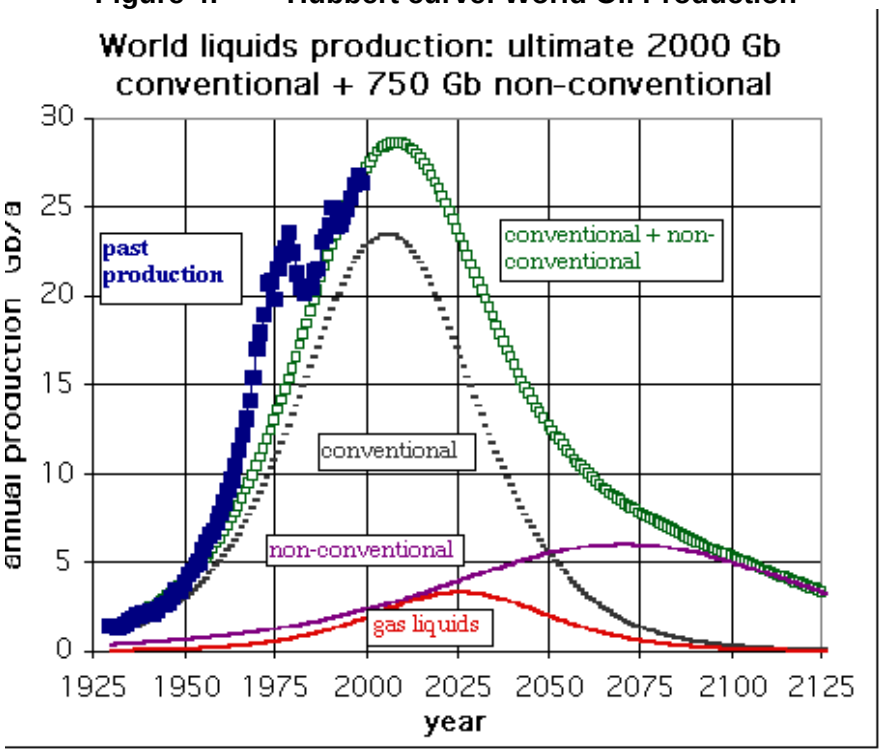
devoid of air. Unlike composting, which occurs in the presence of air, anaerobic decomposition releases methane rather than CO2. Because methane is 21 times more potent of a GHG than CO2, human induced anaerobic digestion is a significant contributor to climate change (14% of global emissions). Effective capture and use of methane as a fuel source or changes in decomposition mechanisms from anaerobic to aerobic modify the gas emissions from methane to CO2, effectively reducing emissions by 21 times.

Climate Change and Peak Oil

Fossil fuels are non-renewable resources and therefore, are being depleted. At some point in the future, maximum global petroleum extraction will be reached (peak oil) and then there will follow a perpetual decline in fossil fuel production. Predictions vary about when global oil production will peak. Some claim we have already past the peak, and others claim we are on the cusp. Optimistic reports state that by 2020 production will begin to decline.[9]

M. King Hubbert created and first used the models behind peak oil in 1956 to accurately predict that United States oil production would peak between 1965 and 1970. According to the Hubbert model, the production rate of a limited resource will follow a roughly symmetrical logistic distribution curve based on the limits of exploitability and market pressures[10]. Figure 4 shows the Hubbert curve.

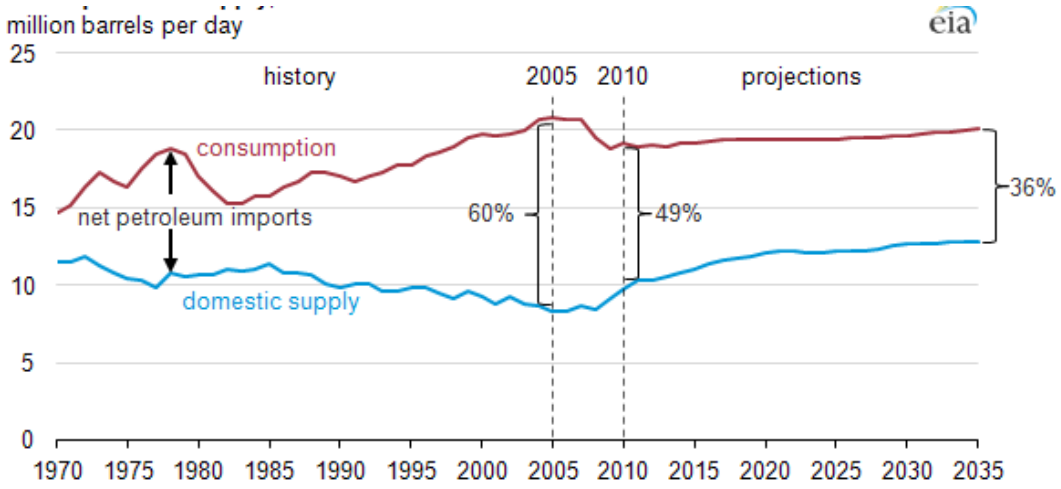
Figure 4: Hubbert curve: World Oil Production



[9] Wikipedia. Peak Oil. http://en.wikipedia.org/wiki/Peak_oil
[10] Wikipedia. Peak Oil. http://en.wikipedia.org/wiki/Peak_oil

Figure 5 shows US energy consumption and production of liquid fuels in millions of barrels per day. The data consistently shows that US consumption is greater than US production, and has been for years. Future predictions on consumption are low, based on an assumption that transportation energy demand will only increase about 0.2% each year given new CAFÉ standards[11].

Figure 5: US Liquid Fuels Supply, 1970-2035



Although there is controversy over the way that the energy future will play out, predictions of large curtailments of energy supply, with serious consequences, are becoming increasingly main stream. Some communities have completed Energy Descent Plans that prescribe actions that can be taken to reduce the vulnerability of the local economy to future volatility in energy costs/supply. These plans identify programs and collaborative opportunities that can protect a region from rising energy costs while helping address climate change mitigation and adaptation efforts.

1.1.6 Local Impacts of Climate Change[12]

IPCC scientists predict that the serious consequences of climate change will continue to grow and expand. The rapid and unprecedented increase in surface temperature is accelerating the planet's water cycle, which will make severe storms and droughts more frequent and severe.[13] These events will likely disrupt and damage food and fresh water supplies. The extreme increases in temperature to come will continue to melt the Greenland ice shelf and cause the oceans to thermally expand, both of which will raise the average level of all oceans. This rise in sea-level will have multiple effects, including coastline destruction, the displacement of major population centers, and economic disruption.

[11] http://www.oilgaslawbrief.com/miscellaneous/post-1/ February 13, 2012.

[12] Much of the following discussion regarding local impacts of climate change comes from the City of Santa Cruz Climate Action Plan, and is used with their permission.

[13] Global Climate Change Impacts in the United States, 2009

Climate and Weather

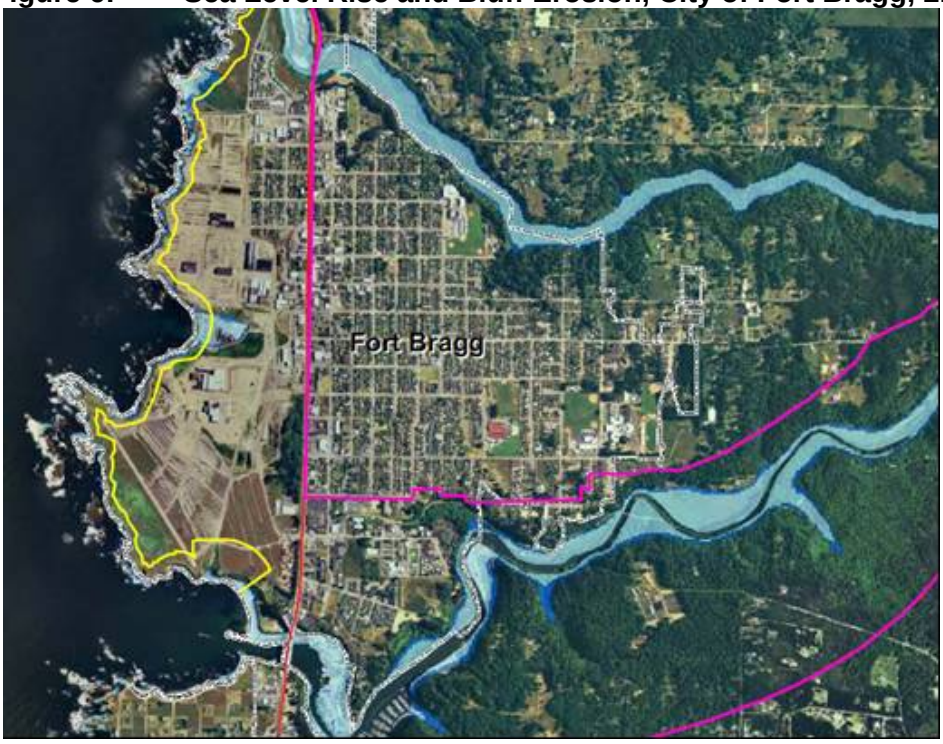
Climate change will impact Fort Bragg's day-to-day weather patterns and will very likely cause more frequent periods of wet days and hot dry days. Fort Bragg may also see more extreme periodic heat waves, more fog in the summer months, and more severe freezes during the winter. Perhaps most importantly, the increase in precipitation will probably not be over long periods of time but rather in short and extreme bursts that will increase the chances of flash flooding and mudslides.

Sea Level Rise

Since 1900, the average global sea level has risen by about three inches. In the next 100 years, sea level is expected to rise by as much as four and one half feet.[14] This does not mean that Fort Bragg will experience the minimum or maximum predicted rise as exact levels depend on local topography, average temperature of the local ocean, and circulation patterns. The rise in sea level could cause increasingly severe coastline destruction and lead to the displacement of homes and businesses in low-lying areas. A rise in groundwater below the city could also cause flooding of underground infrastructure such as basements, electrical conduits and water pipes.

A recent analysis prepared for the California Coastal Conservancy predicts significant bluff erosion along Fort Bragg's coastal bluffs and flooding in the Noyo Harbor. As shown in the figure below, extensive flooding (blue shading) and bluff erosion (yellow line) are predicted for Fort Bragg and Noyo Harbor within 100 years.

Figure 6: Sea Level Rise and Bluff Erosion, City of Fort Bragg, 2100



[14] Climate Change Scenarios and Sea Level Rise Estimates for the California 2009 Climate Change Scenarios Assessment

Water Supply

In Fort Bragg, we rely entirely on local surface water sources for our community's water supply, namely the Noyo River, Waterfall Gulch and Newman Gulch. The changes in rainfall patterns, as predicted by the IPCC, could result in increased flooding events followed by extended periods of drought. The City of Fort Bragg is vulnerable to water shortages during drought conditions because the City's current water supply is based on surface water flows, which fall significantly in drought years, and because the City has limited water storage of six million gallons. When river water flows are less than City water demand, the City uses stored water to make up the difference.

Plants and Animals

The effects of climate change have also been evident in the plant and animal worlds. Over the past 25 years, 80% of the changes in distribution and behavior of organisms have been consistent with the changes in local surface temperature. Animal and plant species across Earth have been shifting their ranges to areas more north as well as higher elevation, both which correspond to cooler temperatures.[15] All of the phenomena that have occurred from a 1.5 degree rise in temperature have had a myriad of impacts that are already changing natural environments and ecosystems planet wide. The predicted temperature increase of 2 - 12 degrees over the next century will have potentially devastating effects. Currently, global species extinction is on the rise and researchers are continuing to identify local extinction (or extirpation) of some species attributed to climate change.[16]

North Coast Ecosystems

A changing climate will lead to a change in the summer temperature extremes, ocean surface temperatures, rain fall patterns, and fog patterns, all of which will result in a change in ecosystem structure and species diversity. For instance, a recent study found that annual fog density patterns on the San Francisco peninsula have decreased over the last few decades. If such reductions occur on the Fort Bragg coast, declines in redwood survival from decreases in fog drip, decreases in kelp forests, and increases in evaporation from our watersheds are likely.

What you can do... ..

Action (one person)	**Carbon Saved in one year**
Stop driving	6.0 tons
Slash home energy use	5.2 tons
Go vegan	2.2 tons
Stop flying	0.9 tons

Ocean Acidification

Ocean acidification describes the decrease in the pH, or the increase in the acidity of the global oceans resulting from the uptake of human generated carbon dioxide from the atmosphere. Less than half of the carbon dioxide produced historically by the burning of oil, gas and coal stays in the atmosphere and about a third currently ends up dissolving into the oceans. While this process has helped remove very large quantities of carbon

[15] Global Climate Change Impacts in the United States, T. Karl et al. Cambridge University Press, 2009.

[16] Extinction risk from climate change, C. Thomas et. al, Nature, January 2004

dioxide from the atmosphere, reducing the greenhouse effects that would have otherwise been significantly greater, it continues to make the oceans more acidic.

By the first decade of the 21st century, the pH or acidity of the world oceans had increased by about 30% over the "natural" pre-industrial revolution level. As carbon dioxide emissions continue with the burning of fossil fuels, additional carbon dioxide will enter the oceans and pH will continue to decrease. Future rates of change will depend upon when and how rapidly the US and the rest of industrialized society choose to move away from a fossil fuel based economy.[17]

It is believed that this progressive decline in pH or shift towards increased acidity will gradually begin to affect the organisms in the ocean that build their skeletons or shells out of calcium carbonate. Calcium carbonate dissolves in acidic solutions, so the lower the pH, the more difficult it will be for these organisms to either grow new shells or skeletons or maintain their existing health and populations. Ocean acidification can affect both the larger and more visible organisms such as coral, sea urchins, and mollusks and also many zoo- and phytoplankton that are the primary producers and first level consumers within the ocean food web. These tiny organisms lie at the base of the food chain and provide the food supply for the larger plankton such as krill, which are the primary food source for salmon and other fish, as well as sea birds and baleen whales. Phytoplanktonare credited with producing 70% of the world oxygen through photosynthesis and impacts to phytoplankton species distribution and abundance due to changes in global ocean pH is still uncertain.

A significant portion of Fort Bragg's fishery is composed of organisms that will be impacted by increasing ocean acidification, including abalone, sea urchins and crab. Likewise the tiny snail known as pteropods will also suffer population declines; pteropods are a vital food source for young salmon. A recent study found that the north coast of California is particularly susceptible to the impacts of ocean acidification due to existing upwelling, which brings significant CO2 to the surface waters from deep waters.

Economy

Fort Bragg's economy relies heavily on tourism as a scenic coastal destination. Threats to coastal resources and open space as well as to public infrastructure and resources may diminish many of the current attractions upon which local businesses rely. Clearly climate change will also have impacts on the regions natural resources, including the redwood forest and fisheries which will also impact Fort Bragg's economy.

1.2 State and Federal Programs for Reducing GHG

Executive Order S-3-05

California is a substantial contributor of global greenhouse gases, emitting over 400 million metric tons of carbon dioxide a year.[18] In June 2005, Governor Schwarzenegger

[17] *Energy Information Administration, Oil, Gas and Law Brief*, Stone Pigman Walther Wittmann, LLC.
[18] Air Resources Board 1990 to 2004 State Inventory (November 2007)

established California's greenhouse gas emissions reduction targets in Executive Order S-3-05. The Executive Order established the following goals:

- Greenhouse gas emissions should be reduced to 2000 levels by 2010;
- Greenhouse gas emissions should be reduced to 1990 levels by 2020; and
- Greenhouse gas emissions should be reduced to 80% below 1990 levels by 2050.

Global Warming Solutions Act of 2006 (Assembly Bill 32)

The State's Legislature enacted Assembly Bill 32, the California Global Warming Solutions Act of 2006, which Governor Schwarzenegger signed on September 27, 2006 to further the goals of Executive Order S-3-05. Assembly Bill 32 states:

> Global warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California. The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine ecosystems and the natural environment, and an increase in the incidences of infectious diseases, asthma, and other human health-related problems.[19]

AB 32 represents the first enforceable statewide program to limit greenhouse gas emissions from all major industries with penalties for noncompliance. The foremost objective of California Air Resources Board (CARB), tasked with implementing AB 32, is to adopt regulations that require the reporting and verification of statewide greenhouse gas emissions. The initial State goal is to limit greenhouse gas emissions to 1990 levels by 2020. In January 2008, a statewide cap for 2020 emissions based on 1990 levels was adopted. In June 2010, CARB prescribed GHG reduction goals to regional governments. These prescriptions are the regional benchmarks from which to track local reductions.

1.3 Why a Climate Action Plan?

Fort Bragg, a coastal community with relatively small river drainages and reservoirs, is particularly vulnerable to decreased freshwater supply, drought, and sea-level rise. The City recognizes eight important reasons to work to reduce our GHG contributions in the City's GHG inventory, and these include:

- **Improve Service Delivery.** Energy efficiency initiatives will enable the City to offer services more efficiently and economically.
- **Reduce Cost.** By reducing energy consumption, the City and local citizens will save money on energy bills. While energy efficiency initiatives may require an initial capital investment, paybacks of between four and seven years can be expected in many cases and savings will continue beyond the payback period. In 2005 the City spent $292,992 for electricity for municipal operations, $83,000 in electricity for street lamps, $45,000 for propane, $63,000 for gasoline and diesel fuel, and $144,000 for

[19] Global Warming Solutions Act, Assembly Bill 32, 200

waste disposal. Overall the various sources of energy use and waste disposal costs amounted to $628,000 in 2005.

- **Improve Air Quality and Public Health.** The combustion of fossil fuels emit a variety of pollutants that are known to have negative health impacts and reduce local air quality. Less energy consumption means less local air pollutants.
- **Improve Asset Management.** Proactive asset management of the wastewater and water systems includes systematic review of operations and implementation of a logical repair/upgrade schedule. The reduction of GHG can be another motivator to improve overall asset performance.
- **Community Leadership.** By providing leadership, the City will motivate local businesses, institutions, and residents to take action.
- **Quality of Life for Citizens/ Healthy Cities.** Programs that reduce emissions, such as bike paths, public transit, and smart growth, increase the overall quality of life by improving air quality, promoting active lifestyles and creating a more beautiful community.
- **Job Creation.** The transition to a "climate friendly economy" will require new investments, which will in turn create new jobs in our community.

1.4 Climate Action Plan Content & Structure

This Climate Action Plan (CAP) details projects and strategies necessary to reduce Fort Bragg's contributions to climate change. These steps include a variety of changes in operations, purchasing, technology, policy, and behavior at the municipal level, and the implementation of education programs, regulation, and incentives at the community level. This plan includes specific GHG emissions reduction projects and strategies, that once implemented will result in the reduction of GHG emissions in order to meet the City's reduction target of 20% by 2020.

The Climate Action Plan (CAP) is organized in six chapters.

- Chapter 1 provides an overview of: 1) the global regional and local impacts of climate change; 2) the causes of climate change, 30 state and federal programs for reducing GHG emissions; 3) an overview of the Climate Action Plan organization.
- Chapter 2 includes a summary of the City's GHG reduction goals, provides a overview of the City's 2005 GHG emissions inventory, and summarizes current City and community efforts with regard to GHG emission reductions. Background, describes the ICLEI Cities for Climate Protection Campaign, defines an action plan, reviews the Fort Bragg Greenhouse Gas Inventory, and identifies the reduction targets set by the Fort Bragg City Council.
- Chapter 3, Methodology, explains the process to create the action plan.
- Chapters 4 and 5 provide the meat of the report and detailed specific strategies and projects that the City and community members can undertake to achieve the GHG emission goals by 2020.
- Chapter 6, Financing & Implementation, outlines funding sources, including a cash flow payback analyses for various proposed projects. Delegates tasks to each department for successful implementation of the CAP.

1.5 Compliance with ICLEI's Cities for Climate Protection Campaign

The City of Fort Bragg's efforts with regard to climate protection follow that protocol set by ICLEI. In 1993, at the invitation of ICLEI, municipal leaders met at the United Nations in New York and adopted a declaration that called for the establishment of a worldwide movement of local governments to reduce GHG emissions, improve air quality, and enhance urban sustainability. Since its inception, the Cities for Climate Protection (CCP) campaign has grown to involve more than 650 local governments integrating climate change mitigation into their decision-making processes. Based on recent analysis, CCP participants account for about 15 percent of global anthropogenic GHG emissions (ICLEI 2008). Nationwide, members have reported a reduction of more than 23 million metric tons of carbon dioxide equivalent ($MTCO_2E$) GHG emissions. As a part of Fort Bragg's participation in ICLEI's CCP Campaign, the City has voluntarily committed to complete the following milestones of the campaign:

- Conduct a baseline emissions inventory and forecast
- Set an emissions reduction target
- Develop an action plan to meet the emissions reductions target
- Implement the action plan
- Monitor and verify progress and results

The adoption of this report will qualify Fort Bragg for recognition of achieving Milestones 1-3 of the framework.

2 GHG Reduction Goals and Current Emissions

This chapter provides an overview of the City's GHG emissions reduction targets, 2005 GHG emission performance by the City and the community, and an overview of the GHG quality of PG&E's power (the City's electricity provider).

2.1 GHG Reduction Goals

A greenhouse gas reduction target is expressed as a percent reduction in emissions relative to baseline year GHG emissions. California cities have adopted 2005 as the baseline year for analysis. ICLEI recommends a 20% target for local government operations and a 6% target for the community within 10 years of joining the Climate Protection Campaign (CPC) program[20]. As a part of Fort Bragg's participation in ICLEI's CCP Campaign, the City has voluntarily committed to complete the following milestones of the campaign:

1. Conduct a baseline emissions inventory and forecast (completed)
2. Set an emissions reduction target (completed)
3. Develop an action plan to meet the emissions reductions target (completed)
4. Implement the action plan
5. Monitor and verify progress and results

The adoption of this report will achieve Milestones 3 of the framework.

The City of Fort Bragg's voluntary reduction goals for both the City and community significantly surpass the ICLEI recommendations. The City of Fort Bragg selected a target of 20% reduction for the local government sector and a target of 15% reduction for the community by 2020 (see Table 2-1).

Table 2-1: Reduction targets established by the City of Fort Bragg

	Baseline Year	Target Year	Reduction Goal
Local Government	2005	2020	30%
Community	2005	2020	15%

These reduction targets allowed the City to quantify the level of its commitment to GHG emission reduction. The City's next steps are to: 1) fund and implement strategies to achieve the goal; and 2) measure the effectiveness of the implementation strategies through time.

[20] 1.1 **Climate Protection Campaign.** The City of Fort Bragg's efforts with regard to climate protection follow that protocol set by ICLEI. In 1993, at the invitation of ICLEI, municipal leaders met at the United Nations in New York and adopted a declaration that called for the establishment of a worldwide movement of local governments to reduce GHG emissions, improve air quality, and enhance urban sustainability. Since its inception, the Cities for Climate Protection (CCP) campaign has grown to involve more than 650 local governments integrating climate change mitigation into their decision-making processes. Based on recent analysis, CCP participants account for about 15 percent of global anthropogenic GHG emissions (ICLEI 2008). Nationwide, members have reported a reduction of more than 23 million metric tons of carbon dioxide equivalent ($MTCO_2E$) GHG emissions.

2.2 Current Emissions: Fort Bragg's GHG Emission Inventory

The City of Fort Bragg Greenhouse Gas Emissions Inventory was completed in the summer of 2007, using Clean Air Climate Protection (CACP) software and detailed emissions produced by municipal operations and the community. The inventory used 2005 as the baseline year and included emissions analysis of various sectors and forecast based on growth rates and other variables embedded in the CACP software. To view the entire Fort Bragg Greenhouse Gas Emissions Inventory visit: http://ci.fort-bragg.ca.us/pdf/GreenhouseGasInventory8-15-2007.pdf

The inventory was conducted to develop a benchmark of GHG emissions produced by municipal operations and the community, identify where the GHG emissions originate, and to assist in the development of this CAP.

2.2.1 Community Greenhouse Gas Emissions

The greenhouse gas inventory reveals that emissions from the community primarily come from transportation, residential and commercial energy use, and solid waste generation (City of Fort Bragg 2007). Overall, GHG emissions per capita in Fort Bragg are lower than the national average. In 2005 Fort Bragg generated approximately 20 $MTCO_2E$ of GHGs per capita. In 2004, per capita GHG emissions in the U.S. were approximately 24.1 $MTCO_2E$ (USEPA). However, total U.S. emissions include sources not included in this City of Fort Bragg Emissions Inventory such as agricultural soil management, air transportation and industrial emissions not related to energy use. If these additional remote sources of GHG emissions had been included in the inventory, the per capita emissions in Fort Bragg would be closer to the national average.

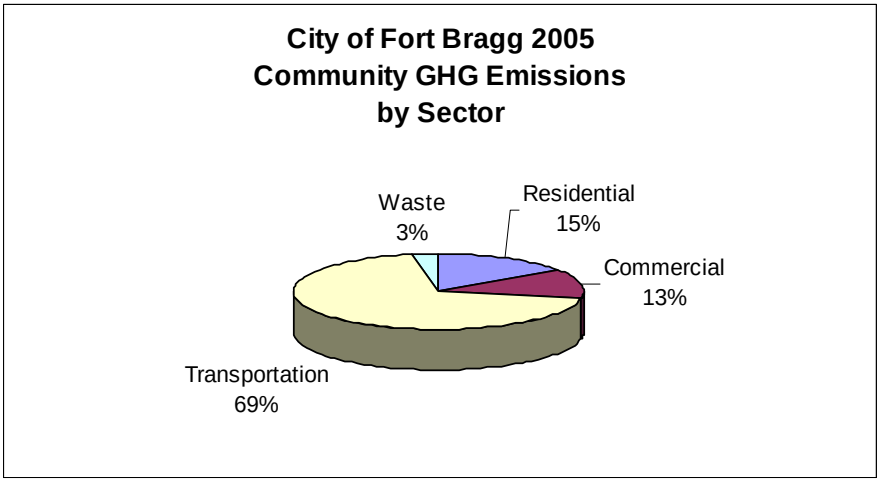


Figure 7: 2005 Community GHG Emissions by Sector

In 2005, the Fort Bragg community generated 138,824 $MTCO_2E$[21]. Nearly **70 percent** of these emissions were produced by the vehicles, primarily automobiles (see Figure 7). Residential uses were the second largest contributor, accounting for 15%, followed by commercial businesses (13%), and solid waste (3%) (City of Fort Bragg 2007).

[21] A $MTCO_2E$ is a metric tonne of CO2 equivalents that include greenhouse gases which contribute to climate change.

By comparison at the national level, 21% of emissions were generated by residential uses, 17% by commercial businesses, 28% by industry, and 33% by transportation. Transportation emissions are considerably higher in Fort Bragg because we are rural and because visitors contribute significantly to Fort Bragg's transportation emissions as they drive here to experience our scenic beauty and interesting culture and typically fill up their vehicles before returning home (City of Fort Bragg, 2007).

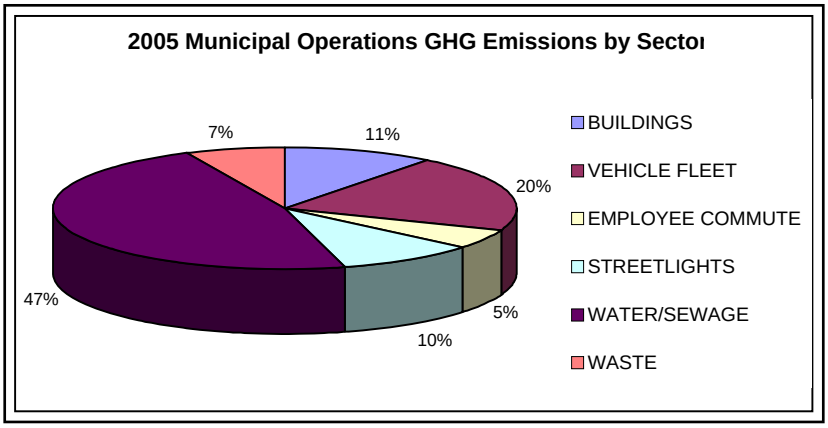
Clearly, in order to achieve GHG emission reduction targets for the City of Fort Bragg, the City must focus significant efforts on transportation improvements that get residents and visitors alike out of their car and walking and biking in town. However, real progress in this area must be spearheaded at the National level to increase Corporate Average Fuel Economy (CAFÉ) standards for vehicles. Starting with 2011 models, the federal government's fuel-economy standards, which have sat frozen for years, have gotten a big-time thaw—the biggest change since the CAFE law was created in 1975. The average fuel economy for cars must improve from the current 27.5 mpg, where it has been since 1990, to 37.8 mpg by 2016. The truck standard has to rise from 23.5 mpg to 28.8. This means the energy use (and consequently the GHG emissions) from cars must decrease by 37 percent, trucks by 23 percent. Combined, cars and trucks in 2016 should average 34.1 mpg, up 35 percent from the current 25.3 mpg—a jump of 5.1 percent per year. The application of this standard will help the City achieve its GHG emissions goals for the community sector by 2020, as many current vehicles will be retired by that time and replaced by more efficient vehicles that produce much lower GHG per vehicular mile traveled.

2.2.2 Municipal Operation Greenhouse Gas Emissions

The City produces GHG emissions from operation of City buildings/facilities, utility operations such as Waste Water Treatment and Water services, and City vehicles (public works, police, etc.). It also indirectly impacts emissions through the regulation of development and the siting/design of community transportation infrastructure. GHG emissions data was generated direct impacts and was grouped into sectors, namely: buildings, vehicle fleet, employee commute, streetlights, water, sewage, and waste. The government analysis was more detailed than the community analysis because detailed data was available by sector. In 2005, the City's annual GHG emissions were 1,181 $MTCO_2E$, an increase of over 11 percent from 2003. Overall energy use increased by 7.3 percent between 2003 and 2005 while energy costs increased by 17 percent over this timeframe. The CVStarr center was not owned and operated in 2005 and it is not part of the City or community emission baseline. The 2012 GHG Inventory will likely show City emissions increasing significantly due to CVStarr ownership and operations, which will make achieving the 2020 reduction target slightly more challenging. The CVStarr Community Center produces an estimated 130 $MTCO_2E$ from electricity use (530,749 kWh) and an estimated 262 $MTCO_2E$ from propane use (45,209 gallons).

Figure 8 shows the percentage of City GHG emissions emitted in 2005 from each sector. The water/sewage sector GHG emissions exceed those of other sectors, claiming nearly half (47%) of total emissions. Vehicle fleet emissions (20%) ranks second, followed by City buildings (11%), streetlights (10%), waste (7%), and the employee commute (5%).

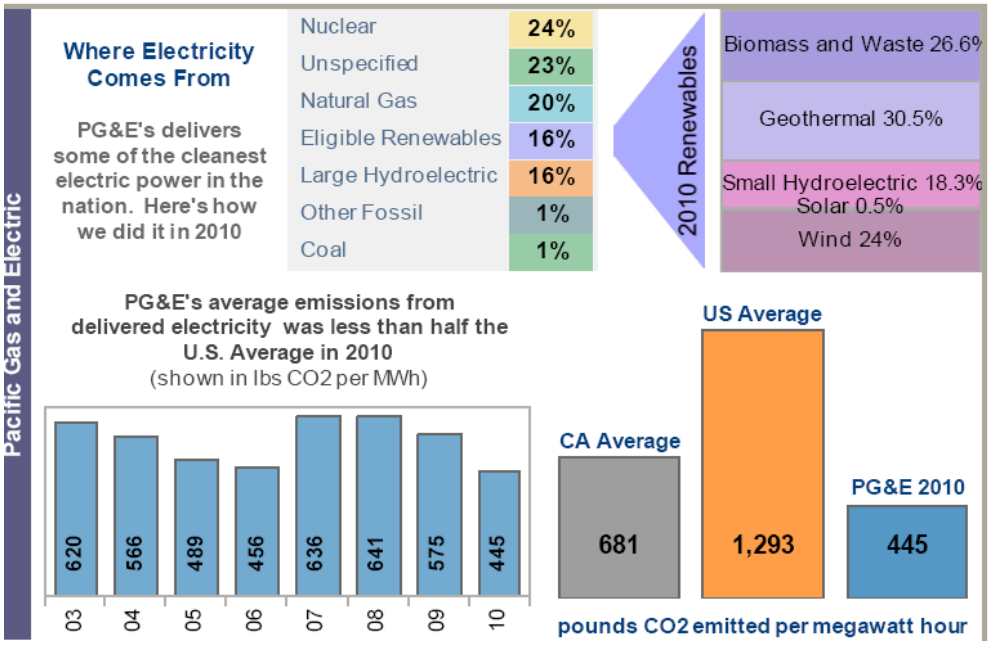
Figure 8: 2005 Municipal Operations GHG Emissions by Sector



2.3 Electricity Provider Emissions

Both the City of Fort Bragg and the community obtain electricity from Pacific Gas and Electric (PG&E). Not all electricity providers are equal and PG&E's electricity is relatively clean in terms of GHG emissions. As shown in Figure 9, 16% of PG&E's electricity is from renewable sources such as biomass, geothermal, solar, wind, and small hydroelectric. Another 16% comes from large hydroelectric, and 24% comes from nuclear. None of these sources release androgenic GHGs into the atmosphere, and therefore they do not contribute to global warming. Only 45% of PG&E electricity produces emissions as it is generated.

Figure 9: PG&E Electricity Sources



Additionally, as shown in Figure 9, PG&E emits less CO2 per megawatt hour than the average California or US utility. Figure 9 also illustrates that PG&E is driving emissions

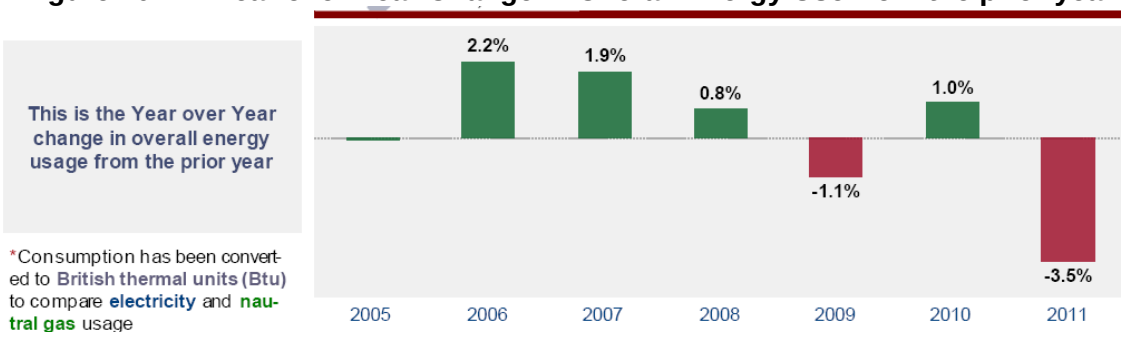
down each year. In sum, PG&E electricity is relatively clean and thus helps the City have a relatively lower negative impact on the climate.

Electricity Use in Fort Bragg

PG&E provides general statistics on electricity use in Fort Bragg. Overall Fort Bragg residential electricity use has increased by 2.4% since 2005, while non-residential use has increased by 0.1%; however, both figures include the power produced by on-site PV systems so they don't correlate with GHG reductions. PG&E identified 17 commercial PV sites and 73 residential PV sites that are grid tied and produce 572 kW, and 269kW respectively.

Figure 10 below illustrates the change in electricity use each of the past six years. The recession has reduced electricity use in Fort Bragg.

Figure 10: Year over Year Change in Overall Energy Use from the prior year



PG&E has a number of programs to reduce electricity use and emissions, and these programs have resulted in the following GHG reductions in Fort Bragg since 2005:

- 122 MTCO2 avoided by homeowners, primarily through the installation of energy saving appliances; and
- 781 MTCO2 by non-residential energy users, primarily through installation of energy efficient appliances, lighting, refrigeration and HVAC systems.

3 Methodology

3.1 Overview

To develop this Climate Action Plan (CAP) staff undertook the following steps:

- Researched climate action plans and GHG reduction strategies from other communities;
- Interviewed City Staff for recommendations regarding City operations;
- Held two community meetings to identify and prioritize potential GHG reduction activities;
- Completed an energy audit of all municipal operations to identify specific energy conservation projects and the GHG reduction and operating costs benefits associated with each project; and
- Identified costs and benefits associated with community priority actions.
- Prepared draft Climate Action Plan and presented it to City Council for adoption.

3.2 CAPs from other Communities

GHG reduction measures can be specific, narrow, broad and creative. The strategies developed for this CAP originated from a variety of sources, including:

- The City's Energy Audit;
- Strategies recommended by ICLEI, the League of California Cities, and the California Climate Action Network; and
- The Climate Action Plans of Santa Cruz, Denver, Durham, Fort Collins, and Seattle.

3.3 Interviews with City Staff

Community Development Department staff met with Public Works Director, Dave Goble, the Fleet Manager, Mike "Q" Cimolino, WWTF Chief Operator John Smith, and the police chief to:

- Summarize findings from Energy Audit; and
- Select and prioritize potential GHG reduction actions and projects

Through these meetings City Staff providing insights about the best ways to reduce energy use and waste from operations associated with their respective departments.

3.4 Community Workshops

Two well attended community workshops, with 100+ participants total, were held to identify and select CAP goals, priorities strategies and actions in 2010. Participants of the community workshops identified and prioritized actions that individuals, organizations and the City can take to lower emissions. The workshops also educated and motivated participants to take action to reduce individual contributions toward climate change. The gatherings included a presentation, group discussion, and prioritization exercises of potential climate action measures. Primarily, the presentation reviewed the findings of the City of Fort Bragg Greenhouse Gas Emissions Inventory. Community members also formed groups and discussed actions that individuals, the community, and municipal government can take to help reduce GHG emissions. These actions were recorded by group facilitators, comprised of City staff and community members[22], and were

[22] James Bernard, Charles Bush, and George Reinhart

prioritized by participants through voting for their favorite emission reduction actions. The emission reduction actions were organized into three categories as follows, and many are included in this Climate Action Plan:

1. Individual Actions: Technological and Behavioral
2. Community Actions: Organizational, Technological, and Behavioral
3. Municipal Actions: Municipal Programs, Technological, and Policies

3.5 Community GHG Reduction Survey

The City prepared a voluntary survey of community efforts to reduce GHG emissions. A total of 193 people took part in the survey in the spring of 2012. The survey questioned residents and business owners about what they are doing and what they would like to do to conserve energy, reduce water use, reduce auto use, and reduce waste generation. Of the 193 respondents, 30 own a business in Fort Bragg and answered specific questions regarding business operations. Input from the survey is included throughout this document. The survey results in their entirety can be found in Appendix A.

3.6 2012 Energy Audit

An energy Audit was prepared to identify activities which would reduce GHG emissions and lower operating costs for all City facilities. The energy audit identified $5.6 million in potential energy conservation and alternative energy generation projects. Staff reviewed all of the projects that were analyzed and has divided the project list into three tables for consideration:

1. Table 4.1 includes projects that have a very short simple payback (average of 1.7 years) and achieve significant GHG reduction at minimal cost. This table includes 22 projects, with a total implementation cost of $84,741 and annual energy saving of $50,468, these 26 projects pay for themselves very quickly and reduce GHG emissions by 76 $MTCO_2E$.
2. Table 4-2 includes six PV projects for City Hall, the CV Starr Center, the police station, Bainbridge Park, the corporate yard, and the water treatment facility. These projects total $514,000 and would save $31,700 in energy cost per year for a simple payback of 16.2 years and total GHG savings of 73 $MTCO_2E$.
3. Table 4-3 includes seven WWTF and WTF projects totaling $846,000 with a annual cost savings of $92,500 and a simple payback of 9 years and total emissions savings of 198 $MTCO_2E$.

Some projects from the energy audit were deleted from these tables because they were: 1) already completed; 2) mutually exclusive with an otherwise selected project; 3) had a negative return on investment; or are unfeasible based on staff knowledge. The results of the energy audit are incorporated through out this Climate Action Plan.

3.7 Development of Greenhouse Gas Reduction Measures

Input from the workshops, city staff meetings and the energy audit were used to develop a set of measures and programs with quantified emissions reductions, cost estimates, and simple payback calculations

4 City Action Plan

This chapter outlines specific GHG reduction measures to reduce municipal emissions. It provides an overview of current conditions, a summary of best practices to reduce emissions, a table illustrating potential GHG reduction actions, and specific recommendations. The chapter discusses each of the following sectors in sequential order: buildings, water and sewage facilities, streetlights and traffic control signals, vehicle fleet and employee commute.

4.1 City Buildings

The City's buildings offer varying levels of energy efficiency. Some City-owned buildings such as City Hall and the Guest House Museum, waste energy due to poor insulation, single-pane windows, energy intensive lighting and appliances, energy-intensive practices, and older heating systems. On the other hand the Police Station is relatively energy efficient. Overall the potential for reducing energy use is still quite large in City's buildings. The following section identifies current emissions from City Buildings and itemizes energy conservation and renewable energy projects that can be undertaken to reduce operating costs and GHG emissions from City buildings.

Emissions

In the baseline year of 2005, City buildings were responsible for approximately 120 $MTCO_2E$ a year, equivalent to approximately 11% of the total municipal operations GHG emissions. In order to achieve a 30% reduction, 36 $MTCO_2E$ must be cut by 2020. However, the addition of the CV Starr center to the City's Building inventory has added 392 $MTCO_2E$ of annual City building emissions. Thus a 30% reduction should be calculated from all of these buildings and would require an additional reduction of 117 $MTCO_2E$ for a total of 153 $MTCO_2E$.

GHG emissions, from City buildings, result from propane and electricity use. Propane is used to heat air and water, while electricity is used for lighting and office equipment. Figure 10 depicts GHG emissions from each of the City's nine facilities. The CV Starr Center uses more energy and generates more GHG emissions than all other buildings combined due to the cost of heating and circulating water for the pools, however as this building was not owned by the City in 2005 it was not included in the GHG inventory. The Police Station also generates relatively significant GHG emissions, because it operates on a 24 hour/7 days cycle, while the other buildings operate on an 8 hour/five day week.

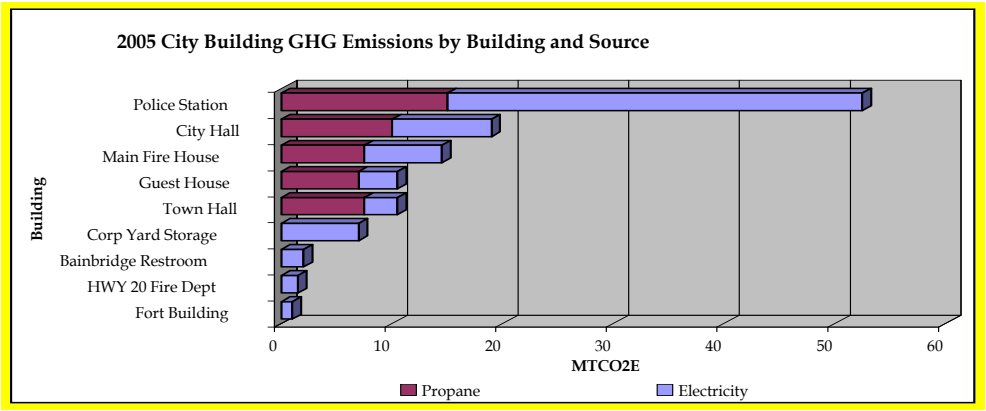


Figure 11: 2005 Building GHG Emissions by Building & Source

The City Energy Audit identified a wide range of specific projects for implementation to reduce GHG emissions, save energy and reduce operating costs at City facilities. Staff organized these projects into two tables. Table 4-1 illustrates projects that will reduce GHG emissions at a relatively low cost and result in a quick payback on investments. Table 4-2 identifies projects that are relatively higher cost and have a longer term payback and make sense to implement from a long term operating cost and GHG emissions perspective.

Specifically the 22 energy efficiency projects listed in Table 4-1 will:

- Reduce City GHG emissions by 76 $MTCO_2E$;
- Cost approximately $114,000 to implement (minus $29,000 in rebates);
- Save $50,000 in annual energy costs;
- Pay for themselves in less than two years.

These projects are clearly low hanging fruit and they should be implemented as soon as possible. They will allow the City to exceed its GHG reduction objectives for City buildings, which is set at 36 $MTCO_2E$.

Table 4-2 illustrates renewable energy projects which have higher upfront cost and longer payback period, but are worthwhile to implement. The six renewable energy projects listed in Table 4-2 will:

- Reduce City GHG emissions by 73 $MTCO_2E$;
- Cost approximately $560,00 to implement (minus $52,000 in rebates);
- Save $30,000 in annual energy costs;
- Pay for themselves in 16 years.

Table 4-1: High Priority Projects - Cost Effective Energy Savings & GHG Emission Reduction

#	Facility	Project Description	Estimated Cost	Rebate	Net Cost	Cost Savings	Simple Payback	Net Present Value	Internal Rate of Return	GHG - eTon/Yr
1	Police	Tankless Gas Water Heater	$ 4,600	$ -	$ 4,600	$ 1,561	2.9	$26,067	34.3%	0.2
2	Fire House	Infrared Heating, Apparatus Room	$ 8,960	$ -	$ 8,960	$ 510	17.6	$1,315	1.4%	1.1
3	Fire House	Hall Furnace Replacement	$ 3,288	$ -	$ 3,288	$ 338	9.7	$3,423	8.4%	0.7
4	Fire House	Main Furnace Replacement	$ 2,340	$ -	$ 2,340	$ 460	5.1	$6,731	19.5%	1.0
5	Fire House	Porpane Tankless Water Heater	$ 3,600	$ -	$ 3,600	$ 1,294	2.8	$21,821	36.3%	0.1
6	Fire House	Lighting Retrofit - TEAA	$ 10,177	$ 4,984	$ 5,193	$ 5,316	1.0	$75,450	106.4%	8.0
7	Guest House	Furnace Timer	$ 180	$ -	$ 180	$ 2,720	0.1	$53,009	1511.6%	5.8
8	Corp Yard	Break Room Heater	$ 1,000	$ 68	$ 932	$ 150	6.2	$1,965	14.2%	0.2
9	Corp Yard	Replace Diesel Heater with Propane Heater	$ 5,130	$ -	$ 5,130	$ 1,137	4.5	$17,282	22.2%	2.7
10	Corp Yard	Plug Load Sensor	$ 135	$ 15	$ 120	$ 36	3.3	$227	27.5%	0.1
11	Corp Yard	Lighting Retrofit - TEAA	$ 6,931	$ 1,677	$ 5,254	$ 1,789	2.9	$21,987	37.5%	2.7
12	City Hall	Tankless Gas Water Heater	$ 600	$ -	$ 600	$ 195	3.1	$3,234	32.9%	0.0
13	City Hall	Plug Load Sensors	$ 945	$ 105	$ 840	$ 529	1.6	$4,237	62.9%	0.7
14	City Hall	Furnace Timer	$ 710	$ -	$ 710	$ 2,362	0.3	$45,488	333.1%	5.1
15	Town Hall	Restroom Furnace Replacement	$ 1,872	$ -	$ 1,872	$ 517	3.6	$8,308	27.9%	1.1
16	Town Hall	Tankless Gas Water Heater	$ 1,200	$ -	$ 1,200	$ 368	3.3	$6,045	31.0%	0.0
17	CV Starr	Pump VFD in Competition Pool	$ 20,000	$ 7,048	$ 12,952	$ 9,225	1.4	$127,105	75.2%	13.8
18	CV Starr	Pump VFD in Leisure Pool	$ 20,000	$ 10,888	$ 9,112	$ 13,685	0.7	$198,364	154.2%	20.5
19	CV Starr	VFD on Air Handling Unit	$ 8,050	$ 3,200	$ 4,850	$ 5,642	0.9	$80,719	120.3%	8.4
20	CV Starr	Parking Lot Light Replacement	$ 13,500	$ 961	$ 12,539	$ 1,640	7.6	$12,658	13.6%	2.5
21	CV Starr	Vending Machine Controllers	$ 540	$ 300	$ 240	$ 614	0.4	$9,064	259.8%	0.9
22	CV Starr	Exit Signs	$ 500	$ 270	$ 230	$ 380	0.6	$5,530	169.2%	0.6
		Total	**$ 114,258**	**$ 29,516**	**$ 84,742**	**$ 50,468**	**1.7**	**$ 730,031**		**76**

Table 4-2: PV Projects: High Cost, High GHG Emission										
#	Facility	Project Description	Estimated Cost	Rebate	Net Cost	Cost Savings	Simple Payback	Net Present Value	Internal Rate of Return	GHG - eTon/Yr
1	Rec Center	8.2 kW AC Parking Structure PV System	$ 51,846	$ 4,536	$ 47,310	$ 2,755	17.2	$22,548	2.8%	6.3
2	City Hall	16.5 kW AC Parking Structure PV System	$ 90,012	$ 9,845	$ 80,167	$ 5,989	13.4	$54,002	4.0%	13.6
3	Police	44.7 kW AC Parking Structure PV System	$ 281,735	$ 25,450	$ 256,284	$ 15,037	17.0	$166,156	3.6%	35.1
4	Corp Yard	17.5 kW AC Floating Pond PV System	$ 110,465	$ 9,665	$ 100,801	$ 5,665	17.8	$59,855	3.4%	13.3
6	Bainbridge Park	6.1 kW AC Shade Structure PV System	$ 33,350	$ 3,476	$ 29,874	$ 2,246	13.3	$29,985	5.4%	4.8
		Total	**$ 567,408**	**$ 52,972**	**$ 514,436**	**$ 31,692**	**16.2**	**$ 332,546**		**73.1**

Recommendations

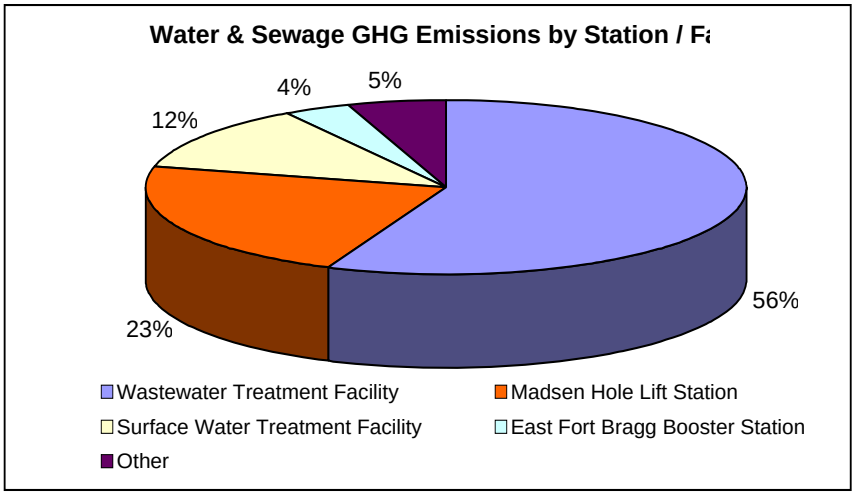
In order to reach the target 30% reduction in emission, the City would have to eliminate 153 $MTCO_2E$ from this sector. A reduction of this magnitude can be achieved by undertaking all of the projects listed in Table 4-1 & 4-2, and staff recommends that the City Council consider implementing all of the items in both tables. There are a number of options for funding these investments in renewable energy production and energy conservation, which are discussed in the implementation section of this action plan.

4.2 Water and Sewage

Emissions Summary & Background

Water and wastewater operations provide the largest contribution of GHG emissions to the City's carbon footprint, accounting for about 515 $MTCO_2E$ of GHG emissions in the baseline year of 2005. This represents approximately 45% of total City generated GHG emissions. More than half (56% or 326 $MTCO_2E$) of those GHG emissions originate from operations at the wastewater treatment facility. Emissions generated by Madsen Hole Lift Station rank second, followed by the Surface Water Treatment Plant, Other Pumping Stations[23], and the East Fort Bragg Booster Station (Figure 11).

Figure 12: Water & Sewage GHG Emissions by Station / Facility



GHG emissions generated in the water and sewage sector originate almost entirely from purchased electricity with an exception of the wastewater treatment facility where about one-third of GHG emissions are generated from the combustion of propane used to heat digesters and other operations. In addition to GHG emissions generated by electricity and propane, the wastewater treatment process also emits methane from the digesters and the sludge. The decomposition of the sludge generated by the wastewater facility is the source of 24% of the facilities GHG emissions, primarily from the generation of methane gas. In normal operating conditions the methane released from the digesters is flared, or ignited, reducing its potential global warming potential. However, on occasion, the flare goes out and has to be relit manually. During these times significant amounts

[23] Other Pumping Stations refers to the Highway 20 Water Tank, Native American Sewer Lift Station, Pudding Creek Sewer Lift Station, Sanderson Sewer Lift Station, South Fort Bragg Booster Station, and the South Harbor Sewer Lift Station.

of methane, a GHG 23 times more potent than CO_2, is released directly into the atmosphere.

Emissions from the water and wastewater sector can be reduced through supply-side management, by improving the efficiency of water treatment operations and through demand-side management to decrease the amount of water consumed.

Community Feedback[24]

Although the operation of the water and sewage treatment facilities sector are municipal operations the GHG emissions generated from this sector are directly tied to community use. Therefore, staff gathered input at the community workshop about water conservation. Attendees suggested the following ideas to reduce water use and sewage generation.

a) Programs requiring or incentivizing rainfall catchment and grey water systems in homes and businesses;

b) Requiring that landscaping be limited to drought tolerant plants;

c) Educating the community about water conservation; and

d) Using tertiary treated (reclaimed) water.

Staff has developed water conservation regulations for the Inland General Plan and the Mill Site Specific Plan which specifically incorporate a, b and c above into both documents. These changes will be incorporated into the Coastal General Plan during the next Local Coastal Program amendment.

Energy Audit results

The City hired Lescure Engineering to complete a comprehensive energy audit of the WWTF and identify opportunities for facility improvements. Lescure analyzed the relative pros and cons of using the sludge digester methane gas, which is currently flared, as a source of cogeneration electricity and as a source of gas to heat the digester instead of propane. Lescure determined that a specialized boiler capabale of burning raw digester gas would effectively utilize all of the methane gas released by the digester to heat the digester. This project would significantly reduce the demand for propane at the WWTF. The Bio-Gas boiler, noted in Table 4-3, would eliminate 84 $MTCO_2E$ and achieve a five year simple payback on a relatively small investment of $215,000.

Lescure also looked at the efficiency of the pumps which are utilized to re-circulate spray flows on the bio-filters at the WWTP. Again this project, identified as Biofilter VFD, would significant reduce GHG emissions by 41 $MTCO_2E$ and at a 6.6 year simple payback is another cost effective project for the WWTP.

[24] Derived from votes taken at the community workshop. This list is in order from most to least votes (Appendix A).

Table 4-3: WWTF & WTF High Priority Projects - Cost Effective Energy Savings and Reduction of GHG Emissions

#	Facility	Project Description	Estimated Cost	Rebate	Net Cost	Cost Savings	Simple Pay back	Net Present Value	Internal Rate of Return	GHG - eTon/Yr
1	WTP	East Pump Station	$ 15,782	$ 1,464	$ 14,318	$ 3,111	4.6	$15,847	20.9%	4.7
2	WTP	Replace Clearwell Pump Motor 2	$ 2,340	$ 79	$ 2,261	$ 242	9.3	$127	1.1%	0.4
3	WTP	Lighting Retrofit - TEAA	$ 7,121	$ 1,317	$ 5,804	$ 1,405	4.1	$15,639	27.0%	2.1
4	WTP	79.1 kW AC PV System	$ 514,711	$ 47,214	$ 467,497	$ 26,767	17.5	$280,253	3.4%	65.2
5	WWTP	Bio-Gas Boiler	$ 215,500	$ -	$ 215,500	$ 39,651	5.4	$761,603	17.6%	84.8
6	WWTP	Biofilter VFDs	$ 154,188	$ 14,670	$ 139,518	$ 21,190	6.6	$67,367	11.9%	41.4
7	WWTP	Lighting	$ 1,500	$ -	$ 1,500	$ 101	14.9	($487)	-3.5%	0.2
		Total	$ 911,142	$ 64,744	$ 846,398	$ 92,468	9.15			198.8

Proposed projects at the Water Treatment Plant net a lower level of energy or CO2 emission savings. However as shown in table 4-3 all energy efficiency and energy recovery projects combined at the WWTF and WTP have the following potential beneficial impacts on the City operations:

- Reduce City GHG emissions by 198 $MTCO_2E$;
- Cost approximately $911,000 to implement (minus $64,000 in rebates);
- Save $92,000 in annual energy costs;
- Pay for themselves in nine years.

Additionally, Lescure Engineering examined the feasibility of installing a 252.5 kW AC Ground Mounting PV System at a cost of $1.3 million. This project would save $74,000 in energy costs and result in a reduction of 208 $MTCO_2E$. With a simple payback of 16.4 years, this project also could net significant savings and benefit to the City of Fort Bragg. However, staff is cautious about recommending this project given the harsh marine environment and the possibility that the system will not perform as long as projected. Staff recommends that this project be further researched.

Additional Actions

There are several additional projects (identified by staff) for reducing energy consumption & GHG emissions in the water and wastewater enterprises. These include the following:

1. Upgrade and retrofit agency plumbing and irrigation systems with state-of-the-art water conserving technology (ie. dual flush toilets, waterless urinals, etc.)
2. Waste Water Treatment Facility Projects
   - Identify an alternative to sludge disposal. Currently the City's sludge is trucked to an out of county landfill. Communities such as Arcata and Half Moon Bay compost the sludge to avoid transporting it. The Town of Mendocino incinerates its sludge. Sludge incineration or composting will significantly reduce GHG emissions.
3. Water Projects
   - Replace the large industrial compressor at Madsen Hole.
   - Upgrades to the East Fort Bragg pressure zone. A recent pump and manifold upgrade has been undertaken, but additional work may include installation of new remote sensors, pressure bladders, supply system and variable speed control pumps.
4. Reduce demand for water and wastewater treatment.
   - Encourage grey water systems and/or water catchment in new development.
   - Require water conservation in new development.
   - Develop sustainable landscaping standards for new commercial and residential construction.
   - Require water efficiency audits at point of sale for commercial and residential properties.
   - Undertake educational campaigns and strategic pricing to reduce the demand for treated water, thereby saving energy for water treatment.

Recommendations

There are substantial opportunities to improve the City's water and wastewater treatment operations. In order to reduce GHG emissions associated with these operations by 30 percent the City will need to eliminate 154 $MTCO_2E$. If the City undertakes the projects identified in Table 4-3, it will achieve a savings of 198 $MTCO_2E$.

4.3 Streetlight, Park Lighting and Traffic Control Signals

Emissions Summary and Background

In the baseline year, streetlights and traffic control signals in Fort Bragg were responsible for 114 $MTCO_2E$ or approximately 10% of the total emissions from municipal operations for that year (City of Fort Bragg, 2007). In order to reach the reduction target of 30%, a reduction of 34 $MTCO_2E$ is required by 2020 for this sector alone.

Streetlights, park lights, and traffic control signals operate on purchased electricity from Pacific Gas and Electric (PG&E). There are 704 streetlights and nine traffic control signals, however only 20 of the streetlights are City owned. Fort Bragg has made significant strides towards energy efficiency in traffic control signals as incandescent traffic control signals have been replaced by light emitting diodes (LEDs) and PG&E has converted all its streetlights from metal halide to high-pressure sodium (HPS) technology. The City and PG&E will need to be innovative in order to further reduce emissions in this sector, as HPS lighting is highly energy efficient.

Energy Audit

The City pays for the operation of more than 700 PG&E owned street lights. PG&E charges are based on a matrix of light fixture wattages and the lower the wattage, the lower the monthly payment. The City can replace the PG&E owned lights, reducing the wattage, and reducing costs. However, the cost of the installation is quite high because the City will be required to meet PG&E's installation requirements, which adds ~ 50% to the cost. In addition, PG&E has submitted an application to the CPUC to replace the lights in the near future with LED lights. The City should wait for the result of the PG&E application. In the event that PG&E does not replace the bulbs with LEDs, the project would cost the City $1.1 million to implement with an annual savings of $40,000 for a simple payback of 27 years. While the project would reduce GHG emissions by 55 $MTCO_2E$, staff does not recommend this as a cost effective project.

For the 20 City-owned streetlights the LED replacement costs is $20,000, and with a $1,413 savings in annual energy costs the payback for this improvement is a more manageable 14.2 years. However this project would only save 2.8 $MTCO_2E$.

Best Practices

There are several additional methods to reduce energy use and GHG emissions by streetlight and traffic control devices. These include:

- Reduce the hours of use for streetlights, however as these are owned by PG&E this is not currently feasible. PG&E has a solicitation out to install a network controlled dimmable streetlight pilot program. The program requires that a minimum of 300 lights be controlled by the system and applications are due December 31,2012. In the event that the PG&E application to install LEDs in Fort Brag's street lights is not successful, staff could pursue this alternative course of action, given sufficient staff time.
- Reduce the total number of streetlights.
- Install occupancy sensors on Bainbridge Park tennis court lights.
- Install solar panels on Light Emitting Diodes (LED) traffic signals in order to eliminate GHG emissions.

Recommendations

The streetlights sector possesses few opportunities for GHG reductions. In order to achieve a 30% reduction, emissions would need to be reduced by 34 $MTCO_2E$. This target will be achieved if PG&E replaces the existing street lights with LED lights as proposed to the CPUC. However, absent this investment by PG&E, the City could apply to be in the Dimmable Streetlight Pilot Program.

4.4 City Vehicle Fleet

Emissions Summary

In 2005, the City's fleet was responsible for 237 $MTCO_2E$, or 21% of the total municipal GHG emissions for the year. In order to reach the designated target of 30%, a reduction of approximately 71 $MTCO_2E$ is required by 2020 for this sector.

In 2005 the fleet was composed of 71 gasoline, diesel, propane vehicles and/or equipment. The fleet is composed of the following sub-fleets: police department (24 vehicles), public works (27 vehicles), city hall (4 vehicles), and the fire department (16 vehicles). Figure 12 illustrates that of the four sub-fleets the police department generates the most (54%) GHGs. The public works fleet ranks second (36%), followed by the fire department, (8%) and City Hall vehicles (2%).

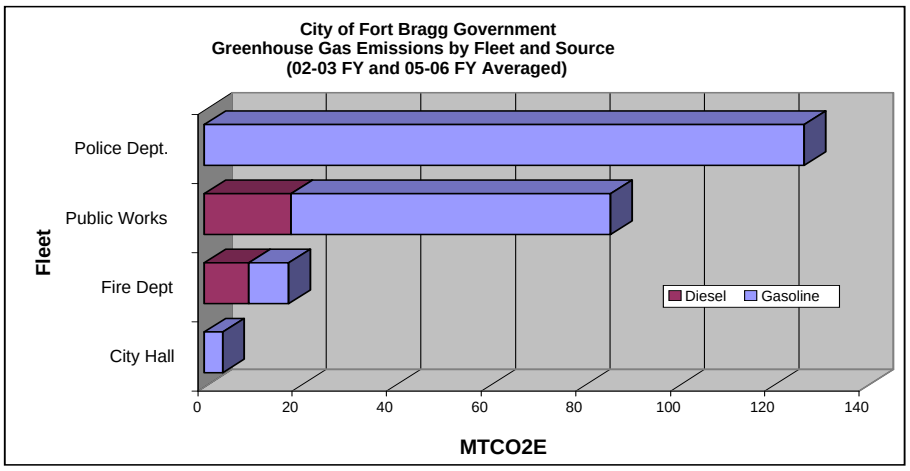


Figure 13: Fleet Emissions by Sub-fleet and Source

Greenhouse gas emissions from the Police Department are particularly high due to 24-hour operation of vehicles, arrestee transports, travel to court appearances and training seminars, personnel use of vehicles, and patrol vehicle size and power.

- Officers frequently utilize their patrol vehicles to travel from Fort Bragg to Ukiah (a distance of approximately 120 miles roundtrip) to transport arrestees, make court appearances, and attend training seminars. The Fort Bragg police department makes approximately 400 arrestee transports per year accounting for about 48,000 miles a year, or 25 $MTCO_2E$ (10% of GHGs for the vehicle fleet).
- Officers also travel to Ukiah about once a week for court appearances accounting for approximately 6,000 miles, or 3 $MTCO_2E$.

- Officers travel to various destinations including Ukiah, Sacramento, Santa Rosa, and Southern California for mandated training seminars. These trips are less regular making them more difficult to estimate mileage and GHG emissions.
- Finally, under current practice Fort Bragg Police officers are allotted their own patrol car and use their vehicles for commuting. Some officers live in neighboring counties and commute substantial distances on a frequent basis. This is a considerable benefit for officers.

The Police Department has made some efforts to reduce GHG emissions as two bicycle police patrols have been implemented and one electric vehicle has been purchased. The Police Department is currently transitioning from Ford Victorias and Dodge Chargers to hybrids such as the Ford Explorer, Escape, or Chevy Tahoe. Other potential solutions include:

- Discontinuing personal use of patrol cars and replacing this privilege with increased salary, and
- Utilizing a caged hybrid pool car for arrestee transports, court appearances, and mandated training seminars.

The Public Works Department is interested in converting some vehicles to liquid petroleum gas (LPG) as an alternative fuel. Converted vehicles would reduce GHG emissions by 11% in comparison to gasoline and provide more stable fuel cost. Moreover, Public Works could perform the conversions "in house" and maintain the converted vehicles. However, the conversion would decrease cargo space and propane fuel is not always readily availability (for example when traveling on a business trip). In most cases LPG fuel tanks are mounted in the back of pick-ups or in the trunks of autos, decreasing the amount of usable cargo space. The Public Works Department frequently hauls equipment and debris making the loss of cargo space a disadvantage. LPG fuel is currently available in Fort Bragg but is not available at the card lock stations currently utilized by the city fleet. Public Works Superintendent, Mike Cimolino suggested that if the City chooses to convert city vehicles to LPG the City would need to purchase its own LPG fueling tank.

Table 4-4: Projects to reduce GHG Emissions and Fuel Costs in City Vehicle Fleet

#	Strategy	Description	$MTCO_2E$ Reduction	Cost
1	Police Department hybrid pool car	Acquire and use hybrid pool cars for all arrestee transports, court appearances, and mandated training.	10 $MTCO_2E$	$56,000
2	Discontinue personal use of police patrol cars	Discontinue or limit the use of City purchased fuel for personal use in police vehicles.	6 $MTCO_2E$	No cost
3	Office bicycles/ police bicycle patrols	Use police bicycle patrol in good weather. Provide City Hall bicycle/helmet for City Hall staff.	Unknown	$650
5	Convert City vehicles from gasoline to CNG	CNG reduces GHG emissions by 11%, reduces fuel cost, extends the life of the engine, and requires less maintenance. The conversions can be done "in house" but require an initial investment of the conversion kits and fueling tank.	23 $MTCO_2E$	~$2,000/ Vehicle $100,000
6	City Hybrid Pool Car	Prioritize use of the City Hall hybrid pool car for long distance travel for training and meetings	Unknown	No cost
7	Reduce training travel	-Hold remote meetings via conference call &	Unknown	No cost

		internet-based conference as feasible. - Bring trainers and workshops to Fort Bragg for standard training, rather than send city employees away for training. - Require car-pooling for all remote meetings.		
		Totals	39	$156,650

Recommendations

Reaching the GHG emissions reduction goal of 30% or 71 $MTCO_2E$ for the vehicle fleet will take efficiency upgrades, and behavioral changes that include implementation of many of the measures presented in Table 4-4. Staff recommends that the City implement all recommendations for in Table 4-4 for a total reduction of 39+ $MTCO_2E$.

The City could also benefit from conducting an ongoing under-utilized vehicle study and continue transitioning to smaller and more efficient vehicles in order to decrease fuel use, GHG emissions, and cost. Also, by monitoring fuel usage the City will learn exactly where it can save money, fuel, and GHG emissions. Under its current practice the City does not track the amount of miles driven by driver, task or vehicle.

4.5 Employee Commute

Emissions Summary and Background

In the baseline year of 2005, the City of Fort Bragg employee commute generated 64 $MTCO_2E$ of GHG emissions, or six percent of government emissions. While the employee commute is the smallest contributing sector of GHG emissions, it ranks second in production of air pollutants overall (City of Fort Bragg, 2007). In order to reach the government designated target of 30%, a reduction of approximately 19.2 $MTCO_2E$ is required by 2020.

City employee commuter behavior was surveyed in 2008 and the survey found that the average work commute is three miles. However despite this short average commute, 86 percent of all employees drive. It should be noted that a significant number of employees must drive to work because they use City vehicles for that commute (this is especially true of the police department). The survey also found that employees commute primarily with a midsized auto, followed by large trucks/sport utility vehicles, and then compact autos. None of the employees surveyed use alternative fuels, hybrid, or electric vehicles. All emissions resulting from the employee commute were generated from gasoline (City of Fort Bragg 2007).

Best Practices

There are relatively few methods for getting City employees out of their car for their commute to work, and these include:

- Incentivize auto-alternatives by providing bicycle facilities and provide the opportunity to telecommute.
- Install bicycle racks at all City facilities to promote bicycle use.
- Work with Caltrans and the County to improve bicycle lanes along Highway 1, as many employees live north and south of town.

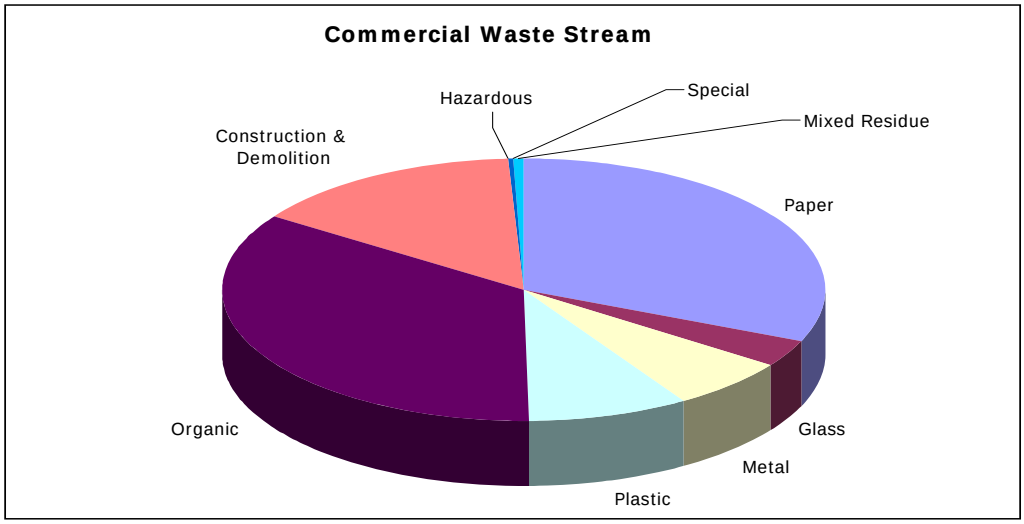
Recommendations

It will be difficult to achieve a 30% (19.2 $MTCO_2E$) reduction in employee commute emissions. However new CAFE standards by the Federal government will eventually reduce emissions by the City employee commute.

4.6 Municipal Waste

The waste sector contributes an average of 81 $MTCO_2E$ of GHGs annually, representing about seven percent of emissions. Emissions originate primarily from decomposition of waste at the landfill in the form of methane gas. Redwood Landfill currently does not capture or utilize this GHG[25]. Additionally, fuel to haul waste to the Redwood Landfill in Novato, 150 miles away in southern Sonoma County, also produces GHGs.

Figure 14: Municipal Waste Stream



Biogenic CO_2, originally taken up from the atmosphere by plants through the process of photosynthesis before being utilized by humans, is not counted when calculating Fort Bragg's "footprint" of anthropogenic (human caused) GHG emissions. For example, CO_2 from composting operations is biogenic, as is CO_2 released from landfills. Methane released from landfills is counted as human caused, however, since decomposition under natural conditions would not usually generate methane and methan is a much more powerful GHG. Food waste, and moisture rich compostable waste like grass clippings, create substantial methane gas emissions when landfilled.

[25] CH_4 is one of the three most important GHG that causes the earth's lower atmosphere to warm. CH_4 is more than twenty times as effective as CO_2 at trapping heat in the atmosphere

Best Practices

Table 4-5: Proposed Measures – Waste Reduction				
#	Strategy	Description	$MTCO_2E$ Reduction	Cost
1	Environmentally Preferable Purchasing Policy	Adopt an environmentally preferable purchasing program requiring for example purchase of only 100 percent recycled paper, elimination of bottled water, purchasing low VOC building supplies, etc.	~10	Staff Time
2	Continue Recycling Program	Continue to implement the recycling program at City facilities, including recyclable materials (paper, cardboard, cans and bottles), construction and demolition waste, and compostable materials (food waste).	~10	Staff Time
		Totals	20	

Recommendation

Staff recommends that both strategies be implemented.

4.7 Municipal Operations Summary

In order to reach the City's goal of a 30% GHG emissions reduction by 2020, the City will need to eliminate 350 +117 for CVStarr $MTCO_2E$ for a total of 467 $MTCO_2E$. Table 4-6 illustrates the reductions possible for each municipal operation. As noted in the table, the proposed 30% GHG reduction target is not quite achievable given the cost effective implementation measures outlined in this chapter. With the addition of the C.V. Starr Community Center the City needs another 70 MTCO2E to achieve its goal. If PG&E retrofits the City's Streetlights with LED bulbs it will reduce MTCO2E by an additional 55.7 metric ton. Additionally, all of the projects identified reduce operating costs and pay for themselves over time with energy efficiency.

Table 4- 6 Fort Bragg GHG Emissions Opportunities

Sector	Table	Potential GHG Emission Reduction (MTCO2E)	Target Reduction (MTCO2E)	Percent of Target	Installation Cost	Cost per metric Ton	Simple Payback (years)
City Buildings	Table 4-1	76	153	97%	$84,742	$1,115	1.7
	Table 4-2	73			$514,436	$7,037	16.2
Water & Sewer	Table 4-3	198	154	129%	$846,398	$4,275	9.2
Streetlights		3	35	8%	$20,000	$7,143	14.2
City Fleet	Table 4-4	39	71	55%	$156,650	$4,017	--
Employee Commute	--	--	19.2	0%	$ -		--
Municipal Waste	--	20	24.3	82%	$ -		--
Total all City GHG		**399**	**467**	**85%**	**$1,622,226**	**$4,067**	

5 Community Measures

This chapter identifies current emissions, best practices, and recommended implementation measures/strategies for the community by the following categories: residential buildings, commercial buildings & operations, transportation, and waste.

5.1 Residential GHGs

With one hundred and fifty years of development history Fort Bragg's building inventory offers varying levels of energy efficiency. Many homes and businesses waste energy due to poor/no insulation, energy intensive lighting and appliances, and out-dated heating systems. Many buildings in Fort Bragg are 80 years old or more, providing unique historical value but offering less energy efficiency than newer buildings.

In the 2005 baseline year, the residential built environment in Fort Bragg generated approximately 21,300 $MTCO_2E$, or 15 percent of community GHG emissions. The average 2005 Fort Bragg household produced approximately 7.5 $MTCO_2E$. By comparison the average US house generates 13 $MTCO_2E$ per year and the average house (globally) produces just 4 $MTCO_2E$. To reach the community designated reduction target of 15%, approximately 3,195 $MTCO_2E$ will need to be trimmed by 2020 from this sector.

Residential buildings produce GHG emissions through energy consumed for space/water heating, appliances, and lighting. Residential GHG emissions come from electricity, propane, heating oil, and fuel wood. In 2005, electricity and propane generated a similar amount of GHG emissions, producing 37 percent and 35 percent respectively. Heating oil ranked third, having contributed 27 percent of residential sector GHG emissions (Figure 4-1) (City of Fort Bragg 2007). Fuel wood generated the smallest amount of GHG emissions, with just over 1% of emissions for the residential sector (City of Fort Bragg 2007).

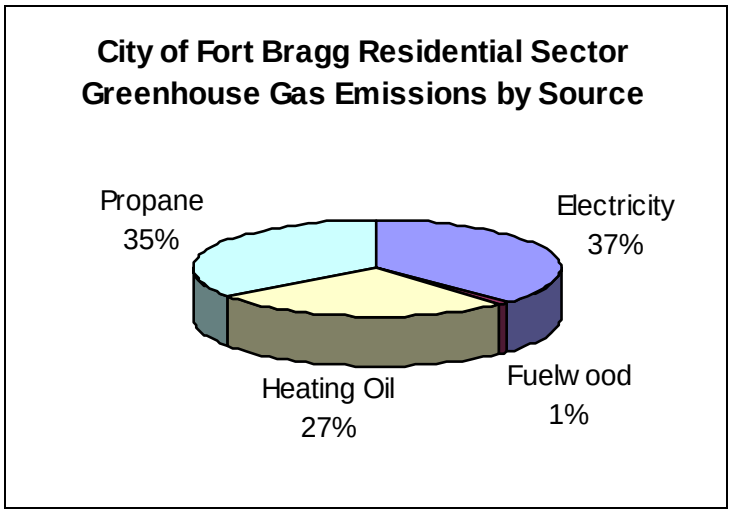


Figure 4-1: Residential GHG Emissions by Source

Community Feedback[26]

Attendees from the community workshops demonstrated a strong desire for residential programs. More specifically, attendees support programs that help them:

- Retrofit their homes for energy efficiency (energy audits, weatherization, water heater blankets, CFLs, attic insulation, windows, programmable thermostats, parasitic power reduction, energy efficient appliance rebates);
- Undertake green building and remodel activities;
- Heat water efficiently ("on demand" water heaters, solar hot water, and replacing water heaters that use heating oil);
- Build new alternative homes with efficient designs (straw bale, rammed earth, cob, adobe);
- Acquire energy efficient appliances (wood pellet stoves, refrigerators, washers/dryers, etc.).

5.2 Current Activities

5.2.1 City Sponsored Community Oriented GHG reduction efforts

The City has implemented the following projects to reduce GHGs by residential buildings within the City of Fort Bragg.

- The **Inland General Plan** and **Mill Site Specific Plan** both include policy requirements for passive solar design and construction, compliance with minimum green building standards, such as Build-It-Green or Leadership in Energy and Environmental Design (LEED), use of native plants and minimal irrigation, amongst other energy saving requirements in new residential projects. The Inland General Plan requires that the City implement the **State Green Building Code** which will result in all new residential construction being net-zero energy by 2020. The revised 2013 Title 24 residential standards also incorporate significant efficiency improvements for residential windows, the building envelope (wall, ceiling and floor) insulation, and the testing of HVAC systems. According to the CEC estimates, Californians can expect energy savings of 25 percent for homes and 14 percent for low rise multifamily buildings upon utilization of the new 2013 code.
- **2nd residential unit plans**. The City encourages the construction of second residential units where they can be reasonably accommodated within the City limits through the three free Second Unit Designs and Building Plans. According to the National Academy of Science, if 75 percent of new development were built at twice the density of current norms, vehicle miles traveled would drop 25 percent and greenhouse gas emissions could be reduced up to eight percent by 2050.
- **Housing Rehabilitation Loan Program.** This program provides low and no interest loans to income qualified households to address health, safety and energy efficiency issues in single and multi-family projects. In 2012 this program funded loans for the rehabilitation of five distressed properties at a total cost of $325,000.

[26] Derived from votes taken at the community workshop. This list is in order from most to least votes (Appendix A).

- **REDI program** – the City works with the Renewable Energy Development Institute (REDI), providing public assistance to low and moderate income homeowners and business professionals with energy efficiency. Programs include:
    - Home Energy Link Program (HELP) providing affordable assistance to install energy-efficient features and reduce energy and heating costs for income-eligible local residents, plugging the energy leaks in our community.
    - Small Business Energy Alliance (SBEA) links small businesses and other entities in the region to energy efficiency improvements to their facilities, funded by California ratepayers and local grants.
    - Flex Your Power – REDI works with the California Public Utilities Commission, providing education and materials on how to save energy.
    - California Alternative Rates for Energy (CARE) – REDI helps people apply for low-cost lifeline utility service through PG&E.

5.2.2 Community Greenhouse Gas Reduction Efforts

Photovoltaic Projects. As shown in Table 1, a number of homeowners have installed a total of 50 Kw of PV systems, which will reduce GHG emissions by 39 $MTCO_2E$ /per year. In 2005 residential buildings produced 21,289 $MTCO_2E$ and the investment in PV systems has reduced this by 39.4 $MTCO_2E$ or 0.18%; a drop in the bucket.

Table 5- 1: Installed Residential Solar Panel Energy Production Capacity within City of Fort Bragg

Projects	KW	$MTCO_2E$
Habitat for Humanity homes	22.7	17.8
309 E Bush (averaged)	2.9	2.3
1231 Cedar	2.8	2.2
177 Grove	7.4	5.8
445 N Harold	3.1	2.5
230 Brandon (averaged)	2.9	2.3
546 S Whipple	2.7	2.1
165 S Sanderson	2.6	2.0
160 Jewett	3.1	2.4
Total	***50.2***	***39.4***

5.2.3 Proposed Measures

The City is already engaged in a number of best practices to improve energy efficiency of the residential building stock (see above), however more can be done, including the additional measures included below in Table 5-2.

Table 5-2: Proposed Measures – Residential					
#	**Strategy**	**Description**	**Annual MTCO2E savings**	**Cumulative Annual MTCO2E Reduction by 2020**	**Cost**
City Managed Programs for Residential					
1	Implement the California Green Building Code	Implement the 2013 California Green Building Code and the General Plan requirement for Passive Solar Design for all new residential projects. This results in a 25 to 30% energy savings for a new home and or about 1.8 tons of GHG/home. The City adds on average ten new homes per year.	19	131	No cost
2	Housing Rehabilitation Loan Program	Continue to implement Housing Rehabilitation Loan Program as funding becomes available. The housing rehab loan program results in about five residential projects per year, saving about two tons of GHG/home rehab project.	10	30	Grant Funded
3	REDI program	Continue to implement the REDI program which results in 10 completed weatherization projects and 670 Utility Assistance applications per year. Weatherization reduces energy use by 20 to 30% or about 2.9 tons of GHG/year.	29	203	$40,000/ year
4	Energy Audits Loan Kill-o-watt meter	The City could partner with PG&E and undertake energy audits for low income households, or could purchase a few Kill-O-Watt meters and loan them out to residents so that residents can determine how much energy that old refrigerator is really using. Assume this replacement of 20 refrigerators per year.	20	140	$75 for three Kill-O-Watt meters
5	Require weatherization as part of all home sales	Many cities require that homes are weatherized when they are sold. In 2011, 62 homes sold within City Limits. This represents a unique opportunity to improve energy performance within the City's housing stock.	120	840	Marginal City cost
6	PACE Program	Establish a Property Assessed Clean Energy (PACE) program similar to the Berkeley Financing Initiative for Renewable and Solar Technology (FIRST), if the Federal Housing Finance Authority, Freddie Mac and Fannie May, revise their strict rulings against any PACE program that places a PACE loan in a superior position to a mortgage. GHG estimate assumes that PV is put on 20 houses with such a program.	6	40	Would require a funding source and admin costs.
7	Prepare grey water stormwater catchment standards	Develop a standard/guideline for grey-water and/or storm water catchment for landscaping.	Unknown		5000
Home Owner Initiated Improvements					
8	Install PV Systems	Owner-initiated install PV systems in 10 existing homes per year.	20	140	NA
9	Weatherization	Owner-initiated weatherize 10 homes per year	20	140	NA
10	Upgrade appliances	Owner-initiated refrigerator replacements	Unknown		
		Total	**278**	**1,664**	

Recommendations
It will be difficult to achieve a 15% reduction (3,195 $MTCO_2E$) in residential emissions by 2012. Implementation of all of the programs enumerated above would result in reductions of 1,664 $MTCO_2E$, which is 7.8% of total residential emissions.

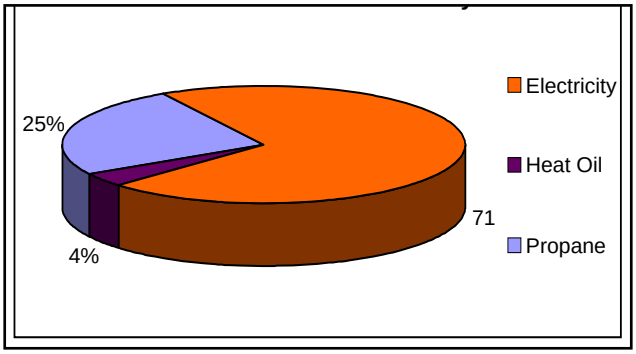
5.3 Commercial

Emissions Summary and Background

In the baseline year (2005) the Fort Bragg business generated approximately 17,583 $MTCO_2E$, 13 percent of community generated GHG emissions. In order to reach the community designated reduction target of 15 percent, a reduction of approximately 2,637 $MTCO_2E$ is required by 2020 for this sector.

The commercial sector consists of office buildings, retail stores, institutions (the hospital, schools, the college, etc.) and government facilities. The average commercial business in Fort Bragg produced 5.6 $MTCO_2E$ per employee, or 0.01 $MTCO_2E$ per square foot. GHG emissions from the commercial sector originate from three sources: electricity, propane, and heating oil. Figure 13 illustrates that electricity produced the most emissions (71 percent), followed by propane (25 percent), and heating oil (4 percent).

Figure 15: Commercial GHG Emissions by Source



Commercial GHG emissions reduction measures are already underway. Many businesses have installed energy efficiency lighting, windows, heating and insulation and photovoltaics. As shown in Table 1, four City businesses have installed a total of 7,186 Kw of PV systems, which will reduce GHG emissions by 5,642 $MTCO_2E$ /per year, a total emissions reduction of 32% of 2005 levels.

Table 5-3: Installed Solar Panel Energy Production Capacity within City of Fort Bragg

Projects	KW	$MTCO_2E$
Commercial		
FBUSD	4,775.4	3,749.8
Coast Clinics	2,350.0	1,845.3
Harvest Market	25.0	19.6
Surf N Sand	35.7	28.0
subtotal	*7,186.1*	*5,642.8*

Community Feedback[27]

Attendees from the community workshops would like to see:

- Programs to help businesses increase energy efficiency in buildings.
- Businesses turning off their lights at night.
- New commercial developments built to LEED certification or higher.
- Businesses acquire energy efficient appliances (EnergyStar® office equipment).

Best Practices

Commercial GHG reduction best practices should focus both on building performance and operations. Commercial enterprises can for example benefit both from better insulation and lighting (building attributes) as well as from operations improvements such as installing variable speed pumps and drives, occupancy sensors, energy efficient equipment, and other equipment depending on the business type.

At the state level, the California Green Building Code of 2013 sets new commercial standards including: time dependent valuation of electricity and gas, new regulations for refrigerated warehouses, proscriptive heat loss/gain equations, new fenestration U-factors for windows and skylights, new fenestration Solar Heat Gain Coefficients (SHGC) for windows and skylights, proscriptive limitations on glazing area, new insulation requirements, new Cool Roof requirements, and revised calculation procedures. According to the CEC estimates, Californians can expect energy savings of 30 percent for commercial buildings upon utilization of the new 2013 code. The California Green Building code will require net zero buildings on the commercial side by 2030.

In addition to the California Green Building Code, there are several measures the City and business owners can implement to reduce energy use/GHG emissions within the commercial sector as enumerated in Table 5-4.

Table 5-4: Proposed Measures – Commercial

#	Strategy	Description	Annual MTCO2E savings	Cumulative Annual MTCO2E Reduction by 2020	Cost
City Managed Programs for Commercial Buildings/Operations					
1	Implement the California Green Building Code	Implement the 2013 California Green Building Code and the Design Guidelines requirement for Passive Solar Design for all new commercial projects. This results in a reduction of 30% of energy use for new commercial projects, or about 0.01 $MTCO_2E$ /SF total. The City adds on average 14,000 SF new commercial space per year.	140	980	No cost
	Energy Audits	The City could partner with PG&E and promote energy audits and PGE incentives for commercial property owners. Assumes ten commercial energy audits per year.	Unknown		Staff Time

[27] Derived from votes taken at the community workshop. This list is in order from most to least votes (Appendix A).

3	Require energy retrofits as part of all commercial property sales	Many cities require that businesses are energy retrofitted when they are sold. In 2011, ten commercial properties sold within City Limits. This represents a unique opportunity to improve energy performance within the City's commercial building stock. Assumes that commercial businesses would save 30% of their energy costs based on an audit and that the typical business produced 15 $MTCO_2E$ per year	45	315	Staff Time
4	Mayor's Well Done Award for energy efficiency.	Promote and reward energy efficiency efforts by providing a Mayor's Well Done Award for energy efficiency.	Unknown		$50
5	Revise LUDC	Require energy efficient exterior lighting for businesses and encourage lighting retrofits from incandescent to LED and or CFL.	Unknown		Unknown
6	Prepare grey water stormwater catchment standards	Develop a standard/guideline for grey-water and/or storm water catchment for landscaping needs.	Unknown		$5,000
Business Owner Initiated Improvements					
7	Install PV Systems	Owner-initiated install PV systems in 10 additional commercial buildings by 2020	300	2,100	NA
8	Energy audits and efficiency projects	Owner-initiated energy audits and efficiency projects for ten commercial buildings by 2020	100	700	NA
		Total	**585**	**4,095**	Staff Time

Recommendation

The commercial building sector has already exceeded the City's target of a 15% reduction in GHGs. The Private sector is reducing GHG emissions very well on its own and City assistance/regulation in this area in not necessary. However the City could provide additional assistance by implementing the projects above for an additional 4,095 MTCO2E of reductions.

5.4 Transportation

Emissions Summary and Background

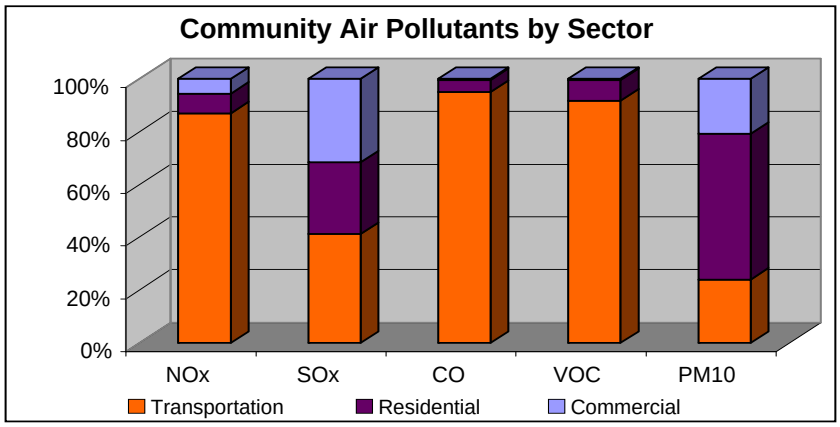
Vehicles generate more GHG emissions than all other sources combined. In the baseline year (2005), vehicles generated approximately 95,866 $MTCO_2E$[28], representing approximately 70 percent of all community generated GHG emissions. A reduction of approximately 14,380 $MTCO_2E$ is required by 2020, in order to reach the 15 percent target.

Vehicles are also responsible for the majority of air pollutants. Figure 16 illustrates the amount of nitrous oxide (NO_x), sulfur dioxide (SO_x), carbon monoxide (CO), volatile

[28] Emissions generated by privately and publicly owned passenger vehicles, transport trucks, public transit vehicles, and all other on-road vehicles associate with personal, commercial, industrial, and government activities are included in this analysis.

organic compounds (VOC), and particulate matter (PM_{10}) greater than 10mm generated from the transportation, residential, and commercial sectors.

Figure 16: Community Air Pollutants by Sector



Community Feedback

Attendees of the community workshops were very supportive of programs for the transportation sector. More specifically, the top five ideas from the workshop to reduce transportation related GHG emissions include:

1. Improvements in bicycling infrastructure including bicycle parking and bicycle pathways (lanes).
2. Safe Routes to School program.
3. Community bicycles co-op/library.
4. Car-pool / car sharing program for commuters.
5. Bus systems that utilize alternative fuels (hybrid/electric or biodiesel technology).

The City and MTA are well on their way to achieving all of these recommendations, as items 1, 2 and 5 have already been implemented.

Current Activities

Like many California coastal towns, much of Fort Bragg's grid pattern was developed prior to the invention of the automobile to serve horse carriages and trolleys. This street grid now serves the City well by providing multiple routes through town which reduce vehicle miles traveled, traffic congestion and GHG emissions. Over the past 15 years the City has also invested significantly in improved infrastructure for pedestrians and bicycles, including the following:

- The new downtown streetscape was designed for easy and safe pedestrian use with wide sidewalks, pedestrian bulb outs, street trees and well-marked cross walks.
- In 2013, the City will open 4.5 miles of biking and hiking trails in Noyo Headlands Park.
- Three Safe Routes to Schools projects.

Additionally, the City vehicle fleet is transitioning to a greener fleet, including the recent addition of an electric car, and a number of hybrid cars. And the Fort Bragg Police Department uses two bicycles to patrol the community and for special events.

The City has completed or will soon complete a number of planning processes/documents which upon implementation will reduce GHG emissions by the community, including:

- The Inland General Plan and Mill Site Specific Plan which both include a number of GHG reduction requirements for all new development projects including: "complete streets", passive solar design and construction, use of native plants and minimal irrigation, amongst other energy saving requirements.
- The 2009 Bicycle Master Plan summarizes includes a number of bicycle transportation projects which, as implemented, will improve the bicycle friendliness of Fort Bragg.
- The 2011 South Main Street Access and Beautification Plan includes specifications for making a more walkable and bicycle friendly Main Street from Highway 20 to Oak Street. Caltrans and the City will undertake some of the identified improvements in 2014 and 2015 as part of the Caltrans ADA project and the City's coastal trail project.
- The 2011 Residential Streets Safety Plan identifies safety enhancement projects for pedestrians, bicyclists and motorists throughout the City, again a number of these projects have been implemented through the Safe Routes to School program.

Best Practices

Significant transportation related GHG reductions will come from three sources:

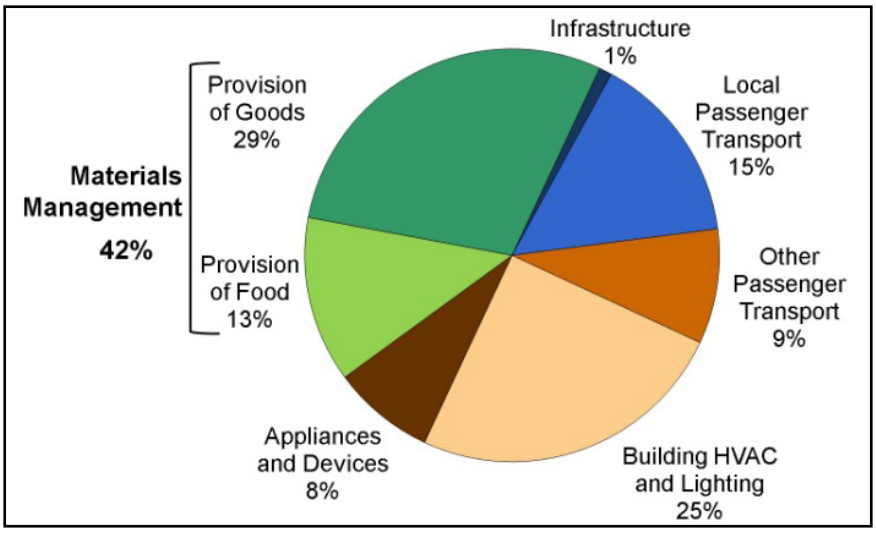
1. Increasing fuel efficiency through innovation and regulation at the National and State level. For example, the new CAFE Standards will raise fuel efficiency to 39 mpg for cars and 30 mpg for trucks by 2016.
2. Changing the built environment to include more compact development, mixed use development, and complete streets to reduce the need for commuting. The proposed Specific Plan will provide opportunities for compact and mixed-use development. Implementation of the City's Bicycle Master Plan and Residential Street Safety Plan will result in a better network of complete streets throughout the City.
3. Expand transportation alternatives by encouraging an alternative fueling station, coordinating with the Regional Blueprint Planning effort to improve transportation choices and reduce GHGs.

5.5 Solid Waste

The direct GHG emissions reductions achieved by landfill diversion are limited, but potential upstream impacts are high. For example, diversion of aluminum from landfills for recycling offers minimal reductions in landfill emissions, but the use of recycled aluminum reduces emissions by reusing the material and eliminating 96% of the energy input the mining and smelting processes to produce a ton of aluminum from virgin materials .

The U.S. EPA employing a systems-based accounting method to categorize U.S. GHG emissions reveals that 42% of emissions result from materials management, *i.e.* the extraction of natural resources, and production, transport and disposal of food and goods. As shown in Figure 17, the benefits of recycling are not from reducing methane production from landfills, but in recycling materials so that virgin materials do not have to be extracted and manufactured.

Figure 17: GHG emissions by activity, US, 2009



Recycling leads to significantly lower emissions especially from the following materials: carpet, core recyclables, corrugated containers, office paper, aluminum cans, newspaper, magazines, PET and HDPE (or mixed plastics), steel cans, dimensional lumber and food scraps.

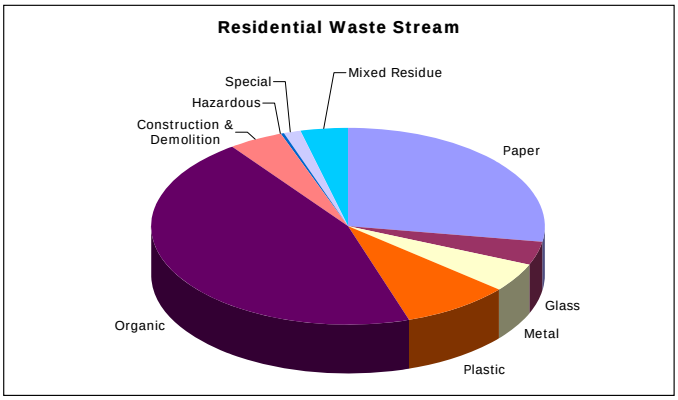
Emissions Summary and Background

This section examines the GHG emissions produced by the disposal of waste only. It does not address the larger issue of GHG emission avoidance through recycling described above. Disposal of solid waste produces greenhouse gas emissions through: 1) anaerobic decomposition of waste into methane, a greenhouse gas 21 times more potent than carbon dioxide, and 2) waste transportation. In the baseline year of 2005, the solid waste sector generated approximately 4,086 $MTCO_2E$, representing approximately three percent of community generated GHG emissions. In order to reach the community designated target of 15 percent, a reduction of approximately 613 $MTCO_2E$ is required by 2015 for this sector alone.

In 2007, Fort Bragg generated 12,249 tons of waste. The majority of waste generated in Fort Bragg goes to landfill destinations in Marin (75%), Solano (16%), and Contra Costa (9%) Counties. Before waste is trucked to the destinations mentioned above it travels to the Willits Transfer Station (Integrated Waste Management Board 2008). Transporting 12,249 tons of waste annually requires an enormous amount of fuel, operational cost, road degradation, and GHG emissions. Once the waste reaches its destination it is buried in a managed landfill where it slowly decomposes. The decomposition process results in methane gas, a powerful GHG. Methane is typically captured and flared at the landfills resulting in carbon dioxide.

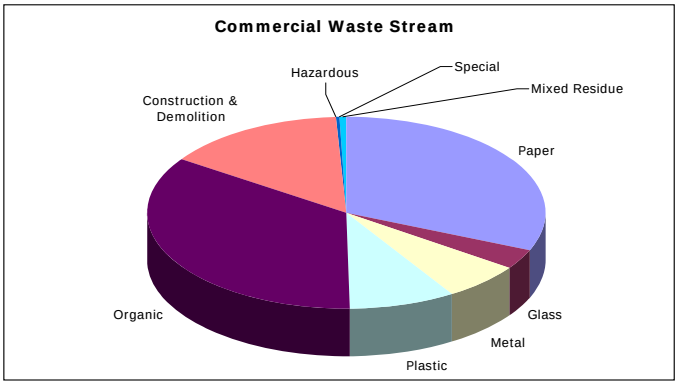
Residential Waste

Fort Bragg residents currently utilize curbside pickup of trash, recyclables, and greenwaste. Fort Bragg residents generate 4,777 tons of waste per year. The average resident generates 0.44 tons or waste per year, or about 4 lbs. per day. The three largest waste types for Fort Bragg residents are organics (45% or 1,256 tons), paper (27% or 766 tons), and plastic (9% or 247 tons).



Commercial Waste

Fort Bragg businesses generate 7,472 tons of waste per year, or about 8.4 pounds/employee/day. The top four business types with the most waste disposal are restaurants (19.9% or 1,624 tons), manufacturing & construction (13.3% or 1,079 tons), medical and health (9.5% or 771 tons), and retail trade (7.7% or 631 tons). The three largest waste types for businesses in Fort Bragg are organics (33.2% or 2,772 tons) paper (30% or 2,506 tons), and construction and demolition (14% or 1,168 tons).



Community Input

Attendees of the community workshops identified the following top ideas to reduce waste related GHG emissions:[29]

- Require Waste Management or some other entity to offer local compost and local recycling;
- Develop a restaurant food waste composting/vermiculture program; and
- Restrict the sale of excess packaging and plastic bags.

[29] Derived from votes taken at the community workshop. This list is in order from most to least votes (Appendix A).

Current Actions

The City has taken a leadership role in reducing solid waste through ordinances that promote recycling and reduce the use of non-recyclable materials, including the following:

- **Construction and Demolition Recycling Ordinance**. The City instituted a Construction and Demolition Waste Ordinance in 2007 requiring recycling of materials for any project over 1,000 sq. feet requiring demolition, any remodel or renovation project more than 500 sq. feet in size, any new construction project or any road, sidewalk, or driveway project resulting in removal of 200 sq. feet or more of asphalt or concrete. Thousands of tons of waste have been diverted from the landfill through the implementation of this ordinance.
- **Plastic Bag Ordinance.** In 2012, City Council adopted an ordinance to prohibit the use of single-use plastic bags within City limits.
- **Vermiculture Project**. In December of 2011, the City completed an Organic Waste Conversion Facility Feasibility Study. The study explored ways for the community to divert food scraps and agricultural wastes from the waste stream, and produce high value, marketable, in-demand soil fertility products. When implemented, the project will reduce carbon and pollution due to the decreased export of organic waste as well as decreased imports of soil amendments and food. The project has additional carbon reduction potential in catalyzation of local sustainable enterprises. A pilot project has been planned, and the Noyo Food Forest has expressed a desire to participate in the pilot project.
- The City has made recycling mandatory at public events.
- The City's Land Use and Development Codes require that all new development projects include adequate space for storage of recyclables.
- Waste Management recycles mixed recyclables, operates a green waste program and an annual program for curbside recycling of large appliances.

Best Practices

Additional activities that the City could undertake include:

Table 5-5: Proposed Measures Waste Reduction

#	Strategy	Description	$MTCO_2E$ Reduction	Cost
1	Restaurant food waste ordinance/program	Initiate a program to pick-up food waste from restaurants. Assumes 15% of restaurant food scraps are composed.	365	Unknown
2	Establish a Coastal Solid Waste Transfer Station	The City is currently engaged in establishing a solid waste transfer station on the coast, which would reduce the transportation costs and GHGs associated with transportation of solid waste and improve opportunities for local recycling and reuse.	0.5	Unknown
3	Residential curbside compost pick-up commercial property sales	Initiate a curbside food waste pick-up program from residents.	235	Staff Time
		Total	**600.5**	Unknown

The proposed programs would enable the City to achieve its15 percent reduction target of approximately 613 $MTCO_2E$ by 2020.

5.6 Alternative Energy, Open Space, and CO2 Sequestration

The City has initiated two additional projects to reduce GHG emissions, specifically, GHG sequestration at Otis Johnson Park and the Biomass project. Each is described below.

GHG Sequestration

Otis Johnson Park Restoration – Otis R. Johnson Park is a 7.5 acre wilderness park in the middle of Fort Bragg. It stands as the last remaining native coniferous forest after over 100 years of urbanization surrounding it. Trails through the park are utilized by students and everyday citizens to cross town rather than driving. Over the years since its dedication in the mid 1900s, the flora of the park had been invaded by horticultural varieties escaped from neighborhood gardens. Since 2009 the City of Fort Bragg has "gone native" in the park with a thorough weeding and native planting program targeting about six acres. Native species were successfully propagated by local students who have also been responsible for much of the planting. Long term carbon storage is realized in living form as long lived redwoods and bishop pines in the overstory, shrubs including native berries in the understory, and a wide variety of native ferns and ground covers on the forest floor (Barber 2012).

Alternative Energy

Biomass Feasibility Project – In December 2006, the Fort Bragg City Council adopted a resolution supporting a feasibility study for a biomass power plant in the Fort Bragg area. At that time, the Mayor appointed an ad hoc Council committee consisting of former Council members Jere Melo and Dan Gjerde to participate in a "Biomass Committee" that was informally established during the initial feasibility study for a biomass plant. Partners include the County of Mendocino, Congressman Mike Thompson, Mendocino County Resource Conservation District, Hawthorne Timber Company, Campbell Timberland Management, The Conservation Fund, Usal Redwood Forest, and Pacific Gas and Electric Company. A local biomass plant would use abundant local wood waste to produce energy. While biofuels are carbon-based fuels, the carbon in biofuels is already part of the active global carbon cycle in which carbon exchanges rapidly between the atmosphere and the biosphere. Bioenergy production does not add new carbon to the active carbon cycle, and can be more efficient in transferring carbon from the biomass stock to the atmospheric stock than alternatives such as open burning or burying of wood waste.[30] The feasibility analysis has concluded that a 5 megawatt facility is feasible with a small lumber mill. The group has identified a number of potential sites and has been meeting with energy companies interested in possibly locating a biomass facility on the Mendocino Coast.

[30] *Bioenergy and Greenhouse Gases*. Pacific Institute, May 2008
http://www.hm3e.com/files/pdfs/BioEnergyGHGWhitePaperMorris5-08_000.pdf

6 Financing & Implementation

6.1 Financing

Energy efficiency, Renewable Energy and Green House Gas Reduction projects recommended through this Climate Action Plan fall into three general categories:

1. Those that pay for themselves through energy savings within ten years and that are good investments for the City in terms of energy savings, GHG emissions reductions, and cost savings. These projects can be financed as capital improvements or they may be financed as part of operations and maintenance.
2. Those that are relatively more expensive and pay for themselves over a longer period of time (10 to 20 years), but have significant GHG reductions and long term cost savings. These projects should typically be financed as capital improvements with grant, loan or bond financing.
3. Projects and programs that don't result in directly quantifiable energy/cost savings to the City, but that have a significant GHG emission reduction benefit for the City or the community. If implemented these programs and projects should become part of staff duties or partnerships with other organizations.

There are a number of common methods of paying for GHG/energy conservation strategies which are described below:

Direct Purchase

Many GHG reduction strategies pay for themselves in a very short period of time, and are implemented with existing funds.

Revolving Fund

The City can establish a permanent revolving fund to finance energy efficiency and greening programs. A revolving fund operates by financing new projects with the savings achieved through investments in previous projects. Essentially energy efficiency savings finance new investments. By establishing a revolving fund for GHG reduction projects, Fort Bragg can keep the costs and savings from these projects independent of the capital budget. However, this approach should not be used on its own as it will result in delays of important projects while the City waits for sufficient funds to accrue in the revolving loan fund. Rather it should be combined with financing the first round of projects, which allows the City to pay off the financed projects with savings in energy costs at the same time that it starts saving funds for additional projects. The benefit of the energy-fund strategy is that the savings of projects that have very good return on investment can fund projects that have a relatively poor return on investment.

Financing

Financing Options include:

- California Energy Commission (CEC) low interest loan program provides 3.5% interest loans with a term based on the simple payback of the projects, up to 15 years. This program is available to all government entities.

- PG&E On-Bill financing provides zero interest financing directly on the PG&E bill. This program applies to energy efficiency only (not PV) and electricity savings only.
- Third Party financing allows a great deal more flexibility but may have a higher interest rate.

Third Party Ownership

Third parties will often own and operate assets on behalf of the City and pass on a portion of the savings. A current popular example is a renewable energy Power Purchase Agreement[31] (PPA). Solar System installers are also taking this approach. They will install the PV system and charge the City the current rate for the electricity produced by the PV system. The advantage of this method is that it results in immediate GHG emissions reductions with no capital outlay by the City. However the City would not own the systems and would continue to pay for all electricity (at future rates) through the lifetime of the system.

Performance Contracts

The City can also avoid the upfront costs of energy retrofitting while securing the GHG reduction benefits by entering into energy saving performance contracts with an energy service company. An Energy Service contractor conducts an energy audit of government facilities and identifies opportunities for energy savings, estimating the costs and savings of the retrofits. The contractor then conducts the retrofit, at no cost to the City, and recovers the costs by receiving a percentage of the energy cost savings over a specified period of time. Due to the tremendous amount of cost-savings potential in most buildings, payback periods usually amount to ten years. Upon completion of the contract, the City owns the more efficient equipment that costs much less to operate and has a much higher value.[32]

6.2 Selecting and Financing the Actions

With financing a concern, it is tempting to pick the 'low-hanging fruit' with quick payback periods first. However, this approach is considered by some to be 'cream skimming,' and can make it more difficult to perform comprehensive retrofits in the future. Often, the measures that produce the greatest energy savings are those measures with longer payback periods. If these measures are left until the end, the long payback period often acts as a major obstacle to implementation. Therefore, it is better to take a more comprehensive approach by combining fast payback measures with longer payback measures so that the overall payback period is medium-term, and greater overall energy and cost savings are achieved

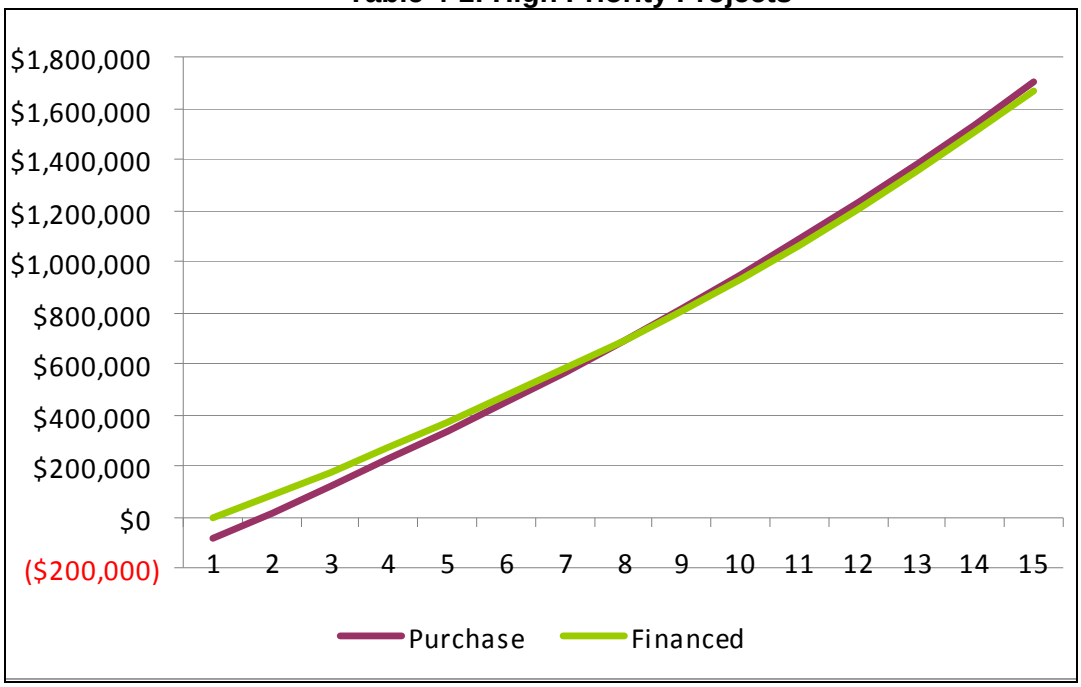
[31] A Power Purchase Agreement (PPA) is an alternate method of "buying" renewable energy without having any out-of-pocket expenses. The vendor constructs the Renewable Energy system at no cost to the City, and charges the City for the energy produced. The vendor can take advantage of the tax credit and accelerated depreciation, and pass the savings along to the City.

[32] More information on performance contracts and other financing mechanisms are described in the EPA document entitled *A State and Local Government Guide to Environmental Program Funding Alternatives*, available at:
http://www.epa.gov/owow/nps/MMGI/funding.html

The items in Table 4-1 and 4-3 are the low hanging fruit for the City of Fort Bragg. These projects have a relatively short simple payback and are inexpensive to implement given GHG reductions and the cost savings.

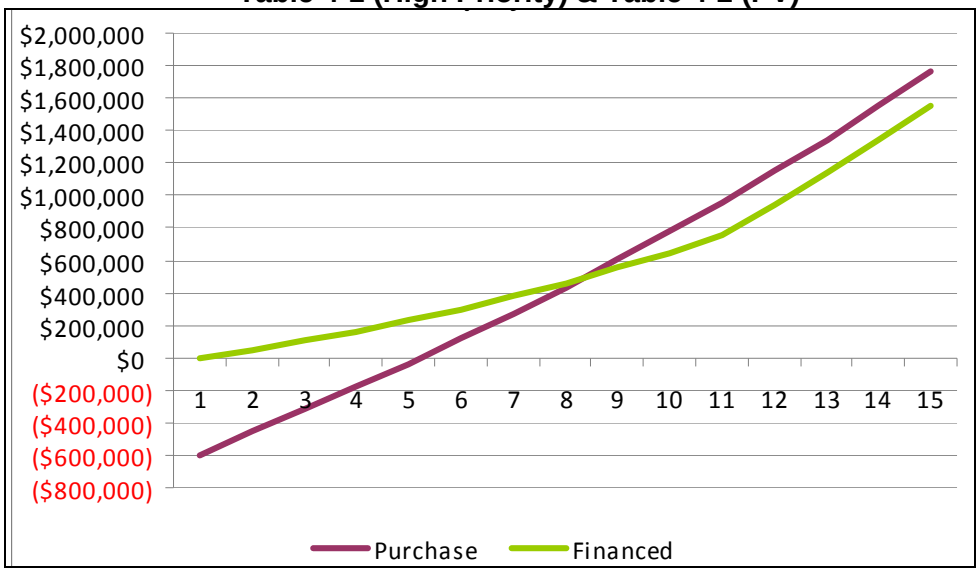
Figure 18 shows the cash flow for the energy efficiency projects from Table 4-1 High Priority Projects. The chart shows that with financing the projects would result in a positive cash flow in the first year, and without financing the project would result in a positive cash flow by the second year. In either case over 15 years these projects result in a cumulative $1.65 million in savings with an initial investment of just $85,000, and would reduce GHG emissions by 76 MTCO2E per year. These projects are clearly the "low hanging" fruit.

Figure 18: Cost to Directly Purchase vs. Finance Projects from Table 4-1: High Priority Projects



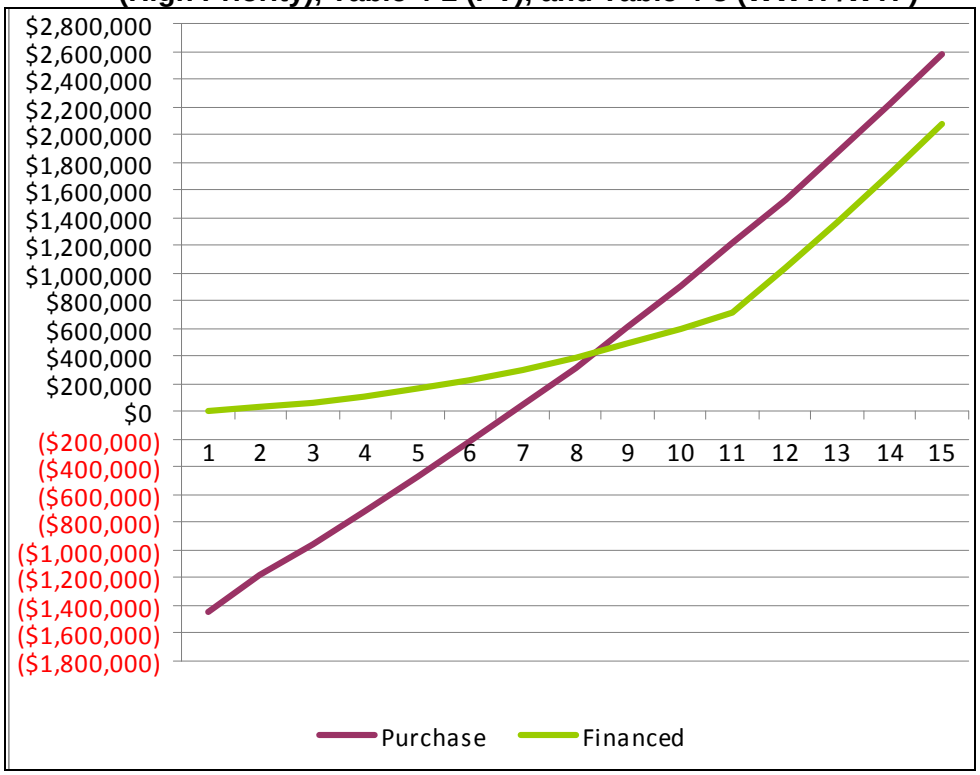
By comparison Figure 19 shows the cash flow from Table 4-1: High Priority Projects and Table 4-2 the High Cost PV projects (described in Chapter 4). The figure illustrates that these projects would need to be financed and would generate a positive cash flow to the City by the second year even after paying the financing costs. Over a 15 year period these projects would result in a cumulative savings of $1.6 million but would reduce GHG emissions by 159 MTCO2E per year.

Figure 19: Cost to Directly Purchase vs. Finance Projects in Table 4-1 (High Priority) & Table 4-2 (PV)



Finally, as shown in Figure 20, if the City chooses to pursue the projects identified in Tables 4-1, 4-2, and 4-3, the City will realize a net positive cash flow of $2 million over 15 years and will reduce GHG emissions by 348 MTCO2E annually. Again, this project will have a positive cash flow from the first year of implementation if it is financed.

Figure 20: Cost to Directly Purchase vs. Finance Projects in Table 4-1 (High Priority), Table 4-2 (PV), and Table 4-3 (WWTF/WTF)



6.3 Implementation

The development of this Climate Action Plan is a major step toward achieving significant GHG emission reductions. However, the plan will only be successful if it is implemented, evaluated and updated as needed.

6.3.1 Departmental Roles & Responsibilities

Key City departments, primarily Public Works and Community Development will need to implement this Climate Action Plan. Staff recommends that responsibility for implementation of the actions in the Climate Action Plan to reduce the City's GHG emissions be delegated as shown in Table 6-1 below:

Table 6-1: Responsible Department and Timeline for Action Implementation for City Operations

Table	Action	Department	Timeframe	MTCO2E/Year
Table 4-1	High Priority Projects	Public Works	2013-2014	76
Table 4-2	Photo Voltaic Projects	Public Works	2014-2016	73
Table 4-3	WWTF & WTF Projects	Public Works	2013-2016	198
Table 4-4	Police Dep. hybrid pool car	Police Department	2014	10
	Discontinue personal use of police patrol cars	Police Department	?	6
	Office bicycles/ police bicycle patrols	Police Department	Ongoing	unknown
	Convert City vehicles from gasoline to CNG	Public Works	2013-2020	23
	Prioritize Use of City Hybrid Pool Car	Public Works	Ongoing	unknown
	Reduce training travel	All Departments	Ongoing	unknown
Table 4-5	Environmentally Preferable Purchasing	Community Development	2014	10
	Continue Recycling Program	Public Works	Ongoing	10
	Total			406

If these activities are undertaken the City's total emissions would be reduced by 406 MTCO2E. In 2005, City operations produced 1,181 MTCO2E + 392 for the C.V. Starr Center for a total of 1573 MTCO2E, so this reduction would amount to a 25.8 percent reduction in total emissions. Once these measures have been implemented, the Plan can be revisited and a second set of measures chosen for implementation.

6.4 Community Wide Implementation Program

The City will play a leadership role within the community. Key implementation measures for the Community GHG reductions are outlined in Table 6-2.

Table 6-2: Responsible Departments, Implementation Timeline for Community Reductions

#	Action	Department	Timeframe	MTCO2E/ Year	MTCO2E Reduction in 2020
Table 5-2: Proposed Measures – Residential					
1	Implement the California Green Building Code	County Building Department	Ongoing	19	131
2	Housing Rehabilitation Loan Program	Community Development	2013-2014	10	30
3	REDI program	Community Development	2013	29	203
4	Energy Audits	PG&E	2013 & Ongoing	20	140
5	Require weatherization as part of all home sales	City Council, Community	2015	120	840
6	PACE Program for PV Installation	Community Development	2017	40	40
7	Prepare grey water stormwater catchment standards	Public Works	2012	Unknown	
8	Install PV Systems	Homeowners	ongoing	20	140
9	Weatherization	Homeowners	Ongoing	20	140
10	Upgrade appliances	Homeowners	Ongoing	Unknown	
Table 5-4: Proposed Measures – Commercial					
1	Implement the California Green Building Code	County Building Department	Ongoing	140	980
2	Energy Audits	PG&E	Ongoing		
3	Require energy retrofits as part of all commercial property sales	City Council, Community Dev Department	2015	45	315
4	Mayor's Well Done Award for energy efficiency.	Community Development	2013 & ongoing	Unknown	
5	Revise LUDC for energy efficient exterior lighting	Community Development	2013	Unknown	
6	Prepare grey water stormwater catchment standards	Public Works	2013	Unknown	
7	Install PV Systems	Business Owners	Ongoing	300	2100
8	Energy audits and efficiency projects	Business Owners	Ongoing	100	700
Table 5-5: Proposed Measures Waste Reduction					
1	Restaurant food waste ordinance/program	Waste Management, Community Development	2014	365	365
2	Establish a Coastal Solid Waste Transfer Station	Community Development, City Manager, City Council	2018	0.5	0.5
3	Residential curbside compost pick-up	Waste Management, City Council	2016	235	235
		Total		**1,463**	**6,360**

If these activities are undertaken, the Community's total emissions would be reduced by more than 6,360 MTCO2E per year by 2020. In 2005, the Fort Bragg community produced 138,824 MTCO2E, so this reduction would amount to a four percent reduction in total emissions, clearly insufficient to achieve the total 15% target by 2020. Real action must come at the Federal level with higher CAFÉ standards and incentives for renewable energy.

As measures are implemented, the City will track its progress at reducing GHG emissions. City staff will use the CACP software, following the methods recommended by ICLEI for tracking reductions of GHG emissions to track performance. A Greenhouse Gas and Emissions Inventory should be completed in five-year increments, the next to be evaluated in 2017. This will enable the City to assess if emission reductions are being achieved as planned. With this information, the emissions targets and action plan can be reassessed and updated as needed.

City Council will be updated on the progress of the CAP at regular intervals as projects are implemented. The support of the City Council is fundamental to the success of the Climate Action Plan. Once every five years, City Council should receive information about the cost and benefits (dollars saved, GHG reduction achieved, and other efficiencies) of measure implementation.

6.5 Conclusion

Our commitment to sustainability should be integrated into our everyday decision-making processes at City Council, within City departments, and throughout the community. We should all identify specific measures to work on each year. The implementation of sustainability measures, such as energy efficiency, water conservation, waste reduction, localization of goods, and alternative transportation methods, should become part of the normal evaluative criteria in work plans, budgets construction contracts, and proposals. Together we will make a difference.

Appendix A: Your Personal Climate Action Plan

Fort Bragg will reach its greenhouse gas (GHG) emissions reduction target, if we all do our part. Put together your own climate action plan using some of the easy steps listed below.

My Personal Climate Action Plan			
Action	Average Household GHG Emissions Reduced (%)	Pounds of GHGs eliminated each year	Check your Priorities
Easy Actions			
Replace one of five non-commute auto trips with bike, bus, walking	6%	530	
Replace your drive to work with a bike, bus, or walk one day/ week	5%	445	
Replace all incandescent and halogen light bulbs with Compact Fluorescents (CFLs) and turn off unused lights	3%	265	
Upgrade to a water-saver (2.5 gallons per minute) showerhead	3%	265	
Dry your clothes on the line during the warmest half of the year	2%	180	
Dry your clothes on an indoor drying rack during half of the year	2%	180	
Turn your water heater down to 120 degrees	2%	180	
Wash clothes in cold water rather than hot	2%	180	
Replace your 20 year old refrigerator with a new ENERGY STAR model	2%	180	
Plug all electronics into power strips and switch off when not in use (including cell phone and other chargers, TV, VCR/DVD, stereos, etc.)	1%	90	
Watch half as much TV each day	1%	90	
Keep car tires inflated (significantly improves your gas mileage)	1%	90	
Get a free Home Energy Audit from PG&E	2%-10%	180-900	
Total	40%	~3575	
Intermediate Actions			
Apply weather stripping to doors and windows	5%	445	
Upgrade your attic insulation to 12 inches	5%	445	
Reduce amount of weekly waste by one garbage bag (buy products with less packaging, use recyclable bags, compost food scraps.)	2-5%	180-445	
Subtotal	35%	~3135	
Advanced Actions			
Sell your car.	30-45%	2660-4000	
Install a solar photovoltaic system	15-40%	1330-3550	
Install a solar hot water system	10-15%	900-1330	
Replace old single-pane windows with dual-pane windows	10%	900	
Subtotal	64%	~5790	

Appendix B. Energy Use & Conservation Community Survey

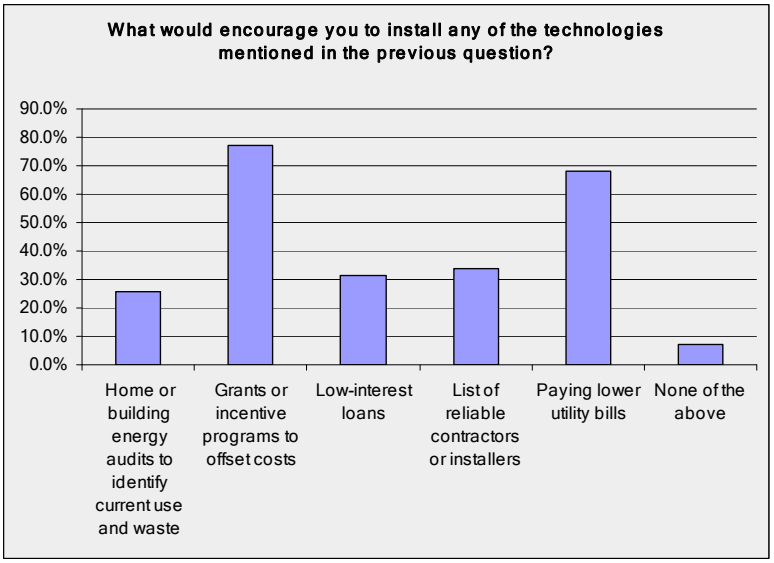
Respondent households either currently engage in or would like to undertake a number of energy saving actions as shown in Survey Table 1 below:

Survey Table 1: What have you already done, or what would you like to do for your home to reduce energy use? (Select all that apply)

Answer Options	I have done	I want to do	Response Count
Replace appliances with more energy efficient models.	60%	35%	99
Replace or upgrade heating system.	40%	42%	88
Upgrade insulation.	35%	48%	87
Upgrade to more energy efficient windows.	39%	50%	94
Install a solar hot water heater.	1%	59%	67
Install solar or wind systems on roof or property.	2%	58%	66
Conserve energy by turning off lights and appliances	95%	4%	109
Participate in an energy audit or retrofit through an energy efficiency program.			10
		answered question	111

Most households do the easy stuff (turning off lights and replacing appliances) yet more than 50% want to install solar hot water or PV.

The survey asked people to identify what would encourage them to install the technologies mentioned in Table 1, and as shown below, most would be motivated to install these technologies with relatively inexpensive incentives such as a list of reliable contractors, low interest loans, and the ability to pay less for their utilities.



As shown in Table 2, respondents are interested in living in the future in a home using renewable energy, while a green or energy efficient home and a small home were viewed with somewhat less enthusiasm.

Survey Table 2: In the next ten years, would you consider living in (you may choose more than one):		
Answer Options	**Response Percent**	**Response Count**
An apartment, condominium, or smaller house?	28.6%	32
A green or energy efficient house?	58.0%	65
A house using renewable energy (such as solar)?	77.7%	87
None of the above.	14.3%	16
	answered question	112

Amongst business owners, a majority of business owners have replaced equipment and turn off lights/equipment to conserve energy. Many businesses have also changed their operations to reduce energy use, and 40% of businesses owners want to install solar or wind systems.

Survey Table 3: What have you already done, or what would you like to do for your business to reduce energy use? (Select all that apply)			
Answer Options	**I have done**	**I want to do**	**Response Count**
Replace equipment with more energy efficient models.	57%	23%	21
Charge operations to reduce energy use.	40%	13%	16
Replace or upgrade heating system.	20%	33%	16
Upgrade insulation.	30%	20%	13
Upgrade to more energy efficient windows.	23%	30%	15
Install a solar hot water heater.	7%	23%	9
Install solar or wind systems on roof or property.	13%	40%	16
Conserve energy by turning off lights and appliances when not in use.	87%	7%	27
Participate in an energy audit or retrofit through an energy efficiency program.			2
		answered question	30

Interesting, business owners are most interested in the power of energy audits (40%) and grants and incentives (82%) to motivate them to adopt energy saving technologies.

Water Use Reduction

Water conservation results in energy conservation and GHG emission reductions for the City, as the City expends energy to move and treat water. Additionally, with Climate Change rain fall events are projected to become more intense and more infrequent, which may challenge water supply and storage capacity.

As noted in Table 4 below over 50% of households have changed the way they do things to conserve water and installed more efficient faucets and low-flow toilets. A large number of residents (40%) expressed an interest in installing a greywater or stormwater system.

Table 4: What have you done in your home to reduce water use? (Select all that apply)			
Answer Options	**I have done**	**I would like to**	**Response Count**
Changed older faucets and showerheads to more efficient models	67%	21%	91
Replaced toilet with new low-flow or dual-flush model	56%	25%	88

Modified the way I do things (shower, water the garden, etc.) to conserve water	85%	4%	96
Collect stormwater for garden use	12%	43%	60
Installed a greywater system for garden use	3%	44%	51
Have a Xeriscaped landscape (low or no irrigation)	28%	19%	50
I have not done anything to my home to reduce water use	8%	0%	9
		answered question	111

By comparison 50% of business owners have installed low use toilets but relatively few have modified operations or changed other equipment to be more water efficient. These findings are surprising given the interest by business owners in energy conservation. This lack of enthusiasm for water conservation is of concern given the City's current water situation. The City should do more to encourage/require water conservation by businesses in Fort Bragg.

Survey Table 5: What have you done in your business to reduce water use? (Select all that apply)			
Answer Options	**I have done**	**I would like to**	**Response Count**
Changed water using equipment to more efficient models	36%	11%	11
Replaced toilet with new low-flow or dual-flush model	50%	14%	18
Modified operations to conserve water	29%	7%	9
Collect stormwater for garden use	7%	21%	7
Have a Xeriscaped landscape (low or no irrigation)	25%	11%	10
I have not done anything to my business to reduce water use	21%	0%	6
		answered question	28

Waste Reduction

Waste is an important source of GHG emissions, both from the transportation of waste and the decomposition of waste. All household (100%) recycle to reduce waste, while a majority undertake other activities to reduce waste as shown in Table 3 below.

Survey Table 6: Do you do any of the following to reduce waste in your home?		
Answer Options	**Response Percent**	**Response Count**
Recycle common materials (paper, cardboard, plastic, glass)	100.0%	111
Utilize green waste bins to recycle yard waste	77.5%	86
Compost organic materials and food scraps	64.9%	72
Recycle hazardous waste materials (batteries, fluorescent light bulbs, appliances)	88.3%	98
Avoid use of Styrofoam products, plastic bags or other materials that are bad for the environment	67.6%	75
Other (please specify)		11
	answered question	111

Amongst businesses owners, again 100% recycle waste but a relatively lower percentage recycle or compost organic materials (see Table 7).

Survey Table 7: Do you do any of the following to reduce waste in your business?		
Answer Options	**Response Percent**	**Response Count**
Recycle common materials (paper, cardboard, plastic, glass)	100.0%	31
Utilize green waste bins to recycle yard waste	45.2%	14
Compost organic materials and food scraps	45.2%	14
Recycle hazardous waste materials (batteries, fluorescent light bulbs, appliances)	83.9%	26
Avoid use of Styrofoam products, plastic bags or other materials that are bad for the environment	83.9%	26
Other (please specify)		4
	answered question	31

Local & Organic Food

Many respondents buy local food and buy organic food. As shown in Table 8, 59% grow food in a garden, 81% buy organic food and 85% purchase locally produced food.

Table 8: Do you participate in any of the following food-related practices? (Select all that apply)		
Answer Options	**Response Percent**	**Response Count**
Grow food in a home garden	59.4%	79
Grow food in a community or neighborhood garden	5.3%	7
Belong to Noyo Food Forest	8.3%	11
Purchase locally produced (within 100 miles) food at farmers' markets, farms, local grocers, etc.	85.0%	113
Buy organic food	81.2%	108
	answered question	133

As shown in Table 9, almost half the respondents drive a more energy efficient vehicle, while most respondents reduce commute costs by minimizing the number of vehicle trips made. This is an indication that State requirements to reduce greenhouse gases by mandating fuel efficiency has a potential to reduce greenhouse gases in Fort Bragg relative to transportation, as people upgrade to more energy efficient vehicles in the future.

Table 9: What have you done to reduce your commute costs or save energy getting to work or school and back?		
Answer Options	**Response Percent**	**Response Count**
Drive a more energy efficient vehicle	47.4%	65
Live closer to work or school	34.3%	47
Minimize number of trips made	80.3%	110
Purchase greenhouse gas credits	0.7%	1
Rideshare	7.3%	10

Ride a bike or walk all the time	1.5%	2
Ride a bike or walk most of the time	16.1%	22
Ride a bike or walk some of the time	25.5%	35
Other (please specify)		11
	answered question	137

Most respondents (over 70%) support voluntary, education based and incentive based measures to achieve green house gas emission reductions. However, 55% support mandatory requirements.

The last question on the survey asks respondents to give us their suggestions to reduce GHG emissions, and suggestions included: better public transit, better pedestrian and bike options, more gardens, chickens, and wind and solar incentives.