

**Energy Action Plan for  
The Town of Crested Butte**

**Prepared by  
The Crested Butte Energy Action Planning Committee  
06/10/09**

## Table of Contents

Introduction	pg. 3
Use of the Energy Action Plan	pg. 3
Energy Action Plan Process	pg. 4
Inventory and Target Recommendations	pg. 5
Guiding Principles	pg. 7
Effectiveness	pg. 7
Priority and Duration	pg. 10
Energy Action Plan	
General	pg. 11
Buildings	pg. 11
Government Buildings and Operations	pg. 14
Public Education	pg. 15
Transportation	pg. 17
Waste	pg. 19
Energy Generation	pg. 20
Policy and Finance	pg. 22
Appendix	
Cost Effectiveness of common building related Energy efficiency measures	pg. 23
Funding	pg. 24
Definitions	pg. 24
Crested Butte Emissions Inventory	pg. 25

## **Introduction**

The intent of this plan is to guide the creation and implementation of energy policy and programs and provide a process by which future energy policy goals and programs may be evaluated.

Following the completion of the Upper Gunnison Emissions Inventory, The Crested Butte Energy Action Planning Committee was convened to develop the Crested Butte Energy Action Plan. The Committee is a voluntary body consisting of Town Staff, ORE Staff, local businesses and community members. With the Upper Gunnison Watershed Emissions Inventory as a reference, the committee developed a set of guiding principles by which programs and policies could be evaluated. Energy programs and policies were then evaluated by these guiding principles and quantitative emissions evaluation tools.

Programs were suggested and evaluated in the following areas:

- General
- Buildings
- Government Buildings and Operations
- Public Education
- Transportation
- Waste
- Energy Generation
- Policy and Finance

Action items in the Plan are not exhaustive; they were created to provide an example of a range of programs appropriate for implementation in Crested Butte. This Plan provides an outline of an evaluation process that should be further developed to accurately evaluate the cost and benefits of specific proposals.

## **Use of the Energy Action Plan**

This document should be used in the creation of policies and programs governing energy use, internal municipal practices, the execution of duties and the development of staff work plans. Because the Gunnison Valley plan contains multi-jurisdictional elements, implementation will be conducted by a combination of private, public and non-profit entities.

While the plan indicates the most likely agencies for implementation, these recommendations are not binding and are meant for guidance only.

Implementation of the EAP should occur on a project-by-project basis. The Town will commit resources and staff as annual budgets allow. Town should also continue to collaborate with the Office of Resource Efficiency based on the

parameters of existing and future partnership agreements. Town Staff, ORE Staff and members of the Town Council should form an EAP steering committee following the adoption of the plan. The role of this committee will be to initiate the first steps outlined in the plan including: further program analysis, finance strategies and staffing. Upon adoption of the Multi-Jurisdictional Energy Plan, the Steering Committee will coordinate with parallel jurisdictions on relevant projects as necessary.

In order to monitor the implementation of the EAP, assist in the development of programs and ensure proper communication between involved parties, the Town should designate a staff member to act as plan coordinator.

The Town will consider this document as part of the normal operation of Town Government, including budgeting, work plans, staff allocation and partnership agreements. The Town Council will consider this EAP in decision-making and use it as a guide to direct Town Staff in the creation of Town policies.

As programs are created, specific budgets will be design to define the scope and financial requirements of the various action items. As technology and funding evolve, this plan will also evolve to reflect the priorities and capabilities of energy conservation policy in the Town of Crested Butte.

The Plan also identifies issues that require a multi-jurisdictional approach. These issues are addressed in the multi-jurisdictional section of the Upper Gunnison River Watershed Energy Action Plan. Like the common language introduction and appendix sections, the multi-jurisdictional component of the plan is separate from the municipal plans, and it should be adopted together with the other local governments participating in the EAP process.

The goal with all Energy Action Plan items is the creation of programs with measurable results. Consequently Energy Action Plan programs should undergo a biennial review by the EAP Steering Committee, with effectiveness gauged against the 2005 Emissions Inventory. The Energy Action Plan Steering Committee will meet to review findings and recommend modifications to programs and planning documents. This is a preliminary plan that must be updated frequently as science, technology, economics, and politics alter circumstances.

### **Energy Action Plan Process**

The creation of the Energy Action Plan (EAP) was a consensus driven process that attempted to combine a variety of decision-making parameters. The UGRW Emissions Inventory was used to identify the sectors with the greatest potential for emissions reductions. Using this as a guide, program and policy ideas were compiled by the Crested Butte EAP Committee. These programs and policies were consolidated under typical program headings, such as “Educational Programming for Children” and grouped by type; such as “Buildings”. The

programs were then evaluated against a broad set of “Guiding Principles” established by the committee.

The refined set of measures was then quantitatively explored with the *ICLEI CAPP Decision Support Tool*. This tool allows the user to adjust parameters and determine projected project costs, energy savings and carbon emission reductions. Selected action items underwent further analysis by the Gunnison Valley EAP Calculation Committee, which incorporated locally determined values of costs and benefits for energy efficiency measures.

This set of measures was then ranked by priority based on a combination of estimated effectiveness and un-quantifiable co-benefits described in the group’s “Guiding Principles”.

### Inventory and Target Recommendations

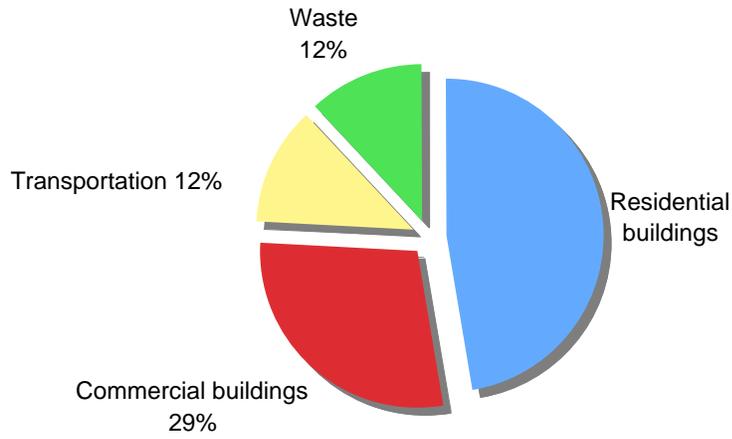
CO2e reduction targets are based on the 2005 UGRW Emissions Inventory. Reduction targets are not per capita; therefore, targets should not be reduced for population growth. CO2e reductions should be measured as the absolute quantity of CO2e emissions from activities itemized in the 2005 emissions inventory.

- By 2020, annual emissions are to be 20% below 2005 levels.
- By 2050, annual emissions are to be 80% below 2005 levels.

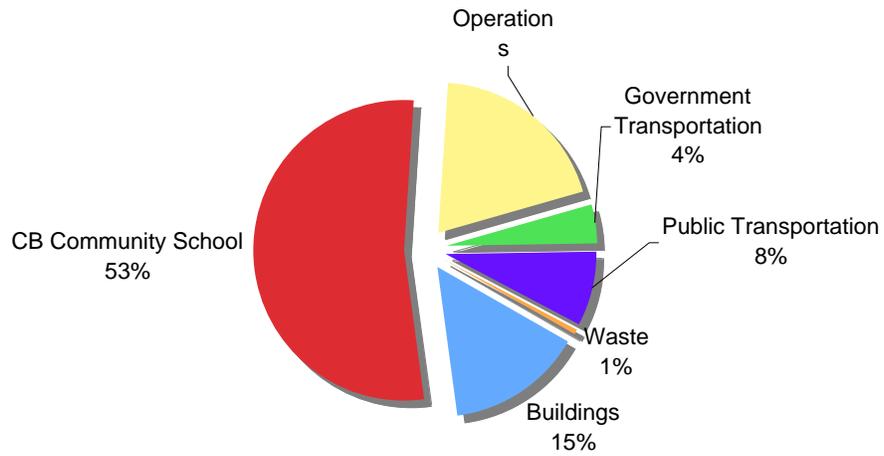
The graphs below indicate the source of emissions by sector for both community and government operations and the annual reduction goal in 2020 and 2050. Energy reduction strategies should be developed for sectors with the greatest potential for reduction.

<b>2005 Community CO2e Emissions by Sector</b>			
	Tons of CO2e	20% annual reduction goal by year 2020	80% annual reduction goal by year 2050
Residential buildings	19,285	<b>8,193</b>	<b>32,271</b>
Commercial Buildings	11,724		
Transportation	5,073		
Waste	4,878		
Other	4		
<b>Total</b>	<b>40,964</b>		
<b>2005 Government CO2e Emissions by Sector</b>			
Buildings, Facilities, Operations	4,971	<b>1,139</b>	<b>4,557</b>
Transportation	690		
Waste	32		
Other	4		
<b>Total</b>	<b>5,697</b>		

### Crested Butte Community CO2e Emissions by Sector



### Crested Butte Government CO2e Emissions by Sector



## Guiding Principles

- Measures should be evaluated by a broad set of parameters, including economic, ecological and social impacts.
- Programs should provide economic and employment opportunities for the residents of Crested Butte.
- Programs, in concert, should meet the carbon reduction goals established by the Energy Action Plan in a cost effective manner based on the criteria of CO<sub>2</sub>e reduction, affordability, energy savings, return on investment and effectiveness.
- Actions should increase reliance on local resources, both human and natural, in order to decrease Crested Butte's dependence on goods, services and energy from outside the Valley.
- Proposed programs should consider community acceptance and appropriateness.
- Programs should have quantifiable impacts and outcomes.
- Programs should leverage partnerships with local stakeholders to accomplish goals.

## Effectiveness

The costs and energy savings of some measures can be used to determine their effectiveness. The effectiveness calculation combines the project cost, energy savings, and CO<sub>2</sub>e reductions into a single metric.

“Effectiveness” is defined as the net program energy savings in the year 2020 divided by the tons of annual CO<sub>2</sub>e reduction in the year 2020.

This method of analysis allows for the comparison of measures and a tool for decision-making. These calculations are estimates and do not represent an actual cost. They are for comparative purposes only.

*Positive effectiveness values represent the dollars saved per ton of CO<sub>2</sub>e reduced. The higher the positive value, the more effective a program is estimated to be. Negative effectiveness values represent the dollars spent per ton of CO<sub>2</sub>e reduced.*

Each program requires further analysis to determine the associated costs and benefits. Effectiveness calculations do not discount future value and assume a constant energy cost per unit.

<b>Cost Effectiveness of Programs</b>	<b>program cost to reach goal</b>	<b>accumulated savings in 2020*</b>	<b>annual CO2e reduction (tons)</b>	<b>effectiveness^</b>	<b>payback (years)</b>
<b>E.1.2</b> 15 additional RTA riders per day	\$63,760	\$52,532	23	\$2,284	5.4
<b>D.3.3</b> Residential Education (1000 homes: reduce electrical 5%, reduce fuel 2%)	\$60,000	\$595,680	494	\$1,206	1.2
<b>B.1.1</b> Basic residential audit and weatherization (800 units)	\$320,000	\$3,118,248	2898	\$1,076	0.9
<b>B.1.3</b> Replace incandescents - >6 per unit/500 units	\$6,000	\$236,413	216.1	\$1,094	0.2
<b>B.1.2</b> Advanced audit and installed systems (300 units)	\$840,000	\$1,585,940	2215	\$716	6.6
<b>B.1.3</b> Rebates for electrical DSM services and appliances (900 units)	\$96,000	\$221,496	335.6	\$660	4.1
<b>D.2.1</b> Educational programming for businesses	\$40,000	\$117,603	179	\$657	3
<b>C.2.1</b> Energy Efficiency of Town Buildings	\$150,000	\$120,309	357	\$337	3.9
<b>G.1.2</b> Install solar hotwater system(100 units)	\$300,000	-\$34,958	236.2	-\$148	11.3
<b>G.1.2</b> Support provision of solar incentives 15 kW PV	\$135,000	-\$101,024	28	-\$3,608	40
<b>Total</b>	\$1,887,000	\$5,912,240	<b>6981.9</b>		
<b>Reduction Goal</b>			8193		

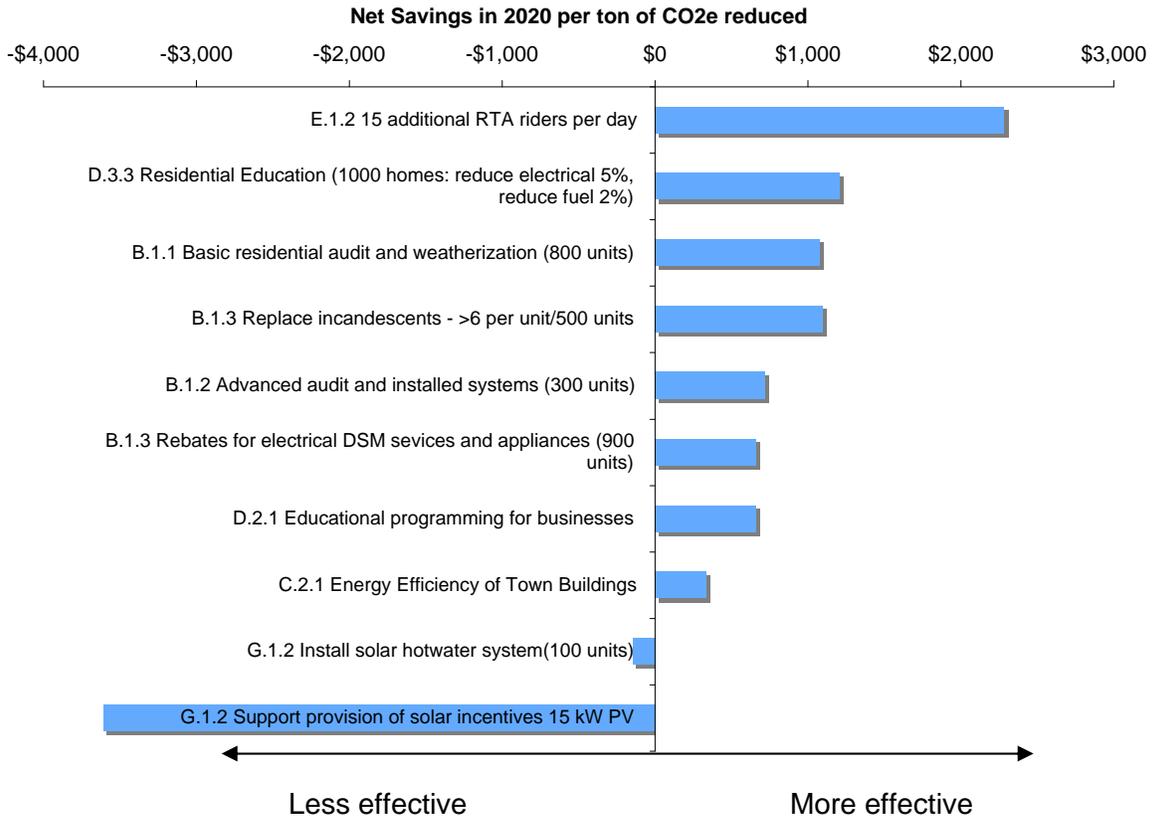
**Table notes:**

Program costs and emissions reductions are estimates. This table is for comparative purposes only.

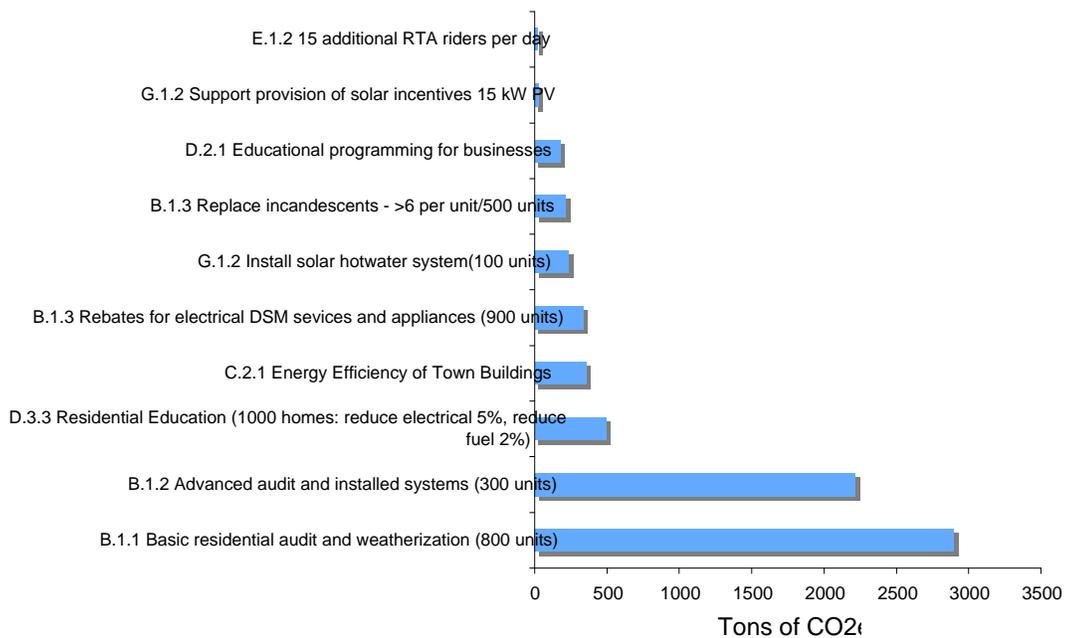
^See "Effectiveness" Section for a description of the "Effectiveness" calculation.

\*Accumulated Savings In 2020 is the difference of the program cost and the accumulated energy savings in 2020 based on immediate adoption.

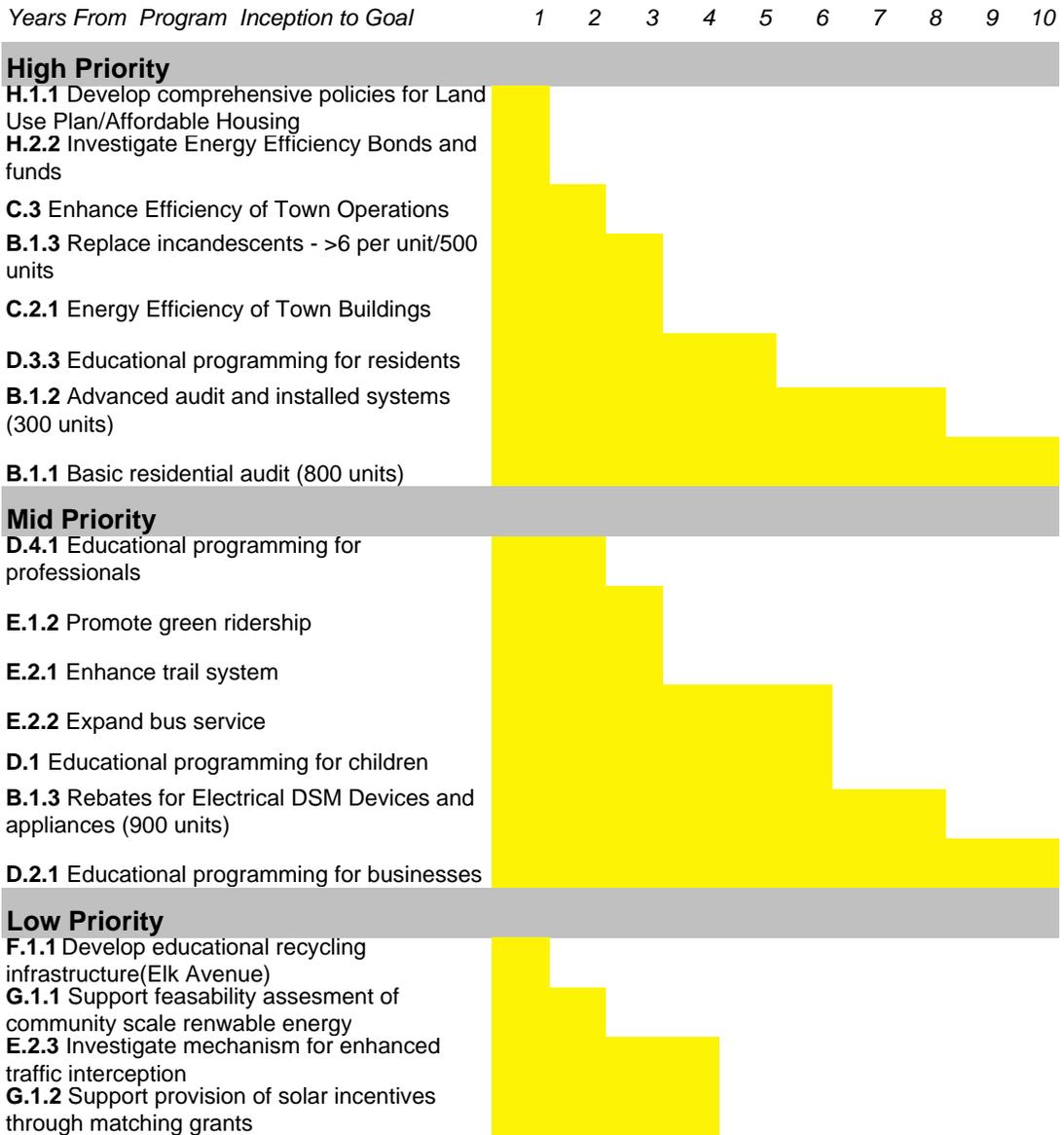
## Effectiveness of Measures



## CO<sub>2</sub>e reduction by Measure



### Measure Priority and Duration



Action items were grouped by priority of implementation based on the “Guiding Principles”, estimated effectiveness and CO2e reduction potential. This table should not prevent the development of programs and polices as opportunities and needs arise.

## **ACTION ITEMS ORGANIZED BY TYPE**

### **A. GENERAL**

OBJECTIVE 0: Develop infrastructure for Implementation of Action Items.

Action 0.1: Establish standing committee for EAP oversight to consist of:

- Councilperson
- Town Staff Member
- ORE Staff Member
- Technical Advisor 1
- Technical Advisor 2

Action 0.2: Establish funding for EAP Implementation Coordinator and initial stages of EAP programs.

### **B. BUILDINGS**

Buildings account for 75.7% of CO<sub>2</sub>e emissions in the town of Crested Butte, residential buildings alone account for 47.1% of CO<sub>2</sub>e emissions. Buildings represent the single biggest opportunity for emissions reductions. Within the sector, existing buildings are particularly important. Because future growth in the Town of Crested Butte is limited by available land, existing buildings will continue to contribute the largest share of emissions.

OBJECTIVE 1: Improved Energy Efficiency and Conservation in Existing Buildings

ACTION 1.1: Develop a program to perform basic audits of residential homes.

The purpose of this initial home visit will be to identify the least cost measures with the maximum return, educate the consumer and realize immediate energy savings through the installation of basic measures such as caulking and weather-stripping.

<b>Measure B.1.1</b>	<b>Basic audit and weatherization of 800 residential units</b>
<b>Status</b>	Some elements existing (e.g. utility rebates); in planning stages
<b>Duration</b>	0-3 yrs
<b>Annual GHG Reduction</b>	2,898 tons
<b>Projected Budget</b>	\$320,000
<b>Effectiveness</b>	\$1,076 per ton
<b>Funding Source</b>	State Energy Program; Insulate Colorado; utility rebates
<b>Agency</b>	ORE, Utilities, Town

*Data from Energy Action Planning Calculation Committee*

**ACTION 1.2: Perform Advanced Audits and Install Measures.**

Develop strong and persuasive incentives for non-income qualified homeowners to invest in energy efficiency upgrades for their homes. The program will include an energy audit conducted by a certified energy professional, documented recommendations and financing options. These programs promote local economic growth and retain financial capital in the community.

<b>Measure B.1.2</b>	<b>Advanced audit and installed measures &lt; \$2,400 for 300 residential units</b>
<b>Status</b>	Some elements existing (e.g. utility rebates); in planning stages
<b>Annual GHG Reduction</b>	2,215 tons
<b>Duration</b>	10 years
<b>Projected Budget</b>	\$840,000
<b>Effectiveness</b>	\$716/ton
<b>Funding Source</b>	State Energy Program; Insulate Colorado; utility rebates
<b>Agency</b>	ORE, Utilities, Town

*Data from Energy Action Planning Calculation Committee*

**ACTION 1.3: Develop programs and partnerships to provide incentives for the purchase and installation of the following items**

- Compact Fluorescent Lighting
- Occupancy sensors
- Programmable thermostats
- Hot water heater blankets
- E-Star dishwashers, clothes washers, fridges, freezers and electric hot water heaters
- Existing building lighting retrofits in residential

<b>Measure B.1.3</b>	<b>300 units per 3 devices Including occupancy sensors, appliances and smart strips</b>
<b>Status</b>	Some elements existing (e.g. utility rebates); in planning stages
<b>Annual GHG Reduction</b>	2,179 tons
<b>Duration</b>	8 years
<b>Projected Budget</b>	\$96,000
<b>Effectiveness</b>	\$660/ton
<b>Funding Source</b>	Utility rebates, State Energy Program
<b>Agency</b>	ORE, Utilities, Town

*Data from Energy Action Planning Calculation Committee*

<b>Measure B.1.3</b>	<b>Replace incandescents: &gt;6 per unit/ 500 units</b>
<b>Status</b>	Some elements existing (e.g. utility rebates); in planning stages
<b>Annual GHG Reduction</b>	216.1 tons
<b>Duration</b>	3 years
<b>Projected Budget</b>	\$6,000
<b>Effectiveness</b>	\$1,094/ton
<b>Funding Source</b>	Utility rebates, State Energy Program
<b>Agency</b>	ORE, Utilities, Town

*Data from Energy Action Planning Calculation Committee*

ACTION 1.4: The Town should investigate a policy requiring owners of long-term residential and commercial rental units to disclose utility bill information to prospective lessees prior to occupancy.

### C. Government Buildings and Operations

Government buildings and operations represent 13% of the Town of Crested Butte’s emissions footprint, 6.5% of which is attributable to the Crested Butte Community School. The Energy Action Plan lays out steps for addressing Government emissions from buildings, transportation, equipment operation and procurement of Government property. Following adoption of the Plan, Staff will develop comprehensive policies for integrating EAP concepts and reduction requirements into existing Town policies and operations.

#### OBJECTIVE 1: Improve Efficiency of Government Buildings and Operations

**ACTION 2.1:** The Town will investigate performance contracting on existing town buildings, including building weatherization, installed devices and mechanical systems.

<b>Measure C.2.1</b>	<b>20% reduction for 100,000 sf @ \$1.50/sf</b>
<b>Status</b>	Unimplemented ESCO plan exists, new plan needed
<b>Annual GHG Reduction</b>	357 tons
<b>Duration</b>	3 years
<b>Projected Budget</b>	\$150,000
<b>Effectiveness</b>	\$337/ton
<b>Funding Source</b>	Performance Contracting, Town budget
<b>Agency</b>	ORE, Utilities, Town

*Data from CAPPA*

#### OBJECTIVE 2: Reduction of carbon based fuel use.

**ACTION 2.1:** The Town will investigate ways to improve the efficiency of fleet vehicles.

#### OBJECTIVE 3: Enhance efficiency of Operations

**ACTION 3.1:** The Town will develop internal polices governing procurement of equipment and materials, specifically, local material sources and employment of high efficiency equipment.

**Action 3.2:** The Town will provide proper instruction for the efficient operation of town property, and the Town will develop policies to encourage the recycling and reuse of equipment and materials.

## D. PUBLIC EDUCATION

Successful Plan implementation requires a high level of public support and participation. Therefore, education programs are a critical first step towards meeting reduction goals. The education program will utilize community resources such as The Town of Crested Butte and ORE websites, The Crested Butte News, The CB Community School, KBUT public radio and public hearings to inform and involve members of the public with the goals, costs and benefits of programs. As programs are developed to implement various aspects of the EAP, companion education and outreach initiatives must also be created to ensure successful programs and emissions reductions.

OBJECTIVE 1: Targeted outreach and education for children.

ACTION 1.1: ORE will collaborate with the School District to develop energy efficiency curriculum and assist in the development outreach events.

ACTION 1.3: ORE will provide children with take home materials and projects to improve energy efficiency at home

OBJECTIVE 2: Targeted outreach and education for businesses.

ACTION 2.1: ORE will continue to promote and expand the Energy Wise Business Program which will provide energy audits and consulting with a annual reduction target of 5% for heating and electricity.

<b>Measure D.2.1</b>	<b>5% fuel and electric reduction for average size business of 2,000 sf, cost per business is \$400. Scale is 10 businesses per year. 100 businesses in 2020</b>
<b>Status</b>	EWB program is operational, requires additional development of metrics
<b>Annual GHG Reduction</b>	179 tons
<b>Duration</b>	10 years
<b>Projected Budget</b>	\$40,000
<b>Effectiveness</b>	\$657/ton
<b>Funding Source</b>	Participant fee
<b>Agency</b>	ORE/Town

Data from CAPPA

OBJECTIVE 3: Targeted outreach and education for residents.

ACTION 3.1: ORE will educate residential consumers on costs and benefits of energy efficiency.

ACTION 3.2: ORE will provide referrals and information regarding the costs and benefits of residential and commercial energy efficiency retrofits.

ACTION 3.3: ORE will work with utilities to create a residential demand side management educational campaign. Programs may include:

- Campaign for energy efficiency including radio, print and digital media
- Competition for energy-savings
- Create a peak energy use awareness campaign
- Efficient living tips
- Create EAP links and data tracking on ORE and other websites

<b>Measure D.3.3</b>	<b>Residential education campaign resulting in 1000 homes reducing electrical consumption by 5% and fuel by 2% at a cost of 60\$/home</b>
<b>Status</b>	Programs in place, require further development
<b>Annual GHG Reduction</b>	494 tons
<b>Duration</b>	5 years
<b>Projected Budget</b>	\$30,000over 10 years
<b>Effectiveness</b>	\$1206/ton
<b>Funding Source</b>	ORE partnership budget
<b>Agency</b>	ORE/Town/Utilities

Data from CAPP

OBJECTIVE 4: Targeted outreach and education for trades people.

ACTION 4.1: ORE will create a program to educate and certify trades people. ORE will develop this program as a multi-jurisdictional resource.

OBJECTIVE 5: Promote renewable systems through workshops and media outreach.

ACTION 2.1: ORE will continue to develop training workshops and public information to promote PV and Solar Hot Water systems.

ACTION 2.3: ORE will continue to promote GCEA renewable energy programs.

## E. TRANSPORTATION

This sector is the most multi-jurisdictional in nature. Transportation infrastructure throughout the Gunnison Valley is owned and maintained by a number of stakeholders including CDOT, the GVRTA, The City of Gunnison, The Towns of Crested Butte and Mt. Crested Butte and Gunnison County. This situation requires that all entities work collaboratively to meet the reduction goals for this sector. To the extent that it is able, The Town of Crested Butte will work to reduce its transportation footprint through the measures listed below. However, the main focus of implementation in this area must be on collaboration with the other involved entities.

### OBJECTIVE 1: Manage Local Transportation Demand

**ACTION 1.1** ORE will collaborate with transportation stakeholders to promote awareness about green transportation

- Newspaper features (e.g. Bus Rider of the Week)
- Monthly “No Drive Day”
- Further publicize RTA and schedule
- Create Tourist/Citizen Hospitality Packet
- Promote school bus riding/discourage drop-offs
- Assist Mountain Express to address energy efficiency and service.

**ACTION 1.2:** The Town will collaborate with the Gunnison County Housing Authority to create affordable housing and reduce commuter vehicle miles traveled.

<i>Measure E.1.2</i>	<i>Transportation Demand Management</i>
	<b>15 additional RTA riders per day @ \$2.30/rider for 5 years</b>
<b>Status</b>	Transportation Plan in place, public transit in place
<b>Annual GHG Reduction</b>	23 tons
<b>Duration</b>	3 years
<b>Projected Budget</b>	\$63,760
<b>Effectiveness</b>	\$2,284
<b>Funding Source</b>	RTA, Town
<b>Agency</b>	ORE, Town, RTA, Mt. Express

**OBJECTIVE 2:** Create a Valley-wide Internet Carpooling Database with The City and County of Gunnison

### OBJECTIVE 3: Enhance Alternative Transportation Infrastructure

ACTION 2.1: The Town and County will collaborate to create continuous trail systems to Town limits.

ACTION 2.2: Expand bus service in range/frequency

ACTION 2.3: The Town will investigate mechanisms to intercept traffic outside of town limits.

## F. WASTE OBJECTIVES

Spreading awareness about our local composting and recycling programs can lead to positive behavioral changes that reduce waste and subsequent carbon emissions. Waste is responsible for 4,878 tons of CO<sub>2</sub>e emissions annually, or 11.9% of the total community footprint. Because the foundation of a comprehensive waste management system exists in the valley, the primary challenge is to encourage participation of residents and business through education and improved access.

### OBJECTIVE 1: Reduce residential and business waste

**ACTION 1.1:** Further develop recycling infrastructure for improved waste management. Programs may include the following actions:

- Place recycling bins on Elk Ave.
- In-Room recycling in area lodging
- Create a Visitor's Guide for recycling
- Promote CFL and battery recycling/ and drop center

**ACTION 1.2:** Create a Town-wide food waste composting program:

- Create a voluntary composting program with a nominal pick-up fee
- Purchase a commercial food pulper for the processing of solid food waste
- Develop a program to sell high-quality compost to regional agricultural producers, with the money funding the continuation of the compost program

## G. ENERGY GENERATION OBJECTIVES

Locally produced energy can significantly reduce the Town’s emissions and lead the Town towards energy independence. Energy production efforts are high-profile endeavors, requiring more space, capital and labor than most other programs outlined in the EAP. Consequently, energy production goals are longer-term than some of the less capital-intensive programs.

However, there are a number of State and Federal programs that have made the development of local, renewable energy sources financially feasible, such as performance contracting and developer financing. The Town will pursue these opportunities with the objective of creating local power production capacity.

OBJECTIVE 1: Support use of renewable energy systems.

ACTION 1.2: ORE and Town will work with utilities to develop programs that provide financial incentives for residential scale PV and solar thermal systems.

<b>Measure G.1.2</b>	<b>Install residential Solar Thermal Systems (100 units)</b>
<b>Status</b>	Experience administering GEO matching grants
<b>Annual GHG Reduction</b>	236 tons
<b>Duration</b>	4 years
<b>Projected Budget</b>	\$300,000
<b>Effectiveness</b>	\$-148
<b>Funding Source</b>	Matching GEO grants
<b>Agency</b>	ORE, Town, GEO

<b>Measure G.1.2</b>	<b>Install 15 kW of PV</b>
<b>Status</b>	Experience administering GEO matching grants
<b>Annual GHG Reduction</b>	28 tons
<b>Duration</b>	2 years
<b>Projected Budget</b>	\$135,000
<b>Effectiveness</b>	\$-3,608
<b>Funding Source</b>	RTA, Town
<b>Agency</b>	ORE, Town, GEO

OBJECTIVE 2: Develop community scale renewable energy systems.

ACTION 1.1: The Town and its partners will explore the feasibility of large-scale renewable energy systems.

The following technologies have been identified as potential energy sources worth further investigation.

- Centralized PV Solar installation
- Micro-hydro
- Combined heat and power (CHP) systems that produce heat and electricity from a single fuel source.
- Methane harvesting at wastewater treatment plant
- Woody Biomass energy production

## **H. POLICY AND FINANCE OBJECTIVES**

Throughout the implementation process, Town Staff and ORE will collaborate to develop policy documents designed to further the implementation process and refine the goals and methods of the Energy Action Plan. Stakeholders will also pursue all applicable funding sources with the goal of developing sustainable revenue streams to fund EAP programs. By developing policy and funding sources, the stakeholders will ensure the continued strength and success of the Energy Action Plan.

**OBJECTIVE 1:** Develop policies pertaining to new development and energy consumption.

Action 1.1: Develop comprehensive polices for inclusion in the Town of Crested Butte Land Use Plan.

**OBJECTIVE 2:** Energy Efficiency Funding

**ACTION 2.1:** Investigate opportunities to establish a revolving loan fund for energy efficiency measures.

**ACTION 2.2:** Investigate Issuance of voter approved county-wide Energy Efficiency Bond measure.

## APPENDICES

### A. The cost effectiveness of common building related energy efficiency measures.

Action Step No.	Action Step	Target Number of Units by 2020	Est. Cost of Action per Unit	Total Cost of Action 2010 to 2020	Est. Annual Tons CO <sub>2E</sub> Reduction per Unit	Est. Annual Total Tons CO <sub>2E</sub> Reduction 2020 On	Est. Annual Savings from Action per Unit	Est. Simple Payback Period per unit (Yrs)	Est. 10-Year Total (Cost)/Savings	Est. "Up-Front" Cost per Ton CO <sub>2E</sub> Reduced	Effective ness= net savings/t ons CO <sub>2E</sub>
<b>WEATHERIZING HOMES</b>											
	Reducing air transfer (caulking, weatherstrip)	300	\$400	\$120,000	3.6	1,087.1	\$430	0.9	\$3,900	\$110	\$1,076
	Insulating crawlspace, attic, + R-10	300	\$1,200	\$360,000	2.0	608.9	\$241	5.0	\$1,209	\$591	\$595
	Insulating walls	300	\$1,200	\$360,000	1.7	519.8	\$203	5.9	\$827	\$693	\$477
	Installing insulated windowshades	300	\$2,000	\$600,000	1.1	323.6	\$128	15.6	-\$720	\$1,854	-\$667
	Installing energy efficient windows	50	\$10,000	\$500,000	0.5	26.5	\$63	159	-\$9,372	\$18,884	-\$17,698
<b>WEATHERIZING COMMERCIAL</b>											
	Reducing air transfer (caulking, weatherstrip)	30	\$500	\$15,000	7.7	229.7	\$896	0.6	\$8,457	\$65	\$1,104
	Insulating crawlspace, attic, + R-10	25	\$4,800	\$120,000	18.1	452.8	\$1,059	4.5	\$5,793	\$265	\$320
	Insulating walls	10	\$2,400	\$24,000	1.7	17.3	\$203	11.8	-\$373	\$1,385	-\$215
	Installing insulated windowshades	15	\$1,440	\$21,600	0.6	9.2	\$72	20.0	-\$720	\$2,340	-\$1,170
	Installing energy efficient windows	5	\$12,384	\$61,920	0.6	3.1	\$35	350	-\$12,031	\$20,300	-\$19,721
<b>ELECTRIC USE REDUCTION</b>											
	Replace incandescents - >6 per unit	500	\$12	\$6,000	0.4	216.1	\$48	0.2	\$473	\$28	\$1,094
	Install motion-sensors, power strips, etc. - >4	300	\$70	\$21,000	0.7	204.9	\$77	0.9	\$696	\$102	\$1,019
	Install E-Star refrigerator in home	300	\$150	\$45,000	0.3	93.2	\$35	4.3	\$199	\$483	\$639
	Install E-Star washer/dryer in home	300	\$100	\$30,000	0.1	37.5	\$14	7.1	\$40	\$800	\$322
	aggregate	\$900	\$320	\$96,000	1.1		\$126	4.1	\$935	#DIV/0!	\$836
<b>HOT WATER HEATING ENERGY</b>											
	Install E-Star hot water heater	100	\$550	\$55,000	0.3	29.2	\$33	16.8	-\$222	\$1,881	-\$759
	Install solar hot water system	100	\$3,000	\$300,000	2.4	236.2	\$265	11.3	-\$350	\$1,270	-\$148

#### Table Notes:

Cost effectiveness is the net savings in the year 2020 divided by the estimated annual tons of CO<sub>2E</sub> reduced in the year 2020 and on.

## B. Funding

The following is a list of potential funding sources and should be assessed for regulatory appropriateness. This is not a prioritized list.

- Selling emissions reductions: An emission reduction (ER) is a quantifiable amount of greenhouse gas that is not emitted into the atmosphere due to the application of a reduction measure; credit for this reduction may be sold in carbon markets.
- Impact fees and REMP expansion
- Self imposed fee on new annexations and subdivisions
- A voluntary 1% donation
- Private sector (i.e. contracting for services)
- Performance contracting for tax-exempt facilities
- Individual investments paid back with energy savings from local, state and federal tax credits and rebates.
- Grants from the Federal government, the Colorado Governors Energy Office, the Rocky Mountain Climate Organization, foundations and other entities.
- Fines for non-compliance
- Instituting a carbon tax or other tax instituted through vote

## C. Definitions

ATMOS	Local natural gas utility
CAPPA	Software created by ICLEI to calculate carbon reduction
CBCS	Crested Butte Community School
CDOT	Colorado Department of Transportation
CFL	Compact fluorescent light bulb
CO <sub>2</sub> e	carbon dioxide equivalent: a combination of all green house gases
DSM	Demand Side Management
EAP	Energy Action Plan
ESCO	Energy Services Company
GCEA	Gunnison County Electric Association
GEO	Governors Energy Office
GHG	Greenhouse Gas: Gaseous byproducts of human activity contributing to climate change
GVRTA	Gunnison Valley Rural Transportation Authority
ICLEI	ICLEI-Local Governments for Sustainability
Mt. Express	Local transportation service
ORE	Office for Resource Efficiency
PV	Photovoltaic
RE1J	Gunnison Watershed School District
UGRW	Upper Gunnison River Watershed

## **Crested Butte Emissions Inventory**

*Excerpted verbatim from the Upper Gunnison River Watershed Emissions Inventory*

Crested Butte had its origins in the 1880s, first as a supply center for the gold-silver boom in the Elk Mountains, then as a coal-mining town; coal was the town's sustaining industry until the early 1950s when rising labor and transportation costs resulted in the closing of all the mines and the dismantling of the Denver & Rio Grande Railroad tracks. Hardrock mining in Mt. Emmons and the beginning of a summer tourism economy sustained the town through the 1950s; then in 1961 a ski area opened on Crested Butte Mountain that has since become the cornerstone of a year-round destination resort economy.

From an energy-efficiency perspective, Crested Butte has some challenges. The town sits in a valley prone to both heavy snowfall and winter inversions. Many of the buildings in town date back to the late 1800s or early 1900s, predating not just the age of energy awareness but also the advent of home insulation. The layout of the narrow north-south lots in the older part of town is not conducive to utilizing solar gain, and the town's status as a Historical District limits the ability of both homeowners and businesses in that district to easily address energy issues, although there are some exemplary energy-efficient homes in the town.

***Emissions Inventory Boundary:*** The Emissions Inventory Boundary for the Town of Crested Butte is the town boundary (*see map below*). This does not include the numerous "suburban" developments south of the Town – Skyland, Riverbend, Riverland, Crested Butte South and other smaller developments – which are closely affiliated with the Town; they are part of the Unincorporated Gunnison County inventory.

## **Inventory Results**

The amount of greenhouse gas emissions in or attributable to the Town of Crested Butte totaled 40,970 tons CO<sub>2e</sub> in the baseline year of 2005 (*see Table 9*). Of that total the Crested Butte government is responsible for 5,697 tons of CO<sub>2e</sub> (*see Table 10*). Nearly all of the emissions are carbon dioxide emitted to the atmosphere from the combustion of fossil fuels (coal, liquid fuel, and natural gas), with a very small percentage coming from methane as decomposition of waste in the landfill and nitrous oxide as fertilizer. This total reflects millions of small and routine acts of energy use such as watching TV or driving to the post office.

## Community Emissions

Community emissions for the Town are broken down by five major sources: Residential Buildings, Commercial Buildings, Transportation, Waste, and Other.

**Table 9: Crested Butte's Community CO<sub>2</sub>e Emissions 2005**

Source of CO <sub>2</sub> e	Tons CO <sub>2</sub> e	Percent of C B Total CO <sub>2</sub> e	Percent of UGRW Total CO <sub>2</sub> e	CB Emissions per capita <sup>1</sup>
<b>Residential Buildings</b>				
- Electricity	12,243	29.9	2.4	
- Non-renewable Carbon Fuels	7,042	17.2	1.4	
<b>Total for Res. Buildings</b>	<b>19,285</b>	<b>47.1</b>	<b>3.8</b>	<b>12.5 T</b>
<b>Commercial Buildings</b>				
- Electricity	7,408	18.1	1.5	
- Carbon-based Fuels	4,316	10.5	0.8	
<b>Total for Commercial Bldgs.<sup>2</sup></b>	<b>11,724</b>	<b>28.6</b>	<b>2.3</b>	<b>7.6 T</b>
<b>Total for all Buildings</b>	<b>31,009</b>	<b>75.7</b>	<b>6.1</b>	<b>20.1 T</b>
<b>Transportation<sup>3</sup></b>				
- Gasoline	4,647	11.3		
- Diesel	426	1.0		
<b>Transportation Total</b>	<b>5,073</b>	<b>12.4</b>	<b>1.0</b>	<b>3.3 T</b>
<b>Waste (Landfill)</b>				
- Paper Products	3,449	8.4		
- Food Waste	571	1.4		
- Plants	452	1.1		
- Wood, Textiles, etc.	406	1.0		
<b>Waste Total</b>	<b>4,878</b>	<b>11.9</b>	<b>0.9</b>	<b>3.2 T</b>
<b>Other</b>	<b>4</b>	<b>&lt;0.1</b>	<b>&lt;0.1</b>	<b>&lt;0.1 T</b>
<b>Total</b>	<b>40,964</b>	<b>100</b>	<b>8.0</b>	<b>26.6 T</b>

**TABLE NOTES:**

1 – The per capita statistics should be considered in appropriate context; they do not take into account shared residences, vehicles, etc. It is intuitively obvious, for example, that a family of four people living together in a single-family residence will have lower per capita emissions than a couple living in a similar single-family house – but that family would also have higher per capita emissions than a family of four living in an apartment building with comparable construction features.

“Emissions per building” or “emissions per vehicle” are more useful for Watershed residents interested in contemplating and measuring reduction progress. In 2005, according to Crested Butte's Planning Office, the town had 1,009 residential units, 726 of which were occupied, according to the Colorado Department of Local Affairs; the average CO<sub>2</sub>e emissions for the occupied units would thus be somewhere between 19.1 and 26.3 tons CO<sub>2</sub>e per residential unit, depending on the amount of time the usually vacant units were used.

- 2 – The “Commercial Buildings” total contains the emissions from the Crested Butte Community School, almost 10% of the “Buildings” total. The school emissions are compiled more specifically in the “Government and Public Sector” report that follows.
- 3 -Crested Butte’s per capita transportation figures are well below those for the aggregate Upper Gunnison Watershed’s. But it is necessary to remember that many of the transportation miles within the Upper Gunnison Watershed represent people commuting from other communities to Crested Butte and vice versa, to work and play.

General Note: Some may question the absence of an “Industrial” category for Crested Butte and Mt. Crested Butte, pointing to the “resort industry” and the “construction industry.” These are not, however, “industries” in the sense of that category in the ICLEI or IPCC guidelines. The “resort industry” is primarily a large set of commercial enterprises; even the electricity for the ski resort constitutes only about one percent of the UGRW electricity use. The construction industry is a labor-and-materials-intensive industry, and a large part of the cost of materials is for transportation from other places to the watershed, but those difficult-to-calculate costs are not included in this inventory. The in situ consumption of energy in construction work is mostly “muscle power,” with relatively modest consumptions of electricity or other carbon-based fuels.

## Government Emissions

Crested Butte’s public sector accounts for 5,697 Tons CO<sub>2</sub>e, or 13.9 percent of the Town’s total emissions. See Table 10 on next page.) As noted in the “Methodology” section, the “Government” inventory is somewhat more detailed and specific, much of it based on departmental records and actual energy bills.

**Table 10: Summary of Crested Butte’s Government CO<sub>2</sub>e Emissions 2005**

Source of CO <sub>2</sub> e	Tons CO <sub>2</sub> e	Percent of CB Govt. total	Percent of CB Comm. total
<b>Buildings &amp; Facilities<sup>1</sup></b> (school exclu.)			
- Electricity	494	8.7	
- Non-renewable Carbon-based Fuels	334	5.8	
<b>Buildings &amp; Facilities Total</b>	<b>828</b>	<b>14.5</b>	<b>2.0</b>
<b>C. B. Community School<sup>2</sup></b>			
- Electricity	2,298	40.3	
- Non-renewable Carbon-based Fuels	738	13.0	
<b>School Total</b>	<b>3,036</b>	<b>53.3</b>	<b>7.4</b>
<b>Operations</b> (Water, Sewer, Streetlights <sup>3</sup> )			
- Electricity	1,012	17.7	
- Carbon-based Fuels	95	1.7	
<b>Operations Total</b>	<b>1,107</b>	<b>19.4</b>	<b>2.7</b>
<b>Buildings, Facilities, Operations Total</b>	<b>4,971</b>	<b>87.3</b>	<b>12.1</b>
<b>Government Transportation<sup>4</sup></b>			
- Gasoline	126		
- Diesel	79		
- Biodiesel	30		
<b>Total Government Transportation</b>	<b>235</b>	<b>4.1</b>	<b>0.6</b>
<b>Public Transportation<sup>5</sup></b> (Mountain Express and School Buses)			
- Gasoline	73		
- Diesel	333		
- Biodiesel	49		
<b>Total Public Transportation</b>	<b>455</b>	<b>8.0</b>	<b>1.1</b>
<b>Total Transportation</b>	<b>690</b>	<b>12.1</b>	<b>1.7</b>
<b>Waste</b> (Food, Paper, Plants, Wood)	<b>32</b>	<b>0.6</b>	<b>&lt;0.1</b>
<b>Other</b>	<b>4</b>	<b>&lt;0.1</b>	<b>&lt;0.1</b>
<b>Total</b>	<b>5,697</b>	<b>100</b>	<b>13.9</b>

**TABLE NOTES:**

1 – “Buildings and Facilities” includes all town parks as well as all the town buildings, and non-governmental public facilities like the Crested Butte Center for the Arts, the Mallardi Cabaret Theatre above the Old City Hall, and KBUT-FM which shares the Marshal’s office building. “Operations” includes the Town’s water system, sewer system and streetlights.

2 – There has been discussion about where “Public Schools” should be included in this inventory, since the school within the Crested Butte town boundary serves county

residents from a much larger area. The schools are operated through a valley-wide school district, but they emit their CO<sub>2</sub>e as public facilities within the boundaries of the individual communities, so are being counted there, but are separated out from other local government buildings.

- 3 – All streetlights are paid for by Gunnison County Electric Association; decorative and seasonal lights are paid for by the Town.
- 4 – Government transportation or „fleet“ emissions are different from the community transportation emissions in that the miles a fleet vehicle is driven accrue to the Town of Crested Butte no matter where the vehicle is driven. For instance, if an administrative vehicle is driven to Gunnison for a meeting, all of the emissions are assessed to the Crested Butte government. This does create a minor disconnect in the emissions data, since those miles accrue to the Unincorporated Area in the “Community” inventories.
- 5 – Fuel emissions from the Mountain Express, the upper Watershed’s public transportation system, have been separated from the other government fleet transportation figures, since this service is funded by the two upper Watershed towns.