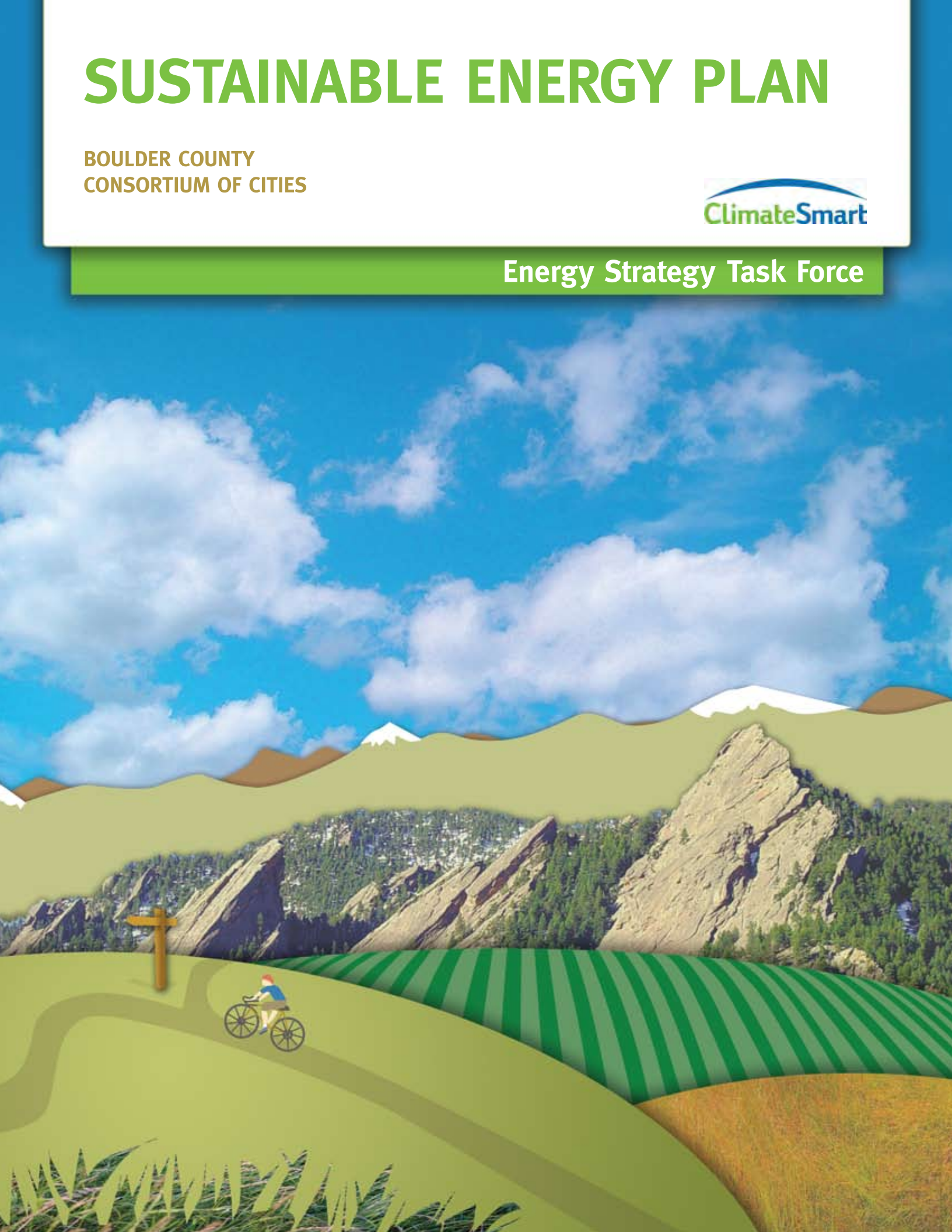
SUSTAINABLE ENERGY PLAN

BOULDER COUNTY
CONSORTIUM OF CITIES

ClimateSmart

Energy Strategy Task Force



SUSTAINABLE ENERGY PLAN

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Boulder County Public Health
on behalf of and supported by
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April 2008

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Executive Summary

Scientific evidence now incontrovertibly demonstrates that carbon dioxide and other greenhouse gases (GHG) released into the atmosphere are currently impacting the Earth's climate and will continue to have profound and devastating effects. To address the local impacts and embrace the opportunities presented by this critical issue, the Boulder County Consortium of Cities convened the Energy Strategy Task Force. One of the chief aims of the Task Force is to provide "a framework for local and regional action on energy sustainability."

The Sustainable Energy Plan (SEP) seeks to provide such a framework. The SEP identifies a host of strategies to reduce greenhouse gas emissions and make our communities "ClimateSmart." These strategies are designed to reduce the major sources of greenhouse gas emissions. Accordingly, the strategies are organized by the main ways we use energy: in our homes, businesses, industries, government operations, and transportation. In addition to making our homes, businesses, industries, and governments ClimateSmart, the Plan is designed to make our power supply ClimateSmart, too.

Highlighted in the SEP are 20 key recommended actions that will lead to meaningful progress toward a sustainable energy future. These actions will not only reduce our county's impact on global climate change, they also result in significant cost savings through increased energy efficiency. In fact, most of the actions identified pay for themselves in five years or less. Cost, cost savings, and GHG reduction impacts have been quantified for 30 of the 35 recommended actions. The remaining five strategies focus on planning, educational, and revenue generating efforts that could not be quantified.

Out of the 35 actions identified, these 20 actions are recommended for "first tier" adoption. These strategies were selected based on: their emissions reductions potential, their cost effectiveness, their persistence, and an effort to ensure equitable contributions across the main GHG contributing sectors and address any social equity concerns. The key strategies include voluntary and support actions as well as statewide and local regulatory programs. Combined, and accounting for overlap between strategies, these key strategies, if implemented, will lead toresult in the county successfully reaching the following goals:

- Emissions reductions in 2012 of more than 1.3 million metric tons of carbon dioxide equivalent and 3.6 million metric tons in 2020
- Emissions reductions 11% below 1990 levels by 2020
- Annual cost savings in 2020 of more than $445 million dollars

Putting the impact of these strategies into perspective, the Kyoto target calls for developed countries to reduce their GHG emissions 7% below 1990 levels by the year 2012. The SEP strategies will bring the county nearly halfway (46%) toward achieving the Kyoto Protocol target. In addition, with only one exception (vehicle-to-grid), all of these strategies pay for themselves in five years or less.

In the longer term, these strategies will reduce emissions even more significantly. As indicated above, by 2020, the SEP strategies will enable the county to reduce GHG emissions 11% below 1990 levels. Putting this in terms of Governor Ritter's Climate Action goal (which uses a 2005 baseline) the SEP will result in a reduction of emissions 40% below 2005 levels in the year 2020. This is a reduction nearly twice that called for by the Governor.

The SEP is also intended be a "living document." Participating communities will continue to seek new and innovative strategies to achieve the overall goal of the plan. In addition, these communities have adopted resolutions directing staff to develop programs, projects, and policies that reflect the strategies set forth in the SEP; work in a collaborative manner with other public and private entities to implement these strategies; and seek appropriate funding, within budget constraints, to effectively, efficiently and quickly address GHG emissions in the county in order to achieve the reduction goals set forth in the SEP.

Key Strategies

(Numbers in parenthesis indicate the location of the description of the strategy in the body of the report.)

ClimateSmart at Home	1. Continue to offer high efficiency lighting discounts (1.1) 2. Continue to conduct neighborhood energy awareness sweeps (1.2) 3. Continue to offer discounted residential energy audits (1.3) 4. Develop residential green building codes and ordinances for new and existing buildings (1.4)
ClimateSmart at Work **Commercial and Industrial**	5. Support energy efficiency projects in small and medium-size businesses through energy assessments and project management assistance (2.1) 6. Develop green building codes and ordinances for new and existing commercial and government buildings (2.2 and 2.1.4) 7. Promote industrial combined heat and power technologies (2.3) 8. Encourage statewide participation in the formation of regional "cap and trade" programs through the Western States Climate Initiative (2.4)
ClimateSmart at Work **Local Government**	9. Implement controls and policies to limit idling of municipal and county vehicles (2.1.1) 10. Install light emitting diode (LED) traffic signals (2.1.3)
ClimateSmart **On the Road**	11. Promote sustainable biofuels (3.1) 12. Promote vehicle-to-grid power connection (3.3) 13. Implement a Clean Car Incentive program (3.4) 14. Adopt a statewide Clean Car Standard (3.5)
ClimateSmart Power	15. Develop a sustainable energy financing district (4.4) 16. Maximize the use of rebate incentives (4.1.1) 17. Increase utility demand and power supply incentives, including an aggressive renewable portfolio standard (4.1.2)
Revenue Streams	18. Create energy budgets and rate structures (5.1) 19. Create a revolving loan fund (5.2) 20. Offer "climate offsets credits" and use to build community renewable energy (5.3)

I. Introduction

Global Problem, Local Impacts, Local Solutions

Scientific evidence now incontrovertibly demonstrates that carbon dioxide and other greenhouse gases (GHG) released into the atmosphere are currently impacting the Earth's climate and will continue to have profound and potentially devastating effects. Such effects include:

- Increased risk of extreme weather events
- Increased flood severity
- Increased risk and intensity of catastrophic wildfire
- Increased risk of forest die-offs due to insect invasions
- Changing precipitation patterns and crop productivity patterns
- Increased risk of drought
- Loss of alpine meadows and tundra
- Migration of infectious diseases

In February 2005, the Kyoto Protocol, which is an international agreement, was adopted and; the agreement set binding targets for developed countries to reduce greenhouse gas emissions 7 percent below 1990 levels. While the United States has not ratified this protocol, 160 local governments nationwide have already passed resolutions pledging to reduce greenhouse gas emissions from their government operations and throughout their communities. In November 2004, more than 70% of Boulder County voters approved the passage of Amendment 37, thus requiring that the state's largest public utilities supply 10% of their power from renewable resources by 2010 and raise energy costs by up to 1% to accomplish this goal.

Local government actions taken to reduce greenhouse gas emissions through increased energy efficiency, reduced vehicle miles traveled (VMT), and waste reduction can provide multiple local benefits. These include decreasing air pollution, creating jobs, extending landfill life, and reducing energy expenditures for the county, its businesses, and its citizens. The Sustainable Energy Plan (SEP) identifies 35 such actions. These actions are described in the report along with recommended priorities and the potential cost, cost savings, and environmental impacts benefits. The Plan creates a pathway that local governments across Boulder County can take toward a sustainable future.

The Energy Strategy Task Force

Based upon the challenges and opportunities posed by global climate change, the Boulder County Consortium of Cities (comprised of municipal and county elected leaders from each of the communities in Boulder County and Broomfield) took up this issue. They formed the Energy Strategy Task Force in June 2006 to create a collaborative approach to addressing this challenge.

The purpose of the Boulder County Consortium of Cities' Energy Strategy Task Force is to provide a countywide clearinghouse for information and education on energy issues and a framework for local and regional action on energy sustainability. The goal of the Task Force is to create collaborative approaches among Boulder County, the municipalities in the county, Broomfield City and County of Broomfield, local businesses, non-profit organizations, and residents to address critical energy concerns and strategies. These include reducing the emission of greenhouse gases that are producing global warming, promoting the use of renewable energy production, and reducing the energy costs incurred by residents and businesses. [1]

With technical support provided by Boulder County Public Health, the Task Force developed the Sustainable Energy Plan to identify emission reduction opportunities and strategies and guide our collaborative efforts into the future. The plan focuses on the dominant sources of emissions identified in a countywide greenhouse gas inventory conducted in 2005 and described in detail below. These sources include residential buildings, commercial buildings, transportation, and industrial operations.

Simultaneously, the Task Force evaluated and launched several "early actions" designed to test different approaches and begin the implementation process while the overall plan was being designed. These early actions include:

- **"ClimateSmart" Campaign:** ClimateSmart is a countywide effort, funded by the City of Boulder and Boulder County, to help individuals, families, and businesses increase their energy efficiency and reduce their carbon footprint.
- **Residential Energy Audit Program (REAP):** A REAP home energy analysis helps homeowners understand their energy usage and provides personalized recommendations for lowering energy bills.
- **Neighborhood Energy Sweeps:** Volunteers and CU students have delivered "ClimateSmart" kits to more than 1,000 homes. These kits contain eight compact fluorescent lamp (CFLs) lightbulbs, water quality promotions, and energy education materials.

[1] See http://www.bouldercounty.org/bocc/consortium/Energy/ for a full list of Task Force members, agendas, minutes, and mission statement.

The Energy Strategy Task Force (cont.)

- **Partners for A Clean Environment (PACE) EnergySmart Project:** The PACE EnergySmart Project provides direct support to small- and medium-sized businesses to identify and implement cost-effective energy projects.

- **High Efficiency Lighting Program:** Through this program, with matching funds provided by the county, municipalities are finding creative ways to discount the cost of CFLs and other energy efficient lighting to encourage residents and businesses to give them a try.

The results of the work provide insight into the magnitude of the challenge facing Boulder County with respect to the county's goal of achieving emissions by 2012 that are 7% below the 1990 level. Meeting this goal will be a daunting enterprise requiring substantial community mobilization, county and municipal government commitment, and resources. Figure 1 presents the results of Boulder County's GHG inventory. In 2012, the BAU trajectory is approximately 5,830,000 metric tons of carbon dioxide equivalent (mtCO2e)[2], which is about 85% or 2,680,000 mtCO2e above the Kyoto goal.

II. Countywide Greenhouse Gas Inventory

The first step in creating a Sustainable Energy Plan was to develop a clear picture of historical and current sources and magnitudes of Boulder County's greenhouse gas emissions. In 2005, the county created a GHG inventory to provide this information and to guide this planning process. The inventory includes:

- An inventory of historical GHG emissions for the period of 1990 through 2005.
- A projected "business-as-usual" (BAU) emissions trend line out to 2012 based on the historical emissions data.
- An analysis of sector- and source-specific emissions.

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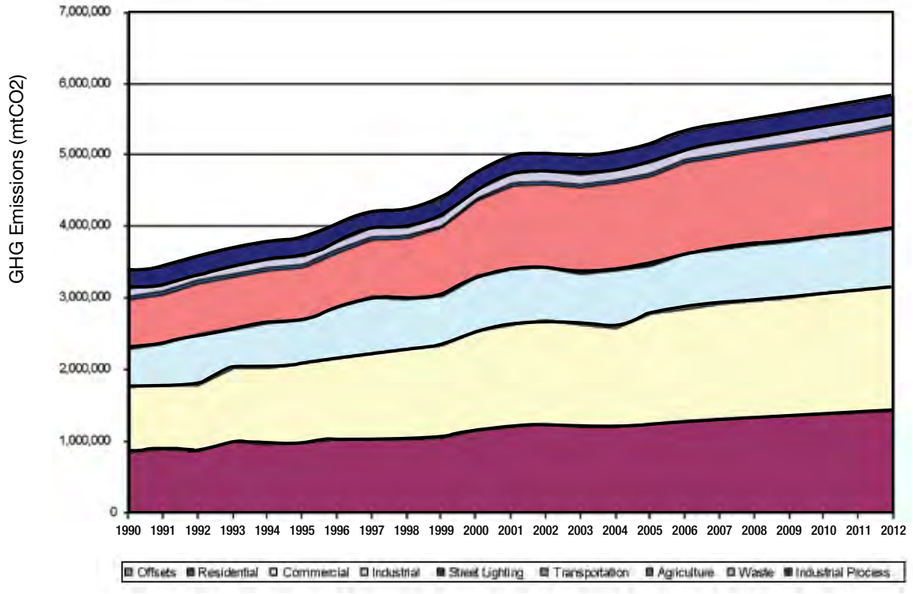
Figure 1. Current and Projected Countywide Greenhouse Gas Emissions



[2]Greenhouse gas emissions are presented in metric tons of carbon dioxide "equivalent" to account for the difference in the global warming potential of the different gases.

Countywide Greenhouse Gas Inventory (cont.)

In 2005, the dominant sectors of emissions were commercial, residential, transportation, and industrial. As shown in Figure 2, together these four sectors account for 90% of the county's GHG emissions. The dominant sources of these emissions are from electricity and natural gas consumption, along with vehicles' fuel consumption in the transportation sector. A breakdown of emissions by municipality is provided in Figure 3.

Figure 2. Greenhouse Gas Emissions by Sector (2005)

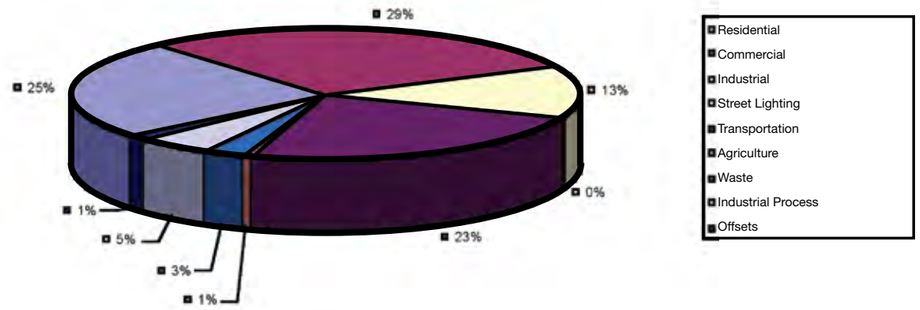
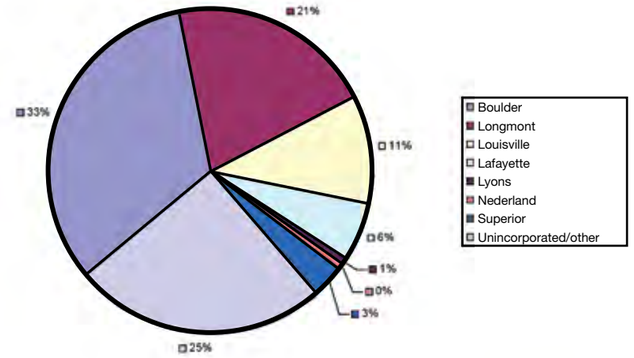


Figure 3. Greenhouse Gas Emissions by Municipality (2005)



III. RECOMMENDED EMISSION REDUCTION STRATEGIES

The Sustainable Energy Plan (SEP) identifies a host of strategies to reduce greenhouse gas emissions and make our communities ClimateSmart. These strategies are designed to reduce the major sources of greenhouse gas emissions. Accordingly, the strategies are organized by the main ways we use energy: in our homes, businesses, industries, government operations, and transportation. In addition to making our homes, businesses, industries, and governments ClimateSmart, the Plan is designed to make our power supply ClimateSmart as well.

Each of the strategies is annotated indicating the benefits it brings to the climate (), the economy in terms of cost-effectiveness (), and other environmental impacts (). The projects are ranked for each area on a scale of zero to four, with four being the highest ranking, or best, strategy.

Appendix A provides a more detailed description of each of these strategies. Appendix B provides more detail on the greenhouse gas impacts, and the cost and benefits for each strategy. As indicated in Appendix B, many of the actions have a positive return on investment, paying for themselves in less than three years.

Key Strategies

Out of the 35 actions identified, 20 actions are recommended for "first tier" adoption based on several criteria. These criteria include the GHG emissions reduction potential of the strategy. The cost of implementation to both the public and private sector, the cost savings of the project and its pay back period, as well as the marginal abatement cost were considered in selecting the first tier strategies. Key strategies were also selected to ensure an equitable distribution across the main GHG contributing sectors such as residential, commercial, industrial, and transportation. Finding ways to enhance the use of more renewable resources to produce energy was also considered a priority. Social equity interests were considered. The persistence of the strategy (how long it will last once it's implemented) is an important criterion. A new building will continue to consume energy for the next forty to sixty years, while a compact fluorescent light bulb will last approximately ten years. Key strategies also include a mix of implementation mechanisms. Voluntary and support actions have been included to promote public awareness and education. Several strategies were selected due to their statewide impacts. Local regulatory programs are also included.

Combined, and accounting for overlap between strategies, these key strategies if implemented will lead to the following goals:

- Emissions reductions in 2012 of more than 1.3 million metric tons of carbon dioxide equivalent and 3.6 million metric tons in 2020
- Emissions reductions 11% below 1990 levels by 2020
- Annual cost savings in 2020 of more than $445 million dollars

Putting the impact of these strategies into perspective, the Kyoto target calls for developed countries to reduce their GHG emissions 7% below 1990 levels by the year 2012. The SEP strategies will bring the county nearly halfway (46%) toward achieving the Kyoto Protocol target. In addition, with only one exception (vehicle-to-grid), all of these strategies pay for themselves in five years or less.

In the longer term, these strategies will reduce emissions even more significantly. As indicated above, by 2020, the SEP strategies will enable the county to reduce GHG emissions 11% below 1990 levels. Putting this in terms of Governor Ritter's Climate Action goal (which uses a 2005 baseline) the SEP will result in a reduction of emissions 40% below 2005 levels in the year 2020. This is a reduction nearly twice that called for by the Governor.

The SEP is also intended be a "living document." Participating communities will continue to seek new and innovative strategies to achieve the overall goal of the plan. In addition, these communities have adopted resolutions directing staff to develop programs, projects, and policies that reflect the strategies set forth in the SEP; work in a collaborative manner with other public and private entities to implement these strategies; and seek appropriate funding, within budget constraints, to effectively, efficiently and quickly address GHG emissions in the county in order to achieve the reduction goals set forth in the SEP.

Key Strategies

(Numbers in parenthesis indicate the location of the description of the strategy in the body of the report.)

ClimateSmart at Home

1. Continue to offer high efficiency lighting discounts (1.1)
2. Continue to conduct neighborhood energy awareness sweeps (1.2)
3. Continue to offer discounted residential energy audits (1.3)
4. Develop residential green building codes and ordinances for new and existing buildings (1.4)

ClimateSmart at Work
Commercial and Industrial

5. Support energy efficiency projects in small and medium-size businesses through energy assessments and project management assistance (2.1)
6. Develop green building codes and ordinances for new and existing commercial and government buildings (2.2 and 2.1.4)
7. Promote industrial combined heat and power technologies (2.3)
8. Encourage statewide participation in the formation of regional "cap and trade" programs through the Western States Climate Initiative (2.4)

ClimateSmart at Work
Local Government

9. Implement controls and policies to limit idling of municipal and county vehicles (2.1.1)
10. Install light emitting diode (LED) traffic signals (2.1.3)

ClimateSmart
On the Road

11. Promote sustainable biofuels (3.1)
12. Promote vehicle-to-grid power connection (3.3)
13. Implement a Clean Car Incentive program (3.4)
14. Adopt a statewide Clean Car Standard (3.5)

ClimateSmart Power

15. Develop a sustainable energy financing district (4.4)
16. Maximize the use of rebate incentives (4.1.1)
17. Increase utility demand and power supply incentives, including an aggressive renewable portfolio standard (4.1.2)

Revenue Streams

18. Create energy budgets and rate structures (5.1)
19. Create a revolving loan fund (5.2)
20. Offer "climate offsets credits" and use to build community renewable energy (5.3)

RECOMMENDED STRATEGIES

The following is a summarized list of all 35 actions organized by the main ways we use energy: in our homes, businesses, industries, government operations, and transportation. In addition to making our homes, businesses, industries, and governments ClimateSmart, the Plan is designed to make our power supply ClimateSmart and generate revenue to support program implementation.

1. ClimateSmart At Home

The residential sector provides the second-largest contribution to Boulder County's GHG emissions. In 1990, the residential sector accounted for 877,850 metric tons carbon dioxide equivalent (mtCO2e), or 25% of the county's GHG inventory. By 2005, residential emissions had risen to 1,305,000 mtCO2e and continued to represent 26% of the county's GHG inventory. If the business-as-usual (BAU) trend continues, 2012 forecasts show that the residential sector emissions will increase to 1,493,200 mtCO2e. Like the commercial sector, Figure 5 demonstrates the dominance of electricity as an energy source in this sector.

Residential sector electricity, and natural gas are consumed by home heating, ventilation, and air-conditioning (HVAC) systems; lighting systems; and miscellaneous electrical equipment. Rural mountain homes frequently use propane or wood burning stoves for heating.

There are a host of actions that will enhance the energy efficiency of our homes. Several "early actions" piloted by the Energy Strategy Task Force are already showing success. These programs include assistance identifying energy-efficient technologies and renewable energy sources, and incentives to encourage their implementation. In addition, several communities have recently adopted or updated residential building codes requiring greater efficiency of newly built and existing residences at a specified time such as during a renovation, at the point of sale, or by a set point in time. Continuing to ensure that new and existing buildings meet efficiency standards, including moving toward "net zero energy homes," will result in significant emissions reductions in the residential sector. Use of renewable energy resources in this sector is described in Table 4 below. Increasing the use of highly efficient wood or pellet stoves, in mountain communities, would have a desirable impact on air quality but would not significantly impact greenhouse gas emissions.

Figure 4. 2005 Residential GHG Emissions by Source

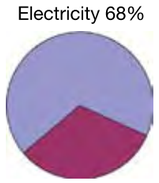


Table 1. Residential Sector Strategies

Mitigation Scores
Mitigation scores are ranked 0-4, with 4 being the highest, based on positive impacts to: climate (🌍), the economy (💰), and other environmental impacts (↘).

1.1 High Efficiency Lighting Program – Early Action
Compact fluorescent lamps (CFLs) and LEDs show tremendous potential for savings in Boulder County. While more CFLs are being installed everyday, their penetration is still not that high in this area. LEDs are just beginning to be considered.

Action: Implement CFL and LED discounts, building on the success of the 2007 pilot.

1.2 ClimateSmart Neighborhood Energy Sweeps – Early Action
Many residents are interested in energy efficiency, but they don't have the time to investigate and implement projects, such as the use of CFLs, power-strips, and energy-efficient refrigerators.

Action: Conduct neighborhood-wide "sweeps" installing energy-efficient devices and educational information.

1.3 Residential Energy Audit Program (REAP) – Early Action
During the pilot phase of the Residential Energy Audit Program (REAP) the county and participating municipalities provided low-cost, energy-efficiency evaluations for Boulder County homeowners; most participants reported that they intended to invest between $1,000 and $5,000 in energy-efficiency upgrades as a result.

Action: Continue this successful initiative.

1.4 Residential Green Building Codes and Ordinances for New and Existing Buildings
Residential energy use accounts for 25% of the county greenhouse gas inventory. While existing buildings account for nearly 90% of this energy use, new buildings are being built every day that will be in use for the next 40 years or more.

Action: Develop a "Green Building" code for new construction and a "residential energy conservation ordinance" for existing buildings.

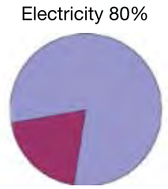
1.5 Net-Zero Energy Home (ZEH)
A net-zero energy home (ZEH) is connected to, and uses energy from, the local electric utility, but unlike typical homes, a ZEH combines state-of-the-art, energy-efficient construction techniques and equipment with renewable energy systems to return as much energy as it takes on an annual basis. ZEH communities are the leading edge of technologies that will someday produce as much energy as they use.

Action: Explore the creation of building codes and ordinances requiring that all homes over a certain size be required to achieve net zero energy use and the expansion of this requirement, over time, to all new home development.

2. ClimateSmart At Work

The commercial sector provides the largest contribution to Boulder County's GHG emissions. In 1990, the commercial sector accounted for 899,500 metric tons of carbon dioxide equivalent (mtCO2e), or 29% of the county's GHG inventory. By 2005, commercial emissions had risen to 1,591,300 mtCO2e and accounted for 31% of the county's GHG inventory. If the business-as-usual (BAU) trend continues, 2012 forecasts show that the commercial sector emissions will increase to 1,945,850 mtCO2e. The industrial sector represents the fourth largest sector contributing 18% of Boulder County greenhouse gas emissions. Combined these two sectors represent nearly 50% of emissions. Commercial sector electricity and natural gas are consumed by building heating, ventilation, and air conditioning (HVAC) systems; lighting systems; and miscellaneous electrical equipment. As indicated, electricity is the dominant source of energy for this sector.

Figure 5. 2005 Commercial GHG Emissions by Source



Actions to reduce emissions from the commercial sector include: maximizing the use of available rebates and incentives to install and implement energy-saving measures and working closely with smaller businesses that lack in-house energy management resources. As in the residential sector, codes for new and existing buildings and requiring energy-efficient construction and operational practices should also be considered for this sector.

Actions to reduce emissions in the industrial sector include the capture of "waste" heat and materials to produce energy, the use of energy-efficient technologies, and policies to encourage and incentivize emission reduction measures. Table 2 provides a list of such actions. Use of renewable energy resources in this sector is described in Table 4 below.

Table 2. Commercial and Industrial Sector Strategies

Mitigation Scores
Mitigation scores are ranked 0-4, with 4 being the highest, based on positive impacts to: climate (🌍), the economy (💲), and other environmental impacts (↘).

2.1 PACE EnergySmart Project – Early Action
Even with financial incentives and free energy audits, small- and mid-sized businesses have difficulty finding the time to implement energy-efficiency projects. The Partners for A Clean Environment (PACE) EnergySmart program helps these business by providing energy assessments and assistance with project implementation.

Action: Remove implementation barriers through the guidance of energy experts.

2.2 Green Building Codes and Ordinances for New and Existing Commercial Buildings
Twenty-nine percent of county greenhouse gas emissions stem from the demand for energy required by the commercial sector.

Action: In partnership with municipal and county building officials, create building codes requiring the high performance of new and existing commercial buildings.

2.3 Combined Heat and Power
Combined heat and power (CHP), also known as cogeneration, is an efficient, clean, and reliable approach to generating power and thermal energy from a single fuel source. CHP systems typically achieve electrical efficiencies of 50% to 70%.

Action: Explore the opportunities for CHP and methane capture in food processing, beverage, and other industries.

2.4 Western States Climate Initiative
Five governors from Western states agreed to work together to create a regional "cap-and-trade program." A similar system is close to being implemented among 7 Northeastern and Mid-Atlantic states. Together, these initiatives will spur demand for a national system.

Action: Encourage Colorado's participation.

2.5 Statewide Lighting Efficiency Standard
Rising energy costs and environmental concerns are encouraging states to follow the lead of Australia and Canada and ban incandescent light bulbs altogether. Nevada took a different approach becoming the first state to pass legislation establishing minimum energy-efficiency standards for general-purpose lights sold in the state on and after January 1, 2012.

Action: Support legislation establishing a statewide minimum energy efficiency standard for lighting.

2.6 Net Zero Energy Commercial Buildings
Using a combination of renewable power and high-efficiency products, commercial buildings are poised to become net zero energy users. Ferreira Construction's new headquarters uses a combination of renewable energy and high-efficiency measures to reach a high plane in energy conservation. According to the U.S. Green Building Council, it is believed to be the nation's first commercial building that can produce at least as much electricity as it uses – known as "net zero energy."

Action: Encourage the implementation of additional net zero energy buildings.

2.7 Net Zero Electric Industrial Plants
High efficiency applications, solar power, and methane recovery are the key ingredients necessary for an industrial plant to produce more energy than it uses. Frito-Lay plans to launch just such a plant by 2010. The company will build at least 50 acres of solar concentrators and a biomass generator to provide renewable fuel. The retrofit would reduce electricity and water consumption by 90% and natural gas use by 80%. Greenhouse gas emissions would be cut by 50% to 75%.

Action: Identify opportunities for and encourage the implementation of net zero electric industrial plants.

Local governments can lead by example and influence the adoption of energy-efficiency and renewable energy technology. This section explores the opportunities that local governments face as large users of commercial building and transportation technology to reduce greenhouse gas emissions in these sectors. Actions include: anti-idling measures, reducing heat gain on roofs, improving the energy efficiency of traffic signals, and demonstrating leadership in building energy performance. These strategies together can significantly reduce energy use in government operations.

In addition, municipal and county governments can also play an important role steering a course for community-wide action. Such actions include: setting and working to achieve a countywide greenhouse gas reduction goal; providing information to residents and businesses on how they can improve their energy efficiency; and developing aggressive energy management plans. While these last items are critically important, they are not quantifiable in terms of specific reductions.

Table 2.1. Government Sector Strategies

Mitigation Scores
Mitigation scores are ranked 0-4, with 4 being the highest, based on positive impacts to: climate (🌍), the economy (💰), and other environmental impacts (🕊).

2.1.1 Anti-Idling Controls and Policies Unnecessary idling of government vehicles wastes fuel, leads to unnecessary air pollution, reduces engine life, and increases maintenance costs. **Action:** Enable a 5-minute auto shut-off control and implement anti-idling policy for all appropriately equipped county and municipal vehicles.	🌍	💰💰💰	🕊
2.1.2 Green or Light-Colored Roofs Surfacing the roofs of county and municipal buildings with greenery and/or light or reflective coloring can reduce energy use and storm water runoff. **Action:** Promote light, white, or “green” surfacing.	🌍	💰💰	🕊
2.1.3 Light Emitting Diode (LED) Traffic Signals LED technology is expected to reduce energy use by 90%; lower maintenance due to increased life; and incorporate innovations like battery backup using photovoltaics. **Action:** Complete replacement of incandescent traffic and crosswalk signals with LEDs.	🌍	💰💰💰	
2.1.4 Leadership in Efficient Public Buildings This strategy will ensure that new and existing public buildings lead the way in energy efficiency and performance. Through codes, standards, policies, or ordinances, public buildings will be required to achieve a higher level of efficiency than the private sector building codes or ordinances envisioned in this plan. **Action:** Make new and existing municipal and county buildings leaders in energy efficiency.	🌍🌍🌍	💰💰	🕊🕊
2.1.5 Goal Setting More than 500 mayors, representing 65 million people, have now signed onto the U.S. Mayors Climate Protection Agreement that includes a commitment to meet or beat the Kyoto goals calling for a 7% reduction in greenhouse gas emissions below 1990 levels by 2012. **Action:** Encourage all local governments within Boulder County to adopt a greenhouse gas reduction goal.	Not Quantified		
2.1.6 ClimateSmart – Early Action Governments play an important role of providing the information, tools, and resources that residents and employers need to make the choices and decisions that will promote a sustainable energy path. The ClimateSmart program provides these resources and education through outreach, programming, and its website. **Action**: Continue to grow and implement the ClimateSmart program.	Not Quantified		
2.1.7 Municipal and County Energy Management Plans A key to implementing and realizing the benefits of energy efficiency in local government buildings and operations is the creation of comprehensive, multi-year management plans that include specific energy performance goals. **Action:** Work with municipal and county facilities managers to implement energy-efficiency management plans through efforts such as the Facility Managers Network.	Not Quantified		

3. ClimateSmart On the Road

Vehicle transportation is the third-largest sector contributing to Boulder County's GHG emissions. In 1990, the transportation sector accounted for 670,300 mtCO2e, or 20% of the county's GHG inventory. By 2005, transportation emissions had risen to 1,232,300 mtCO2e and made up 24% of the county's GHG inventory. If the business-as-usual (BAU) trend continues, 2012 forecasts show that the transportation sector emissions will increase to 1,375,000 mtCO2e and comprise roughly 23% of the BAU inventory.

Transportation sector emissions are produced through the consumption of gasoline, diesel, and jet fuel. Gasoline and diesel are used in vehicles, while airplanes use gas and jet fuel. Figure 6 demonstrates the dominance of gasoline as the primary energy source in this sector. Gasoline well exceeds diesel fuel as an energy source in the transportation sector.

Actions to reduce greenhouse gas emissions in the transportation sector include reducing the number of vehicle miles traveled by increasing the use of alternative transportation and other means. While this is an extremely important initiative, these actions are not the focus of action in the SEP because they are being pursued in other venues. Instead the plan focuses on the use of less greenhouse gas intensive fuels to run our vehicles and increasing the fuel-efficiency of our vehicles. Nonetheless, reducing vehicle emissions remains a significant and necessary action that must be pursued aggressively in order to reduce GHG emissions in this sector.

Figure 6. 2005 Transportation GHG Emissions by Source

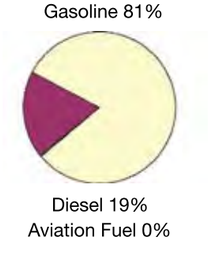


Table 3. Transportation Sector Strategies

Mitigation Scores
Mitigation scores are ranked 0-4, with 4 being the highest, based on positive impacts to: climate (🌍), the economy (💰), and other environmental impacts (🕊).

3.1 Biofuels Promotion
The promise and expectations of biofuels to replace petroleum-based diesel and gasoline are high. These fuels do have tremendous potential if they are sustainably produced.

Action: Promote the use of sustainably produced biofuels.

3.2 Vehicle-to-Grid
Increasing the use of electric-drive hybrid vehicles would not only reduce dependence on foreign oil, but these vehicles could also provide storage capacity to power the electric grid during the many hours of the day that they sit idle. This strategy would reduce the need to build new power plants to meet peak power demand and allow for greater use of renewable energy.

Action: Promote opportunities for vehicle-to-grid power through education, pilot projects, and incentives.

3.3 Clean Car Incentive
A clean car incentive charges users of less fuel-efficient vehicles a fee and applies the funds from this fee, as an incentive, to the purchasers of more fuel-efficient vehicles. The benefits of this approach are that it is a relatively efficient way of promoting the purchase of more fuel-efficient vehicles; users of less fuel-efficient vehicles directly pay for the externalities that they inflict upon society; and it sends a potentially strong market signal to auto manufacturers.

Action: Encourage adoption of a statewide Clean Car Incentive program for Colorado and as a countywide program as part of the vehicle registration process.

3.4 Clean Car Standard for Colorado
The "California Clean Car" standard gives car companies until 2016 to achieve a 30% reduction in greenhouse gas emissions from new cars, pickups, minivans, and SUVs sold in the state. At least twelve other states are moving to adopt the rules.

Action: Encourage the state to adopt the standards.

4. ClimateSmart Power

This section outlines the opportunities to reduce GHG emissions through reductions in energy use and the GHG intensity of grid-supplied electricity through the use of hydroelectric capacity, the purchase of renewable energy credits (RECs), other "carbon offsets" that fund clean energy project investments, and the installation of photovoltaic (PV) and solar water heaters on commercial and residential buildings.

Table 4. Renewable Power Strategies

Mitigation Scores
Mitigation scores are ranked 0-4, with 4 being the highest, based on positive impacts to: climate (🌍), the economy (💲), and other environmental impacts (↘).

4.1 Renewable Portfolio Standard
While the state legislature passed legislation in 2007 strengthening the state's Renewable Portfolio Standard, these efforts may not be sufficient to meet Boulder County's Sustainability goals.

Action: Seek legislation encouraging an even stronger standard.

4.2 Concentrating Solar Project
Concentrating solar power systems are large centralized power generation plants that use the sun's energy rather than fossil fuels. These systems are currently being developed and tested as a means of fulfilling our growing power demand.

Action: Identify partners and project sites in Boulder County to encourage the demonstration of these technologies.

4.3 Community Wind Farm
Municipally and county owned renewable resources account for about .5% of Colorado's energy. While residents can purchase renewable energy credits, these credits lack the full-benefits of a community-owned system. The University of Colorado is also exploring options for local wind.

Action: Explore county/municipal and county participation in building a multi-turbine farm to deliver a significant amount of wind power to the community.

4.4 Sustainable Energy Financing District
Initial capital costs remain a barrier to the broad adoption of solar power and energy-efficiency measures for homeowners and businesses. Local governments are exploring the use of a bond mechanism to finance low interest loans repaid by a transferable property tax assessment or other secured means to accelerate installation and adoption of sustainable energy systems.

Action: Investigate the application in Boulder County or Colorado.

4.5 Solar-Powered Public Buildings
Public buildings can set an example and take advantage of the long-term paybacks associated with photovoltaics (PV) and solar thermal systems.

Actions: Install PV and solar thermal systems in public buildings.

4.6 Maximum Rooftop PV
Incentives for new or retrofitted photovoltaics (PV) on rooftops in the county would help convert light energy into electrical energy.

Action: Provide incentives, such as a "solar cooperative" and/or building codes, to maximize the use the largest rooftops in Boulder County as the source of the most cost-effective PV.

This section explores the unique opportunities electric utility providers can play in encouraging energy efficiency and renewable energy. It documents and evaluates some of the more innovative utility demand-side and renewable energy programs that will be explored.

Table 4.1. Utility Partnerships

Mitigation Scores
Mitigation scores are ranked 0-4, with 4 being the highest, based on positive impacts to: climate (🌍), the economy (💲), and other environmental impacts (↘).

4.1.1 Maximum Use of Rebate Incentives
Boulder County energy providers all offer incentive programs to reduce the upfront costs of energy efficiency and renewable energy projects. In order to maximize the use of these rebates, programs should be put into place to ensure that these opportunities are fully utilized.

Action: Assess and implement a broad range of educational and assistance programs ensuring the maximum use of these funds.

4.1.2 Utility Demand and Power Supply Incentives
Several utilities are currently revisiting or renewing their incentive programs for energy demand management and renewable energy supplies. In addition, several municipalities are reviewing their franchise agreements with Xcel Energy to consider the pros and cons of various power mix strategies, particularly those that can lead to the best combinations of demand reduction, efficiency, and renewable supply options.

Action: Collaboratively investigate and pursue alternative power mix strategies with Boulder County power suppliers.

4.1.3 Carbon Labeling
To bring greater awareness to residents and businesses about the impacts of their energy use, electricity bills could include information on the carbon dioxide equivalent of the energy that was used the previous month.

Action: Work with utilities to provide carbon information on monthly electricity bills.

Not Quantified

IV. REVENUE GENERATION

To support these strategies, resources will be necessary. This section explores investment and incentive opportunities, such as rebates, low interest loans, revolving funds, bonds, and other strategies to attract the necessary resources to cost-effectively reach our GHG reduction objectives.

Table 5. Revenue Generation	Mitigation Scores Mitigation scores are ranked 0-4, with 4 being the highest, based on positive impacts to: climate (🌍), the economy (💰), and other environmental impacts (🐦).
5.1 Energy Budgets and Rate Structures Similar to what communities are doing with water charges, create a rate structure that incentivizes conservation. **Action:** Create energy budgets for home/office use and charge a higher rate for usage above that amount or as a ratepayer moves into higher tiers of energy use.	🌍🌍🌍🌍 💰💰 🐦🐦🐦
5.2 Revolving Loan Fund Seed funding can a go a long way toward helping businesses take on the initial costs of installing energy-efficient projects, while the savings from these projects can create incentives for future actions. **Action:** Create a revolving loan fund to cover the start-up costs of a large-scale energy-efficiency program.	🌍🌍 💰💰💰 🐦🐦
5.3 Climate Offset Credits Everyone uses some amount of energy in daily life. Climate credits can allow for the purchase of more cost-effective greenhouse gas reductions to offset this use. Funds generated could be used to enhance community renewable energy supplies. **Action:** Allow businesses or residents to contribute funding to enhance existing energy.	🌍🌍🌍🌍 💰💰💰 🐦🐦🐦🐦
5.4 Targeted Sales Taxes Statutory cities and counties lack the taxation tools to incentivize energy efficiency and renewable energy designs. **Action:** Seek legislative authority to implement targeted sales tax strategies, such as vehicle registration or carbon taxes.	Not Quantified

V. CONCLUSIONS

The Sustainable Energy Plan provides a range of programs and strategies to protect our climate and our way of life for generations to come. It also lays out a path toward a more energy-efficient and secure future. As indicated in Attachment B, many of the strategies save money and pay for themselves in the near-term. ClimateSmart strategies are often financially smart as well.

The SEP is also intended be a "living document." Participating communities will continue to seek new and innovative strategies to achieve the overall goal of the plan. In addition, these communities have adopted resolutions directing staff to develop programs, projects, and policies that reflect the strategies set forth in the SEP; work in a collaborative manner with other public and private entities to implement these strategies; and seek appropriate funding, within budget constraints, to effectively, efficiently and quickly address GHG emissions in the county in order to achieve the reduction goals set forth in the SEP.

Appendix A.

Detailed Strategy Description

ClimateSmart At Home

There are a host of actions that will enhance the energy efficiency of our homes. These include: adoption of codes and standards requiring greater efficiency of newly built and existing residences; incentives and/or technology standards to enhance the adoption of energy-efficient technologies and renewable energy sources; and assistance to residents identifying and implementing energy efficiency and renewable energy options.

1. High Efficiency Lighting Program – Early Action
Compact fluorescent lamps (CFLs) and light emitting diodes (LEDs) show tremendous potential for savings in Boulder County. While more CFLs are being installed everyday, their penetration is still not very high in this area. Evaluations assert that the bulbs will "fly off the shelves" if discounts can reduce the cost to within $1.00 to $2.00 of standard bulbs. Promoting these products in stores offers the benefit of being able to include a wide variety of bulb types and sizes in the incentive program. The program will be conducted in conjunction with retailers and manufacturers and will be coordinated with the U.S. EPA's "Change-A-Light" campaign. Retailers'/manufacturers' promotions, in-store signage, and end-cap displays will also help promote the program. The City of Fort Collins conducted a similar program and found it to be their most cost-effective effort. LED technologies are just beginning to reach the home lighting market through holiday lights and other specialty features.

This initiative is designed to build on successful efforts piloted in 2007 and expanded in 2008.

2. Neighborhood Energy Sweeps – Early Action
This project would seek to directly install energy-efficient devices in homes on a neighborhood-by-neighborhood basis. Residents, typically in lower income neighborhoods, would be informed of the date of the energy-efficiency sweep in advance to optimize their availability. The sweeps would result in the direct installation of several energy-saving devices at no cost to the homeowner, including:

- ENERGY STAR-qualifying compact fluorescent lamp lightbulbs
- Power-strips to eliminate phantom electric loads

In addition, bulk purchasing could bring energy savings to neighborhoods. For example, residents could be invited to purchase an energy-efficient refrigerator at a reduced cost due to a bulk purchasing agreement directly with the manufacturer. The installation of refrigerators would be conducted on a pre-determined date. Projected savings on energy bills would exceed $500 per household from the lighting measures alone, and when coupled with a new refrigerator, would be significantly more. A recycling and disposal program for collected refrigerators will also be part of this initiative. The City of Fort Collins found that during their program's first year, 699 refrigerators were purchased, resulting in 819 megawatt hours (MWh) saved and 1,017 mtCO2e avoided. Approximately 30% of the CO2e savings resulted from the environmentally appropriate destruction of clorofluorocarbon-11 (CFC-11) foam used to insulate the appliances.

Bulk purchases could also be conducted and made available on a neighborhood level for the purchase of insulation, programmable thermostats, or real-time metering devices. This initiative will build on and continue the successful sweeps being conducted in 2007 and 2008 in Longmont and Boulder.

3. Residential Energy Audit Program (REAP) – Early Action
The Center for ReSource Conservation (CRC), Boulder County, and participating municipalities in the county created the Residential Energy Audit Program (REAP) to provide low-cost energy-efficiency evaluations for Boulder County homeowners working with existing local energy service professionals. Local rebates for energy efficiency and renewable energy investments have created new opportunities for consumers to offset the costs of some energy-conservation upgrades for their homes.

This program was conducted as a pilot in the spring of 2006. Initial feedback on the program was excellent, with most participants reporting that they intend to invest between $1,000 and $5,000 in energy-efficiency upgrades as a result. A similar program in Burlington, Vermont, yielded annual kilowatt hours (kWh) savings of 204,665,000, with lifetime economic value of $169,527,000 and reduction of more than 2 million mtCO2e over the 14-year lifetime of the measures installed after five years of implementation.

In 2008, participating Boulder County communities include: Boulder County, Boulder, Jamestown, Lafayette, Longmont, Louisville, Nederland, and Superior

This project would continue the success of this initiative in identifying and encouraging homeowners to make cost-effective investments in energy efficiency and renewable energy.

4. Residential Green Building Codes and Ordinances for New and Existing Buildings
Residential energy use accounts for 25% of the county greenhouse gas inventory. While existing buildings account for nearly 90% of this energy use, new buildings are being built every day that will be in use for the next 40 years or more. A green building program would promote the use of cost-effective and sustainable building materials, the recycling and reuse of construction materials, and the use of "healthy" construction materials in order to conserve natural resources, reduce solid waste, and improve the indoor environment. A residential energy conservation ordinance (RECO) would ensure that existing buildings would eventually meet modern building codes. Home rule cities currently have the authority to implement RECOs. Statutory counties and cities would need to obtain this authority from the state.

Several communities across Boulder County are implementing or considering these types of programs. For example, Boulder County recently updated the Boulder County Comprehensive Plan and Land Use Code to implement a "BuildSmart" program for new construction and renovations in unincorporated Boulder County. This performance based program will be administered through the building permit process..

The City of Boulder currently implements the Green Points program and the City of Longmont has recently adopted Green Build. These programs consider such elements as: deconstruction & recycling, land use & water conservation, framing, plumbing, electrical, HVAC, solar, and indoor air quality of a new building. Different point totals are required, depending on type and size of the building project. The program is flexible – there are mandatory measures, but a variety of measures can be used to make up the necessary number of points. Some local governments allow for building permit fee rebates and expedited permit processing as incentives.

Home rule cities would consider the adoption of code requirements (like a RECO) for existing buildings that could be implemented at the point of sale, during a remodel, or by a fixed date in the future that would allow enough time for home owners to prepare for and implement the required changes. Rental properties could be an initial focus of this initiative, since most renters pay their own utility costs. Statutory communities would seek the authority from the state to implement this type of program.

5. Net-Zero Energy Home (ZEH)
A net-zero energy home (ZEH) is connected to and uses energy from the local electric utility. But unlike typical homes, on an annual basis, a ZEH produces enough energy to offset the amount purchased from the utility. This results in net-zero annual energy consumption.

A ZEH combines state-of-the-art, energy-efficient construction techniques and equipment with renewable energy systems to return at least as much energy as it uses on an annual basis. Specifically, when renewable resources cannot provide all of the home's power, such as at night or on a cloudy day, the homeowner purchases energy from the utility. When renewable resources produce more than the house is using, for instance on sunny days when no one is home, power is sent back into the utility grid. During these times, the home's electric meter runs in reverse, essentially providing homeowners full retail value for their energy.

ZEH communities are the leading edge of technologies that might someday create houses that produce as much energy as they consume. Premier Gardens, which opened last summer, is one of a half-dozen subdivisions in California where every home cuts power consumption by at least 50%, mostly by using low-power appliances and solar panels. Several more are under construction this year, including the first ZEH community for seniors.

This initiative will explore the creation of building codes and ordinances requiring that all homes over a certain size achieve net zero energy use. This requirement will expand over time to all new home development.

ClimateSmart At Work

Actions to reduce emissions from the commercial sector include: codes and standards, requiring energy-efficient construction and operational practices for new and existing buildings, maximizing the use of available rebates and incentives to install and implement energy-saving measures, and working closely with smaller businesses that lack in-house energy management resources. A list of actions is described below. Use of renewable energy resources in this sector is described in the ClimateSmart Power section below.

1. PACE EnergySmart Project – Early Action

Even with financial incentives and free energy audits, small- and mid-sized businesses have a difficult time implementing projects due to the constant stream of "urgent issues" they face. The objective of this program is to remove these implementation barriers. Using Partners for A Clean Environment (PACE) Program staff to introduce the program through this initiative, an outside consulting firm provides energy experts to guide the businesses through the process of identifying energy-efficiency options and service providers, estimating simple paybacks, overseeing the installation, and completing the necessary paperwork to receive available rebates. Additional rebate incentives could be offered to further sweeten the deal.

The project is modeled on successful business outreach initiatives conducted in Austin, Texas; Long Island, New York; and in Oakland and Berkley, California. If successful, this project could also be ramped up via adoption by Xcel Energy, Longmont Power and Communications, and other county power providers.

2. Commercial Building Codes and Ordinances for New and Existing Buildings

29% of county greenhouse gas emissions stem from the demand for energy required by the commercial sector. In partnership with municipal and county building officials, this initiative will seek to create building codes requiring that the performance of new and existing commercial buildings over time be enhanced to meet a designated standard under the U.S. Environmental Protection Agency's ENERGY STAR Portfolio Manager or other emerging building performance programs, such as the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) standards.

EPA's ENERGY STAR Portfolio Manager rates building energy performance on a scale of 1-100 relative to similar buildings nationwide. The rating system accounts for the impact of weather variations, as well as key physical and operating characteristics of each building. Buildings that achieve a rating of 75 or greater may qualify for the ENERGY STAR.
LEED for Existing Buildings is a green building rating system that was designed by the U.S. Green Building Council to guide and distinguish high-performance commercial and institutional construction projects. Credits are awarded based on five categories of performance: Sustainable Sites, Energy and Atmosphere, Water Efficiency, Indoor Environmental Quality, and Materials and Resources. A project can earn a certain amount of points within each of these credit areas. The number of points the project earns determines the level of LEED certification the project receives.

Through the LEED system, combined with local code development processes, there is the potential to promote a wide range of strategies, including the use of control systems such as:

- Motion detectors
- Centralized control systems to shut down equipment when not in use
- Centralized parking
- Use of green, white, or reflective roofing
- Water conservation practices
- Xeriscaping
- Window glazing
- Design solutions for energy-efficient entryways and vestibules

This initiative will investigate the use of individual performance systems and/or a combination of them. Other strategies that will be investigated for reducing emissions associated with the demand from existing commercial buildings include the Architecture 2030 challenge (www.architecture2030.org) and Berkeley's Commercial Energy Conservation Ordinance. For existing buildings, codes could be required at the point of sale, during a renovation, or at a time established in the future that would give building owners enough time to prepare for and implement the required changes.

3. Promoting Combined Heat and Power (CHP)

Combined heat and power (CHP), which is known as cogeneration, is an efficient, clean, and reliable approach to generating power and thermal energy from a single fuel source. CHP is not a specific technology, but rather an application of technologies to meet an energy user's needs. CHP systems achieve typical effective electric efficiencies of 50 to 70% – a dramatic improvement over the average efficiency of separate heat and power. Since CHP is highly efficient, it also reduces traditional air pollutants and carbon dioxide, the leading greenhouse gas associated with climate change. The CHP system can produce the same electrical and thermal output at 75% fuel conversion efficiency as compared to 49% for separate heat and power. This is a 50% gain in overall efficiency, resulting in a 35% fuel savings.

In addition, there are more than a dozen breweries, wineries, and food processors in Boulder County, and each produces a significant amount of organic waste matter. Nearly every operation either composts this material or offers it to local farms for livestock feed. More benefit might be gained from this material if it were to be digested under anaerobic conditions to produce methane gas. The gas would then be captured and used to fuel an electric generator. Material could be collected from the various operations and transported to a digester.

The New Belgium Brewery in Fort Collins has successfully developed such a process at their facility. It should be noted that a significant driver for New Belgium to install the digester was to avoid large fees from the wastewater treatment plant (WWTP) for the discharge of high biological oxygen demand wastewater.

New Belgium uses the methane produced by the digester to generate renewable electricity and heat. The system is a 290-kW engine with heat recovery. The recovered heat is fed back to the anaerobic digester to maintain the digester's desired temperature of 90°F. In the winter, the digester requires supplemental heat to maintain the optimal temperature. In the summer, the digester can't use all of the waste heat, and New Belgium is looking into other ways in which to use the excess heat. The system is usually set to run between 200-250 kW.

This initiative will encourage the use of CHP in as many instances as possible across the industrial sector. Using the tools and resources available through the U.S. Environmental Protection Agency's CHP Partnership, companies will be encouraged to assess the benefits and voluntarily apply these systems. It will also explore the opportunities to increase the use of anaerobic digestion in the food processing and beverage industries.

4. Western States Climate Initiative

In February 2006, five governors from Western states agreed to work together to reduce greenhouse gases. A central piece of this agreement is the creation of a regional "cap-and-trade program." This approach lets companies that can't meet their emission reduction targets buy credits from those that reduce carbon dioxide missions below their allotted levels. A similar system is close to being implemented by seven Northeastern and Mid-Atlantic states.

The Regional Greenhouse Gas Initiative (RGGI) creates a mandatory cap-and-trade program to reduce carbon dioxide emissions from power plants in the region. The RGGI emissions trading program is scheduled to launch January 1, 2009. Modeled after the federal sulfur dioxide trading program, RGGI includes several innovative program components, including the auctioning of emissions allowances and provision for project-based reductions or "offsets" so non-utility companies can participate.

Together, the Western and Northeastern regional cap-and-trade programs will provide a framework for developing a national cap-and-trade program and spur demand for a national system by businesses concerned about participating in multiple and variable programs. The State of Colorado has currently elected to participate as an "observer" in this important process. Boulder County could use its influence to encourage active participation.

5. Statewide Lighting Efficiency Standard

Rising energy costs and environmental concerns are encouraging states to follow the lead of Australia and Canada and ban incandescent light bulbs altogether. A bill has been proposed in California that, if passed, would ban the sale of incandescent bulbs. Lawmakers in Connecticut and Rhode Island have begun considering bans, and Texas and New Jersey are considering bans in public buildings. Nevada took a different approach, becoming the first state to pass legislation establishing minimum energy efficiency standards of 25 lumens per watt for general-purpose lights sold in the state on and after January 1, 2012.

Incandescent bulbs are about 75% less efficient than compact florescent bulbs (CFLs) and generate 75% more heat. CFLs cost more to purchase, but because they last longer, they actually cost less – saving consumers $30 or more on electricity over the lifetime of the bulb.

This initiative would support legislation establishing a statewide minimum energy efficiency standard for lighting. Rather than enacting a ban on one technology, this approach would ensure that energy efficient lighting is sold in the state, whatever the technology may be. In addition, the standard can be strengthened over time as new technologies (such as LED lighting or super-efficient incandescents) become commercially available.

GOVERNMENT SECTOR

Local governments can lead by example and influence the adoption of energy-efficiency and renewable energy technology. Local governments are also large users of energy for commercial buildings and transportation. This section explores the opportunities that local governments have to reduce greenhouse gas emissions in these sectors.

1. Anti-Idling Controls and Policies for Government Vehicles

Unnecessary idling of government vehicles wastes fuel, leads to unnecessary air pollution, reduces engine life, and increases maintenance costs. A simple mechanical adjustment of technology already available on heavy-duty vehicles will automatically shut the vehicle off after five minutes of idling. Because the device has already been installed on many vehicles and only needs a simple adjustment to activate, this low-cost measure has big results in saving energy and reducing greenhouse gas emissions. Policies will also be drafted and implemented prohibiting unnecessary idling. This initiative will enable a 5-minute shut-off control on all appropriate public vehicles and implement anti-idling policies for all other county and municipal vehicles.

2. Green or Light Colored Roofs

Surfacing the roofs of county and municipal buildings with greenery and light or reflective coloring can significantly reduce energy use associated with the buildup of heat on the roof. In addition to their energy savings, green or vegetated roofs reduce stormwater runoff.

The City of Chicago found that installing a green roof on its city hall building lowered the temperature by 3-7°F, which translated into a 10% reduction in air conditioning requirements. While the city's green roof was 90°F on the summer's hottest days, neighboring roofs measured over 160°F. The degree of savings depends on the type of roof and the climate. Boulder County's climate offers greater energy savings, because green roofs reduce air conditioning costs more efficiently than they lower heating bills. Thus, the strategy targets more greenhouse gas intensive electricity use rather than natural gas, which is commonly used for heating.

Part of this initiative will investigate and promote more conventional roofing strategies, such as light- or white-colored surfacing. In addition, more innovative strategies, such as rooftop photovoltaics, will be encouraged as a higher tier option for use of the roof space.

3. Light Emitting Diode (LED) Traffic Signals

Replace energy-intensive incandescent bulbs in traffic signal lights and pedestrian crosswalk signals with highly efficient LEDs. The technology is expected to reduce energy use by 90%, lower maintenance due to increased life, and incorporate innovations like battery backup using photovoltaics. Xcel Energy offers rebates for such conversions. The payback period for such conversions is typically less than one year.

This initiative will encourage the full adoption of LED traffic lighting.

4. Leadership in Efficient Public Buildings

This strategy will ensure that new and existing public buildings lead the way in energy efficiency and performance. Through codes, standards, policies, or ordinances, public buildings will be required to achieve a higher level of efficiency than the private sector building codes or ordinances envisioned in this plan. For example, public sector buildings would have more efficient heating and cooling system requirements, as well as more efficient windows, and would utilize control systems for office equipment.

This initiative will make all new and existing municipal and county buildings leaders in energy efficiency.

5. Goal Setting

Setting a greenhouse gas reduction target is a good first step for establishing energy efficiency and renewable energy actions as a community priority. More than 500 mayors, representing 65 million people, have now signed onto the U.S. Mayors Climate Protection Agreement that includes a commitment to meet or beat the Kyoto goals calling for a 7% reduction in greenhouse gas emissions below 1990 levels by 2012. The City of Boulder and Boulder County have already adopted the Kyoto goals.

Much like the County and the City of Boulder have, this initiative will encourage all municipalities within Boulder County to adopt a greenhouse gas reduction goal.

6. ClimateSmart

Governments play an important role of providing the information, tools, and resources that residents and employers need to make the choices and decisions that will promote a sustainable energy path and economy. The ClimateSmart campaign provides such resources including informational advertising and timely reminders, as well as tools to assess GHG impacts and identify opportunities for improvement.

This initiative will devote resources to the creation of an educational campaign and tools, such as a carbon calculator, that enable local governments, businesses, and residents to set a reduction goal and create an action plan. This may help with prioritizing options.

7. Municipal and County Energy Management Plans

A key to implementing and realizing the benefits of energy efficiency in municipal and county buildings and operations is the creation of comprehensive, multi-year management plans. These plans provide a systematic process for auditing, prioritizing, financing, and installing improvements. The plan will also establish energy performance goals, such as an energy use per square foot target similar to the approach used by the University of Colorado, Boulder Campus.

This initiative will work with municipal and county facilities managers to develop energy-efficiency management plans.

ClimateSmart On the Road

1. Biofuels Promotion

When compared with petroleum-diesel, biodiesel dramatically reduces sulfur, particulate matter, CO2, volatile organic compounds, which form harmful ozone, and carbon monoxide, while producing a slight increase in nitrogen emissions. Biodiesel can be used in existing late model diesel engines, requiring little or no modifications, and can be distributed through the existing fuel distribution infrastructure. It mixes easily with petroleum diesel for improved performance in colder months and provides improved lubrication necessitated by the new low sulfur petroleum-diesel fuels. Biodiesel costs are currently the same or slightly less than petroleum-diesel.

Ethanol is another biofuel that is added to gasoline to decrease air pollution and to reduce GHG emissions. However, at this time most ethanol is derived from grains, such as corn and wheat or soybeans, through a process that minimizes the greenhouse gas benefit compared with gasoline.

Cellulosic ethanol is produced from a wider variety of biomass feedstocks than conventional ethanol fuel. These new feedstocks include forest waste, agricultural plant wastes, plant wastes from industrial processes (sawdust, paper pulp), and energy crops grown specifically for fuel production (such as switchgrass). The process is expensive at present; however, advances in biotechnology could decrease conversion costs substantially. If Department of Energy (DOE) goals are met, the cost of producing ethanol could be reduced by as much as 60 cents per gallon by 2015. The use of conventional ethanol in the short-term can pave the way for cellulosic ethanol in the near future.

This initiative will promote the use of biofuels consistent with sustainability criteria. Educational barriers will be identified and addressed, beginning with government operations and large diesel fuel users.

ClimateSmart On the Road (cont.)

2. Vehicle-to-Grid (V2G) Connection

Increasing the use of electric-drive hybrid vehicles would not only reduce dependence on foreign oil, but these vehicles could also provide battery/storage capacity for renewable sources to power the electric grid by plugging hybrid vehicles into the electric grid to provide power during the many hours of the day that they sit idle. This strategy would reduce the need to build new power plants to meet peak power demand. They would also allow for greater use of renewable energy supplies because renewables require storage capacity.

Estimates indicate that if automakers were to make 1 million next-generation V2G vehicles by 2020, they could generate up to 10,000 MW of electricity – about the capacity of 20 average-size power plants. Studies also show that it would be far cheaper for utilities to tap the batteries of thousands of cars than the current practice of keeping huge turbines constantly spinning to supply power at a moment's notice. There would be little risk of leaving the office to discover a car with a dead battery, because V2G cars would have onboard controls to prevent their batteries from being drawn below the minimum travel needs set by the owner – for example, a 50-mile trip. The additional cost to outfit today's Toyota Prius with an adequate battery pack to make it viable for V2G power would add roughly $400 to a car's overall cost, and fuel-cell cars will far exceed hybrids in their electric generating potential.

This initiative will explore and promote opportunities for vehicle-to-grid through education, pilot projects (such as the county's plug-in hybrid vehicle purchase), and potential incentives.

3. Clean Car Incentive

A clean car incentive is a financing mechanism to incentivize the purchase of high fuel-efficiency vehicles. The incentive is funded by charging users of less fuel-efficient vehicles a fee and applies the funds from this fee, as an incentive, toward the purchase of more fuel-efficient vehicles. This approach is a relatively efficient way of promoting the purchase of more fuel-efficient vehicles. Users of less fuel-efficient vehicles directly pay for the externalities that they incur upon society.

This type of approach has been considered by state and federal lawmakers over the past 15 years; however, it has never been implemented. Various analyses have been done based on modeling of consumer choice and manufacturer behavior. These studies indicate that with existing technologies, a national feebate program could reduce CO2 emissions from vehicles by 20%.

This initiative would consider and potentially propose a statewide Clean Car Incentive program for Colorado and/or a countywide program as part of the vehicle registration process. Some vehicles, such as those used for work purposes, could be exempted from the program. Purely recreational vehicles, however, require more natural resources to produce and operate and emit more carbon dioxide. These vehicle owners could offset these impacts by reducing the cost of a high-efficiency vehicle.

4. Clean Car Standard for Colorado

The "California Clean Car" standards give car companies until 2016 to achieve a 30% reduction in greenhouse gas emissions from new cars, pickups, minivans, and SUVs sold in the state. While new car buyers will pay more once the new standards are in effect, the standards will save fuel as well as emissions. To date, 15 other states have adopted the rules. A survey conducted in 2004 of 1,300 voters nationwide found that 73% support California's emissions law. Adoption by additional states, including Colorado, would give more support for their national approval.

Through this initiative, Boulder County could use its influence to encourage the state to adopt these standards.

ClimateSmart Power

1. Renewable Portfolio Standard

Colorado became the first U.S. state to create a renewable portfolio standard (RPS) by ballot initiative when voters approved Amendment 37 in November 2004. Colorado's original RPS, which has since been expanded, required large investor-owned utilities to generate or purchase 10% of their retail electric sales from renewable-energy resources. In 2007, the state legislature increased the RPS and extended the requirement to electric cooperatives, among other changes. Colorado's current RPS requires each investor-owned utility to use specific percentages of renewable energy and/or recycled energy according to a schedule that culminates in obtaining 20% of its retail electricity sales in Colorado for the year 2020 and for each following year.

In addition, Colorado's RPS requires all electric cooperatives and each municipal utility serving more than 40,000 customers to use specific percentages of renewable energy and/or recycled energy according to a schedule culminating in obtaining 10% of its retail electricity sales in Colorado for the year 2020 and each following year.

This initiative will investigate the need for a more stringent standard.

2. Concentrating Solar Project

Concentrating solar power systems are large centralized power generation plants that use the sun's energy rather than fossil fuels. These systems are currently being developed and tested as a means of fulfilling our growing power demand. This initiative would encourage the use and continued demonstration of concentrating solar power technologies by identifying partners and project sites in Boulder County.

Conventional power plants today use fossil fuels as a heat source to boil water. The steam from the boiling water rotates a large turbine, which activates a generator that produces electricity. However, concentrating solar power systems use the sun as a heat source rather than fossil fuels. Unlike the photovoltaic units installed on our rooftops, these systems employ mirroring systems to concentrate the solar energy reaching the system.

For example, parabolic-trough systems concentrate the sun's energy through long rectangular, curved (U-shaped) mirrors. The mirrors are tilted toward the sun, focusing sunlight on a pipe that runs down the center of the trough. This heats the oil flowing through the pipe. The hot oil then is used to boil water in a conventional steam generator to produce electricity.

This initiative will explore the possibility and encourage the building of a concentrating solar facility in Boulder County.

3. Community Renewable Energy

Currently, renewable energy sources offset countywide GHG emissions by 1%. The purchase of renewable energy credits accounts for about half of this, with county/municipally owned renewable resources accounting for the other half. Increasing the purchase of renewable energy credits (RECs) can increase the amount of renewable resources being used by county residents and businesses to offset GHG emissions. As a long-term strategy, the county could investigate the possibility of establishing a community wind or concentrated solar project to supply a portion of our electrical needs.

4. Sustainable Energy Financing District

Although solar power is an attractive option for some homeowners and businesses thanks to federal, local, and utility rebate incentives, significant hurdles stand in the way of broad adoption. These include high installation costs (roughly $10,000 to $15,000 with the rebate for homeowners), a long payback period (10-20 years), and the possibility that the property will be sold before the project pays off. To address these issues, the Berkeley, California, City Council directed its staff to design and develop an energy-financing district.

The general concept involves the local government establishing a bond financed loan fund that is available to property owners to use to purchase solar systems (photovoltaic or hot water) and energy-efficiency improvements (some energy-efficiency measures may be required). The fund is repaid, with interest, through an assessment on the property. Administrative costs would be rolled into the property owner's loan. According to City of Berkeley staff, through the financing system, property owners would pay very little in upfront costs. This project becomes particularly attractive if the interest rates offered by a county bond are lower than through commercial equity lines. Since the tax assessment is transferable, if the property is sold before the project is paid for, the next owner would take over the payments. While this adds an additional expense to the property, the "green" aspects of the home may actually attract prospective buyers.

This initiative would track the progress of the analytical efforts being conducted in Berkeley and investigate its application in Boulder County and Colorado.

5. Solar-Powered Public Buildings

Public buildings are a showcase for the public and can be an example of what is possible. In this way, they represent an ideal opportunity for the use solar power. In addition to providing an example, public buildings can also take advantage of the long-term paybacks associated with photovoltaics (PV) and solar thermal systems.

This initiative would focus on installing (where practicable) large-scale PV on public buildings in the 100kW to 1MW range. Third-party ownership is an attractive model that will be considered, as well as the use of other financing mechanisms.

In addition, this initiative will seek to encourage the use of solar hot water systems on all large municipal/county water consumers, such as pools, recreation centers, jails, etc.

ClimateSmart Power (cont.)

6. Maximum Rooftop PV

Incentives for new or retrofitted photovoltaics (PV) on rooftops in the county would convert light energy into electrical energy. This initiative would seek to maximize the use of the largest rooftops in Boulder County as the source of the cost-effective PV. Incentives and/or building codes could be used to ensure that our largest retail and industrial sites take greatest advantage of this renewable resource.

Incentives to incorporate PV into residential design could be provided through the county "Build Smart" program. Not every house could be retrofitted, since PV modules need to be mounted facing the sun, avoiding shade for best results; however, these issues can be considered during the design phase for new construction.

Some utilities, including Austin Energy, have established centralized PV power stations. The program allows customers to pay a small fee on their monthly utility bill that will be used to construct additional PV panels, which would add more renewable energy inputs for the City's overall energy production base.

Another idea is the concept of a solar cooperative. In this model, homeowners or renters that want to "own" PV systems can do so by purchasing an equity position in a local PV system. The panels go up at a central location in their name – and they receive a check every month. The panels, once again, are placed in a location more suitable for PV. Regulatory authority to implement these types of programs may be necessary to overcome existing barriers.

This initiative will explore these ideas, as well as additional financing mechanisms, and the authority needed from the Public Utilities Commission.

Utility Partnerships

This section explores the unique role that electric utility providers can play in encouraging energy efficiency and renewable energy. It documents and evaluates some of the more innovative utility demand-side and renewable energy programs that will be explored.

1. Maximum Use of Rebate Incentives

In January 2006, Xcel Energy launched several rebate and incentive programs to help initiate electricity savings for their business customers. This demand-side management (DSM) program's goal is to reduce system demand by 320 megawatts (MW) and conserve 800,000-megawatt hours (MWh) of energy annually by 2014. Xcel Energy plans to spend up to $196 million on energy conservation in Colorado within the next eight years – much of that will be available as equipment rebates when their customers install qualifying energy-saving equipment, such as lighting, motors, and cooling systems. In April 2007, new DSM legislation applying to both electricity and natural gas demand was passed by the legislature.
Longmont businesses can receive up to $500 per kilowatt (kW) for investing in energy-efficiency improvements. Longmont Power and Communications (LPC) and Platte River Power Authority (PRPA) offer this incentive to all commercial rate customers for installing energy-efficient equipment or controls that reduce electric demand during the summer peak period. Qualifying electric efficiency measures may include, but are not limited to, lighting, heating, ventilation, cooling, motors, manufacturing equipment, thermal energy storage, controls, or other technologies.

In order to maximize rebate use, programs should be put into place to ensure that these rebates are considered when making any equipment purchases or building designs, recommissionings, or retrofits. Such programs would identify when rebates are available and possibly change purchasing and design decisions to take advantage of rebates.

This initiative will assess several strategies for ensuring the maximum use of these funds. In addition, it will assess city and county statutory authority to add rebate and incentive funds to those provided by utilities.

2. Utility Demand and Power Supply Incentives

The City of Boulder and several other municipalities are currently revisiting or renewing their franchise agreements with Xcel Energy. Other power supply contracts in place across the county may be coming up for renewal as well. This is a time to consider the pros and cons of various power mix strategies, particularly those that can lead to the best combinations of demand reduction, efficiency, and renewable supply options.

While the state legislature has just passed legislation supporting stronger demand-side management programs and strengthening the state's Renewable Portfolio Standard, these efforts may not be sufficient to meet county climate goals.

This initiative will investigate and pursue alternative power mix strategies with Boulder County power suppliers, such as municipal aggregation and other strategies, to enhance demand management and renewable resources.

3. Carbon Labeling

Bringing greater awareness to residents and businesses about the impacts of their energy use, electricity bills could include information on the carbon dioxide equivalent of the energy that was used the previous month. Additional information such as the average emission per home or emissions associated with annual automobile use could also help people understand the impact of their energy use.

Revenue Generation

To support these strategies, resources will be necessary. This section explores investment and incentive opportunities, such as rebates, low-interest loans, revolving funds, bonds, and other strategies to attract the necessary resources to cost-effectively reach our GHG reduction objectives.

1. Energy Budgets and Rate Structures

Providing an incentive for conservation energy budgets could be established for certain home or office sizes. For usage above that amount, a higher rate could be charged. This is similar to what communities are doing with water charges.

2. Revolving Loan Fund

Similar to Massachusetts' "MassEfficiency," this initiative would establish a revolving loan fund to cover the startup costs of a large-scale energy-efficiency program. The fund could be established at the state or local level, beginning with private contributions or tax funds. Massachusetts will begin with $2 million in seed funding and is projected to yield $100 million in efficiency measures, meaning a portion of the cost savings from using less energy will be used to pay for additional energy-efficiency measures. In addition to energy-efficiency measures, the project could include new renewable and clean energy generation, and technologies that curb electricity use during peak demand periods.

3. Climate Offset Credits

This initiative will explore the generation of funding for energy-efficiency projects through the sale of "offsets" credits. Under this approach, businesses or residents would be able to directly contribute funding to enhance existing energy efficiency or renewable energy projects. These funds would be applied to expand the scope or impact of these projects to increase the amount of energy saved or renewable energy produced. The value of the credits to the purchasers is that they would offset the greenhouse gas impacts of the energy they use in a more cost-effective way.

4. Targeted Sales Taxes

This proposal would encourage legislation providing statutory cities and counties with the ability to implement targeted sales tax strategies, such as vehicle registration or carbon taxes. These funds would be used to implement investment and incentive opportunities, such as rebates, low-interest loans, revolving funds, bonds, and other strategies to attract the necessary resources to cost-effectively reach our greenhouse gas reduction objectives.

Appendix B.
Table of Emission Reduction Strategies and Impacts
ClimateSmart at Home

Residential Projects	GHG Reductions (tCO2e)*			Cumulative Cost to Implement					Key Assumptions
	2012	2020	Total 2008-2020	Government (Million $)	Private Sector (Million $)	Annual Cost Savings in 2020 (Million $)	Simple Pay Back (Years)	Cost- Effec-tive-ness ($/tCO2e)	
High Efficiency Lighting Program – Early Action	2,000	0	11,000	0.1	0.045	0.17**	0.9	-91	Program ends 2010 - 10,000; CFLs distributed each year 2008-2010; five year bulb life.
Neighborhood Energy Sweeps – Early Action	340	0	1,700	0.03	0	0.037**	0.8	-87	Program life 2008 to 2012; 900 kits with 8 CFLs each distributed each year; 98 in-depth visits conducted with 30 CFLs distributed per visit; average bulb life 5 yrs.
Residential Energy Audit Program (REAP) -- Early Action	3,325	3,325	302,575	2.2	27.3	4.4	6.2	-48	700 homes audited each year thru 2020; 4.74 metric tCO2 reduction/home annually; $3,000 average homeowner/resident investment; $450 average annual savings/home.
Residential Building Codes for New and Existing Buildings	111,000	290,600	1,883,900	0.5	476.72	39.7	8.9	-17	Codes, costs, and cost savings based on county Greenhouse Gas Mitigation Report (http://www.co.boulder.co.us/sustain/energy/GHG.htm); 35% market penetration for existing building stock by 2012; 90% market penetration by 2020.
Net Zero Energy Homes	11,540	24,290	172,180	0.455	71	4.7	15.1	25	Program starts in 2008; 50% market penetration of new construction by 2012 representing 1.5% of residential sector; 100% penetration of new consturction representing 3% or sector by 2020.

Projects in Bold are the Key Strategies recommended for early adoption.

* The GHG reductions claimed by some programs may overlap with the GHG reductions claimed by other programs on the list. Residential electricity rates are assumed to be $0.10/kWh. The table includes only those measures that have been quantified.

** Due to end of project, cost savings achieved prior to 2020.

ClimateSmart at Work

Commercial and Industrial Sector Projects	GHG Reductions (tCO2e)*			Cumulative Cost to Implement					Key Assumptions
	2012	2020	Total 2008-2020	Government (Million $)	Private Sector (Million $)	Annual Cost Savings in 2020 (Million $)	Simple Pay Back (Years)	Cost- Effec-tive-ness ($/tCO2e)	
PACE Energy Performance Project – Early Action	482	482	29,400	0.1	3.1	0.66	4.8	-123	Program will operate with county and municipal funding until 2010 when Xcel will take over and significantly expand the program; PACE will continue to market the program with Xcel.
Commercial Building Codes and Ordinances for New and Existing Buildings	159,800	429,300	2,755,900	0.5	233	46.9	3.0	-70	Codes, costs, and cost savings based on Bundle 2 of the county Greenhouse Gas Mitigation Report (http://www.co.boulder.co.us/sustain/energy/GHG.htm); 35% market penetration for existing stock by 2012; 90% market penetration by 2020.
Combined Heat and Power	74,551	209,894	1,411,940	0.2275	115	19.79	5.8	-35	Assumes the following market penetration rates by 2020: 45% gas engines; 25% microturbine; and 7.5% molten carbonate fuel cell. Assumes business as usual (BAU) case for electricity and natural gas purchases.
Western States Climate Initiative	156,300	401,250	2,620,700	42.51	247	37.7	5.1	-56	Includes $47.4M from Xcel Energy as demand and renewable energy rebates.
Statewide Lighting Efficiency Standard	30,816	36,528	346,416	0.035	8.1	3.5	2.3	-49	Retail availability of incandescent light bulbs is phased out; 100% CFL market penetration by 2020.
Net-Zero Electric Buildings	5,428	27,138	145,186	0.357	12	0.98	6.0	557	Program starts in 2008; 1% market penetration by 2012 and 5% by 2020.

Government Sector Projects	GHG Reductions (tCO2e)*			Cumulative Cost to Implement					
	2012	2020	Total 2008-2020	Government (Million $)	Private Sector (Million $)	Annual Cost Savings in 2020 (Million $)	Simple Pay Back (Years)	Cost- Effec-tive-ness ($/tCO2e)	
Anti-Idling Controls and Policies	526	579	7,182	0	0	0.15	0.0	-272	All diesel heavy duty vehicles will come from dealer with auto shut-off activated after 5 minutes of idling.
Green or Light-Colored Roofs	213	266	2,658	1.2	0	0.17	7	-129	Estimates are for Boulder County buildings only; 70% of all suitable sites; costs are $1.50/sqft for white and $8/sqft for green; 75% of roof space is white and 25% green; installations begin in 2010 and completed by 2020.
LED Traffic Signals	717	717	9,321	0.15	0	0.063	2.4	-63	All remaining incandescent bulbs replaced with LEDs by 2012.
Leadership in Efficient Public Buildings	9,386	65,699	302,685	13.8	0	1.4	9.8	11	Codes, costs, and savings resemble Bundle 3 from county GHG Mitigation Analysis (http://www.co.boulder.co.us/sustain/energy/GHG.htm); 10% implementation in existing buildings by 2012 and 70% by 2020.

Projects in Bold are the Key Strategies recommended for early adoption.

* The GHG reductions claimed by some projects may overlap with the GHG reductions claimed by other projects on the list. Assumes commercial sector electric rates of $0.08/kWh. The table includes only those measures that have been quantified.

ClimateSmart Power

Renewable Power Projects	GHG Reductions (tCO2e)*			Cumulative Cost to Implement					Key Assumptions
	2012	2020	Total 2008-2020	Government (Million $)	Private Sector (Million $)	Annual Cost Savings in 2020 (Million $)	Simple Pay Back (Years)	Cost- Effective-ness ($/tCO2e)	
Renewable Portfolio Standard	241,500	620,700	4,050,000	0.035	852.5	95.5	7.5	-75	8% renewable energy (RE) in 2012; 20% in 2020; mix of PV, wind, biomass
Concentrating Solar Power	63,773	63,773	1,813,775	60	60	5.6	10.7	11	50 megawatt (MW) system; $2,400/kW initial capital cost and $48/kW annual operation and maintenance (O&M) - cost split with private industry; 16% net annual efficiency; begin operation in 2012 w/ 30 year life.
Community Wind	4.000	28,000	168,000	9.2	9.2	3.3	2.8	-12	1.5 MW turbines; $1.75M/MW initial capital cost and $60k/turbine annual O&M - cost split with private industry; 4,500 MWh/yr production/turbine; begin operation in 2012 w/ 30 year life - 1 turbine in 2012 and one additional each year for a total of 7 producing about 10MW.
Sustainable Energy Financing District	94,400	255,800	1,742,900	3.5	506.4	43.5	11.6	-56	County bonds fund low-interest loans to property owners; increased property tax assessment is offset by reduced energy costs from energy efficiency (EE) and renewable energy (RE) equipment installed with loan proceeds; property owners have net zero change in out-of-pocket cost.
Solar Powered Public Buildings	966	3,545	21,252	11.4	0	0.31	74	645	Boulder County buildings only (70% of all suitable sites); capital costs do not include rebates/incentives to avoid double counting; installations begin in 2010 and are complete by 2020; 25 year life of arrays.
Maximum Rooftop PV	20,780	65,630	397,600	0.455	129.6	7.9	16.5	49	10% market penetration in 2012 and 30% penetration in 2020; average installation is 1.5 kW; Xcel Energy level of rebate funding plus current federal tax credit equaling about 50% of installed PV cost.

Utility Partnerships	GHG Reductions (tCO2e)*			Cumulative Cost to Implement					Key Assumptions
	2012	2020	Total 2008-2020	Government (Million $)	Private Sector (Million $)	Annual Cost Savings in 2020 (Million $)	Simple Pay Back (Years)	Cost- Effective-ness ($/tCO2e)	
Maximum Use of Rebate Incentives	86,000	453,900	2,811,000	0.5	59	15.5	3.8	-11	Boulder County homes and businesses receive 20% of Xcel Energy's proposed $196M rebate available through 2014; private sector spends $3 additional dollars for each rebate dollar received.
Utility Demand and Power Supply Incentives	318,900	900,700	5,675,700	41.67	1143	121.9	7.0	-76	10% market penetration by EE in residential and commercial buildings in 2012 and 35% in 2020; 30% average energy savings in each treated building; 1.5% market penetration of Net Zero Energy Homes in 2012 and 3% in 2020; 4% market penetration of PV residential and commercial buildings in 2012 and 9% in 2020; 4% market penetration of third-party wind farms in 2012 and 12% in 2020; 2.5% market penetration of third-party biomass in 2012 and 5% in 2020.

Projects in Bold are the Key Strategies recommended for early adoption.

* The GHG reductions claimed by some projects may overlap with the GHG reductions claimed by other projects on the list. The plan assumes electric rates of $0.08/kWh for commercial and $0.10/kWh for residential. The table includes only those measures that have been quantified.

ClimateSmart On the Road

Transportation Sector Projects	GHG Reductions (tCO2e)*			Cumulative Cost to Implement					Key Assumptions
	2012	2020	Total 2008-2020	Government (Million $)	Private Sector (Million $)	Annual Cost Savings in 2020 (Million $)	Simple Pay Back (Years)	Cost- Effective-ness ($/tCO2e)	
Biofuels	152,800	447,800	2,784,600	0.0875	5.4	0	0	3	CO2 reductions/gallon: 30% corn ethanol; 75% biomass fractionation ethanol; 85% biomass-to-liquid (BTL) ethanol ; 40% transest biodiesel; 85% BTL biodiesel.
Vehicle-to-Grid	63,900	180,300	1,229,600	0.2275	2142.1	107.4	19.9	526	10% market penetration of predicted 2010 vehicle miles traveled (VMT) and 25% of predicted 2020 VMT.
Clean Car Incentives	89,100	103,100	1,204,300	0.945	0	34.1	0	-331	Average CO2 reduction is 17.5%; average VMT is 15,000/vehicle-year.
Clean Car Standard for Colorado	84,700	254,100	1,651,700	0.035	0	84.1	0	-331	25% CO2 reduction by 2030; 6% by 2012; and 15% by 2020.

Projects in Bold are the Key Strategies recommended for early adoption.

* The GHG reductions claimed by some programs may overlap with the GHG reductions claimed by other programs on the list. The table includes only those measures that have been quantified.

Revenue Generation

	GHG Reductions (tCO2e)*			Cumulative Cost to Implement					
	2012	2020	Total 2008-2020	Government (Million $)	Private Sector (Million $)	Annual Cost Savings in 2020 (Million $)	Simple Pay Back (Years)	Cost- Effective-ness ($/tCO2e)	
Energy Budgets and Rate Structures	95,200	279,150	1,735,500	0.07	233.9	43	5.4	-82	Inclining block rate structure that increases electric tariff by 27.5% if usage exceeds threshold.
Revolving Loan Fund	6,070	6,070	78,910	0.28	3.45	0.95	3.6	-73	$3 million fund providing no-interest loans.
Climate Offset Credits	329,700	989,100	6,099,450	0.28	122	0	0	20	Carbon calculator quantifies carbon footprint; consumer purchases offsets at $20/metric tCO2; 30% market penetration with average footprint offset of 50%.

Projects in Bold are the Key Strategies recommended for early adoption.

* The GHG reductions claimed by some projects may overlap with the GHG reductions claimed by other projects on the list. The plan assumes electric rates of $0.08/kWh for commercial and $0.10/kWh for residential. The table includes only those measures that have been quantified.

SUSTAINABLE ENERGY PLAN

BOULDER COUNTY CONSORTIUM OF CITIES

Energy Strategy Task Force

Developed by
Boulder County Public Health
on behalf of and supported by
the communities of Boulder County

April 2008