City of Boulder

2013 City of Boulder Energy Programs: Options and Conclusions

July 17, 2012

brendle GROUP
Engineering Sustainable Change

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Executive Summary

The City of Boulder offers a variety of programs and services related to energy, transportation, and waste to residents and businesses to reduce greenhouse gas (GHG) emissions. The largest source of GHG emissions (out of those currently accounted for in the Boulder community) is energy, and predominantly, electricity. Since 2007, energy efficiency and conservation efforts have been funded by a Climate Action Plan (CAP) tax levied on electricity use. With the tax set to expire in March 2013, the Brendle Group has been charged with analyzing the effectiveness of current programs funded by the CAP tax and identifying more expansive program packages that could move the community closer to its GHG emissions reduction goals. This analysis includes existing and potential demand-side management (DSM) programs by considering their performance, cost-effectiveness, and ability to increase Boulder's direct control while reducing reliance on external energy sources.

The consultant team's key findings emerged from evaluating program gaps, consulting with city staff and community stakeholders to identify new programs and current program enhancements, and looking at the performance of individual programs relative to their cumulative impacts. These key findings indicate that the city should extend the CAP tax beyond 2012 and focus on the following actions:

- Leverage lessons learned from previous and existing programs
- Consolidate existing commercial programs as a cornerstone of CAP spending
- Retain existing residential programs
- Include both mandatory and voluntary approaches
- Integrate renewables
- Allocate significant CAP funding to market innovation mechanisms

Furthermore, the city should integrate program management, including planning, tracking, measurement and verification, and program evolution to maximize cost efficiency, cohesion, and flexibility as programs continue to evolve and to encourage greater market innovation. This integrated management would leverage the city's approach to continuous improvement such that all programs are refined and optimized and market innovations are regularly incorporated.

The program analysis to complement these key findings began with more than 80 initial ideas that were consolidated and prioritized based on criteria relative to GHG emissions, funding, private savings, and market innovation. Ultimately, the list of programs was consolidated to 15.

The analysis process continued with a program evaluation matrix that evaluates each of the 15 core programs on a stand-alone basis. Specifically, the program matrix categorizes programs by sector, estimated impacts, cost effectiveness, and private investment. To help prioritize and optimize the programs in the matrix, five additional evaluation criteria were developed and applied to each:

- Efficiency – biggest bang for the buck
- Effectiveness – magnitude and relevance
- Equity – who pays and who benefits
- Externalities – co-benefits
- Certainty – confidence in performance outcomes

On the basis of the program matrix and analysis of these programs relative to the city's GHG reduction goals and funding constraints, the consultant team developed a number of investment packages. These packages represent the estimated cumulative effect of evaluated programs and integrate them in such a way that they maximize progress toward the city's GHG goals while striving to be within the current estimated annual CAP funding level of $1.8 million. Six specific investment packages were developed for consideration:

1. High GHG reductions (combination of programs that achieves the highest reduction)
2. Residential focus (combination of residential-only programs with highest efficiency and effectiveness criteria)
3. Commercial focus (combination of commercial-only programs with highest efficiency and effectiveness criteria)
4. Multiple benefits (a combination of actions with the highest combined ranking of all evaluation criteria, referenced above)
5. Solar focus (a solar photovoltaic-only package)
6. Renewable energy credit (REC) focus (a REC-only package)

While there is value to each of the six packages, none addressed all of the key findings. As a result, a seventh investment package was developed that combines existing and new programs in a way that reinforces the key findings and achieves balance with the $1.8 million budget. This selected package includes both mandatory and voluntary programs, renewables, and triggers for innovation, while supporting continuous improvement and associated program performance. This selected package is represented in the table below:

Program	Average Annual CAP Funding	Year 10 Snapshot[1] GHGs Avoided ($mtCO_2e$)
Commercial Energy Efficiency Program: Ordinance Development, EnergySmart Enhancements/ Campaigns, 10 for Change	$985,000	146,780
Residential EnergySmart Enhancements and Campaigns	$230,000	1,387
Residential SmartRegs	$85,000	9,620
Open RFP for GHG Emission Reductions	$285,000	50,000
Program Performance and Continuous Improvement	$195,000	0
Total	**$1,780,000**	**207,787**

[1] Snapshot equals the annual emissions reduced in year 10, not the cumulative reduction by year 10.

1.0 Key Findings

This report and its appendices describe in detail the background for and process of evaluating existing and new programs and developing investment packages that maximize the Boulder community's progress to GHG reduction goals within CAP tax funding constraints. The key findings are described below:

- Integrate program management (including planning, tracking, measurement and verification, and program evolution) to maximize flexibility and efficiency, and create cohesion among the suite of programs; include dedicated funding to ensure program performance and continuous improvement (e.g., staffing commensurate to required program performance) to successfully leverage lessons learned from previous and current programs.
- Create a mix of mandatory and voluntary approaches where mandatory programs take advantage of program maturity and lessons learned, and voluntary programs encourage market innovation.
- Include renewable energy generation aspects in both residential and commercial programs.
- Ensure that commercial energy efficiency programs serve as the cornerstone of spending as these programs have the strongest performance for both cost effectiveness and carbon savings.
- Continue to include residential programs as a critical component since the residential sector contributes strongly to CAP tax funding.
- Dedicate a significant portion of CAP tax funding to flexible market innovation mechanisms.

The evaluation criteria, detailed later in this report and employed in development and analysis, address many of the notable motivations for these key findings – including efficiency, cost effectiveness, program maturity, spending and impact equity, visibility, and innovation. In addition, the key findings are based on feedback from city staff as well as community stakeholders.

2.0 City Background

Since 2007, the City of Boulder has been progressively implementing a CAP to lower GHG emissions in line with the Kyoto Protocol goals by 2012. The city currently offers programs and services to reduce electricity use in commercial and residential buildings, implement energy-efficient building standards and codes, incentivize local renewable energy projects, and optimize alternative transportation options. Many of these programs have been funded by the voter-approved CAP tax, which is levied on electricity use. In 2011, the CAP tax produced $1.8 million, which is the funding threshold used throughout this analysis[2]. Although Boulder does not anticipate meeting the Kyoto goal in 2012, it now possesses data related to the costs and effectiveness of each individual program as they have evolved. Analyzing these data will help the city strategically improve DSM programs and draw closer to its goals.

An initial step in this process is developing a multi-part Energy Action Plan (EAP) that will help achieve climate action goals while moving the Boulder community toward greater energy independence and cleaner energy sources. Reducing energy-related GHG emissions is vitally important because electricity contributes approximately 60 percent, and natural gas, 17 percent, of what the city currently counts.[3] This report informs part 1 of the EAP and will serve as the foundation for parts 2 and 3 of the EAP. The consultant team's analysis explores the cost and impact of existing and new DSM programs to inform city staff's recommendation to council about whether or not to continue, expand, or shift the focus of the current CAP tax, if it is extended.

A historic review of the CAP program was completed by Rocky Mountain Institute (RMI) in parallel with the development of this report (*City of Boulder Climate Action Plan Analysis Report, RMI* 2012). RMI's work complemented this report and generated the following findings, which informed this report's analysis:

- Within the current portfolio of CAP programs, those above average in cost effectiveness include residential lighting programs, Commercial and Residential EnergySmart, and 10 for Change.
- Boulder has generated significant carbon savings at reasonable cost. Compared to other municipal programs in Connecticut and Oregon, Boulder's lighting programs are slightly less cost effective, Residential EnergySmart is considerably less cost effective, Commercial EnergySmart is similarly cost effective, and renewables are far more cost effective.
- Commercial and Residential EnergySmart are still maturing as programs and can be expected to improve over time. A sensitivity analysis of the likely future of these programs predicts improved cost effectiveness, which would make Boulder's programs significantly more cost effective than other, more mature municipal programs.

[2] Reducing electricity consumption will reduce CAP tax funding.
[3] Based on the 2010 GHG inventory. More information is available at http://www.bouldercolorado.gov/index.php?option=com_content&view=article&id=15356&Itemid=2150.

- Ongoing programs should continue to be comprehensive (such as the existing Commercial and Residential EnergySmart) and become increasingly coordinated across sectors (i.e., recognizing interrelationships between emissions reductions from energy efficiency, renewable energy systems, and transportation technologies).
- Boulder must push beyond the simple and easy programs and encourage residents and businesses to think longer term about their buildings, investment choices, and energy use.
- The City of Boulder needs to extend an overarching demand side program (which considers interactions with the supply mix) to hit future emissions reductions targets.

As shown in Figure 1, the consultant team's analysis was based on an iterative process in which they evaluated gaps in existing programs, consulted with city staff and community stakeholders to collect ideas for new programs and existing program enhancements, and analyzed programs for individual performance and cumulative impacts. These efforts helped to prioritize programs and provide recommendations.

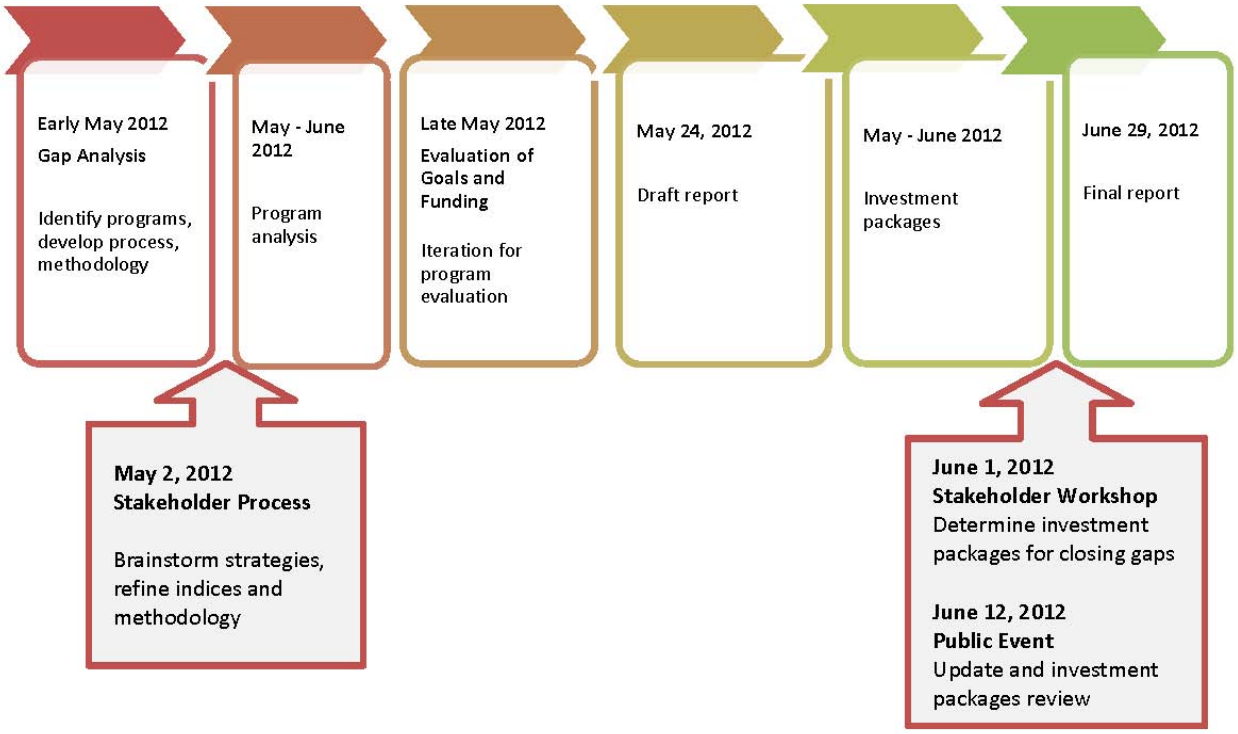


Figure 1: Analysis Process Diagram

2.1 Data Sources

This analysis relied on the following data sources:

- Materials from the Rocky Mountain Institute report, the January 2012 City Council packet, and annual reports for the CAP
- Deemed or actual kilowatt hours (kWh) and therms avoided by previous and current energy efficiency measures, programs, and policies
- Actual or approximate generation and/or capacity from local renewable energy resources, including hydroelectric plants and solar photovoltaic systems
- Program participation data and, where available, point of enrollment and audit-to-action results
- Actual or approximate program expenditures, including tax funds, grant funds, and staffing (both CAP tax and non-CAP tax funded)
- Estimates of private investment associated with programs or policies
- The city's GHG inventory management system (IMS) spreadsheets
- Data on participation by Boulder residents and businesses in utility energy efficiency rebate programs
- Localization report and results from peer review analysis
- Comparison of the effectiveness of Boulder's existing demand-side and supply-side programs to other municipal or utility programs from a consultant report
- Assessment of the cumulative impact of energy/GHG savings and expenditures for each CAP tax funded program and limited CAP-affiliated program assessed over the life of the program
- Analysis of cost-effectiveness for each program presented in levelized cost and considering varying levels of CAP tax funding and program funding

2.2 Input and Stakeholder Engagement

The consultant team worked with city staff and other key stakeholders throughout the development of this analysis, including a May 2, 2012 workshop to review the evaluation approach and solicit beginning ideas for program development. The team then met with city staff again on June 1 to review draft results. City staff also conducted a public event the evening of June 13 to solicit input and review draft investment packages.

3.0 Process

The first step in evaluating programs was to brainstorm a consolidated list of over 80 ideas (full list provided in Appendix A) through input from city staff, community stakeholders, previous reports, best practices from other organizations, and other sources. This initial list was based on exploring ideas in the following areas:

- Continuation and/or modification of current CAP-funded DSM programs
- DSM offerings not currently provided by the City of Boulder
- Potential near-term local generation options that can be offered under the current regulatory framework
- Other innovative approaches to avoid emissions, reduce energy load, or lower the carbon intensity of the fuel supply
- Other innovative approaches to reduce peak electrical load by shifting or removing demand that results in reduced GHG emissions
- Other innovative uses of tax revenue that result in reduced emissions

In addition, the consultant team conducted a gap analysis to identify programs that could continue and possibly be enhanced, and potential programs not currently offered that would improve effectiveness in reducing local GHG emissions. The analysis was organized by sectors and the existing CAP categories of Reduce Use, Build Better, and Ramp Up Renewables. It broadly included comparisons of emissions, cost effectiveness, and existing programs. Result highlights included the following:

- Reduce Use for residential and commercial/industrial represents the largest percentage of emissions compared to these sectors for Build Better and Ramp Up Renewables combined.
- Reduce Use and Ramp Up Renewables have the most existing and potential programs, while Build Better has the least.
- In terms of existing program counts, coverage for residential and a combined sector of commercial/industrial cover is similar.
- Demand response is a far less frequently addressed topic area for both sectors compared to efficiency/conservation and local generation.

Using information gathered from the gap analysis, combining like ideas and action steps into programs, and querying city staff for priority areas, the list was narrowed down to 15 programs representing the top priorities for quantitative and qualitative analysis. Some of these 15 programs were enhancements to existing programs and some are new.

A program matrix was then used to evaluate individual existing and potential programs (independent of one another) in the following focus areas:

- Estimated GHG emissions avoided, in metric tons of carbon dioxide equivalent (CO_2e)
- CAP tax funding dollars
- CAP tax funding dollars per metric ton CO_2e
- Private savings for participants from program implementation

Based on the results collected in the program matrix, a second analysis was completed to evaluate the cumulative effect of evaluated programs with respect to funding, GHG reduction goals, and the potential for overlap and double counting among programs. More detail is provided in Section 4.0.

3.1 Program Evaluation

For the quantitative and qualitative analysis of the 15 priority programs, the overall planning horizon for each program was based on 10 years to align with the possible timing of the CAP tax extension as well as future EAP phases. Detailed in Appendix B, each priority program evaluation included the applicable following components:

- A description of the program
- Categorization of each program by sector
- Key working assumptions such as penetration rates, timelines, and associated funding levels necessary to achieve maximum GHG emissions reductions
- Estimated impacts, including avoided GHG emissions, number of participants, cost-effectiveness, and related community benefits
- Methods of incentivizing private investment

Cost development, including costs associated with staffing levels, was a key step in evaluating each program. The total costs considered were intended to be comprehensive, ranging from applicable capital equipment costs to applicable programmatic costs (city staffing, training, data management, etc.). Where appropriate based on program descriptions, costs did vary over time to reflect program maturity, staff experience, and continuous improvement practices. To reinforce previous CAP review findings regarding the importance of staff resources to leverage CAP dollars, dedicated staffing costs were included in programs that were interpreted to require it (either through current funding levels that include staffing or through estimated costs of new positions). Previewing results detailed later in this report, many programs maintained current staffing levels and associated costs. For programs with new staffing requirements, the most common funding level was for either one-half or one full-time equivalent (FTE) position.

The program evaluation process also took into consideration the following as applicable:

- Appropriate regulations, including how regulatory processes could enhance the efficiency/effectiveness of the program and how regulations can be balanced and integrated with incentives and voluntary compliance
- Access to financing, if any, and what approaches can be used
- To what extent the programs can be made self-supporting versus being dependent on the tax extension remaining in place
- Effective educational means ("develop informed energy consumers")
- Community partnerships
- Other recommended metrics based on experience and consultation with staff

Ultimately to help summarize all the quantitative and qualitative analysis information, five evaluation criteria were developed and applied to each program to aid in prioritizing, determining the appropriate design and implementation, and predicting the uncertainty or resiliency of the overall mix of programs. These evaluation criteria, listed below, are described in more detail in Appendix C:

- Efficiency: Getting the most output for the amount of input
- Effectiveness: How well the program addresses the size and nature of the problem
- Equity: Where funding for a program comes from versus where it is spent, and the extent to which any disadvantaged groups or sectors are impacted
- Externalities: The extent to which a program supports co-benefits that are not directly quantified in the program analysis
- Certainty: The level of confidence that the program will perform as evaluated

Appendix C summarizes the criteria in terms of definition, methodology, and results for how the criteria can be most effectively used in continued discussions and next iterations of program analysis to optimize the mix of programs under any future CAP tax.

3.2 Program Matrix

The following program matrix summarizes the evaluation of all programs. It is important to reiterate that the results shown in this matrix, as well as Appendix B, have been evaluated only on a stand-alone basis. Programs are organized in the matrix by the sector they address (Commercial, Industrial, Residential) and further grouped into three categories based on their primary purpose:

- Reduce Use: The CAP focus area that looks at energy efficiency and conservation in existing buildings

- Ramp Up Renewables: From the CAP focus area on renewable energy technologies
- City Organization: Programs and projects where the city can lead the community by example

As a note, the column associated with average annual cap funding presents the *predicted* annual average over 10 years and is not intended a as reflection of current CAP funding, although current CAP funding was used to inform these predictions.

Table: Individual Program Evaluation Matrix

#	SECTOR	PROGRAM NAME	AVG. ANNUAL CAP FUNDING ($)	CAP $ per mtCO2e	TOTAL $ per mtCO2e	PRIVATE PAYBACK (years)	EFFICIENCY	YEAR 10 ESTIMATED GHGs AVOIDED (mtCO2e)	% of TOTAL GHG EMISSIONS GOAL	EFFECTIVENESS	EQUITY	EXTERNALITIES	CERTAINTY
REDUCE USE													
1	Commercial	Commercial Energy Efficiency	$290,000	$3	$71	7	Medium-High	116,023	3.8%	High	Medium	Medium	Medium-Low
2.1	Residential	Behavior Change Platform (Opower)	$274,700	$70	$70	0	High	3,759	0.4%	Medium-Low	High	Medium	Medium-High
2.2	Residential	Behavior Change Platform (In-House)	$35,000	$12	$12	0	High	2,872	0.3%	Medium-Low	Medium-High	Medium	Medium-High
2.3	Commercial	10 for Change Enhancement	$50,000	$6	$601	5	Medium-Low	11,250	0.1%	Medium-Low	High	Medium	Medium-High
3.1	Commercial	EnergySmart Enhancements and Campaigns (Commercial)	$1,083,100	$20	$87	4	High	46,114	2.3%	High	Medium-High	Medium	Medium-High
3.2	Residential	EnergySmart Enhancements and Campaigns (Residential)	$1,913,600	$83	$217	9	Medium-Low	20,680	3.5%	High	Medium-High	Medium	Medium-High
4	Industrial	EnergySmart Industrial	$109,900	$85	$152	3	Medium-High	1,053	0.1%	Low	Medium-High	Medium	Medium
4.1	Industrial	Industrial Process Renewables/Generation (CHP)	$125,000	$20	$202	57	Low	10,493	0.1%	Medium-Low	High	Medium-Low	Medium-Low
RAMP-UP RENEWABLES													
4.2	Industrial	Industrial Process Renewables/Generation (AD)	$18,800	$36	$460	27	Low	544	0.004%	Low	High	Medium-Low	Medium
5	Commercial	Solar Thermal	$97,400	$112	$561	35	Low	488	0.04%	Low	High	Medium	Medium-High
6	N/A	Hydroelectric power (secure all RECs, expand capacity)	$1,287,600	$96	$96		Medium	18,187	1.2%	Medium-High	Medium	Low	High
8	Residential & Commercial	Solar photovoltaic (increase deployment, gardens, roof-top)	$20,800	$75	$235	24	Low	186	0.01%	Low	High	Medium	Medium-High
OTHER													
9	Residential & Commercial	Open RFP for greenhouse gas emissions reductions	$84,400	$4	$36	4	High	14,913	0.8%	Medium-High	High	Medium	Low
11	N/A	City Lead by Example (Street lighting upgrades/retrofits, roof-top solar, new construction, etc.)	$1,155,500	$220	$220	15	Low	3,249	0.4%	Medium	Medium	Medium-Low	High
13	Commercial	District-scale approach to efficiency, renewables, construction, community aggregated energy efficiency (ESCO?), micro-grid	$419,500	$101	$149	5	Medium	2,831	0.1%	Low	High	Medium-High	Low

3.3 Goals and Funding Evaluation

The consultant team next used the program matrix to take stock of a number of key questions described below.

Funding

Is there a gap between available CAP revenue and required CAP funding?

To fund all of the programs currently analyzed in the program matrix would require the city to invest about $7 million annually. This assumes no outside grant sources, but it does include an assumption that significant contribution by the private sector would be provided in addition to the CAP funding required. Given that 2011 CAP revenue was $1,838,000, there is a significant gap in CAP funding to support program implementation. Therefore, the recommended investment packages discussed later in this report assume a fiscally constrained budget of approximately $1.8 million/year.

GHG Emissions Reduction

Is there a gap between estimated GHG emissions avoided and community GHG goals/targets?

The programs listed in the program matrix are estimated to reduce GHG emissions nearly 253,000 metric tons (mt) of CO_2e annually by Year 10. (For context, this reduction level would achieve just below 50 percent of the city's current total reduction goal based on the Kyoto Protocol, or about 520,000 mtCO2e.)

Program Overlap

Has program overlap and the potential for double-counting contributions to GHG reductions been minimized?

Overlap, or double-counting, means that the GHG emissions assumed for some programs also may be calculated in others -for example, a business in the 10 for Change program might also participate in EnergySmart. The analysis indicated two potential areas of overlap among the programs evaluated. In the area of behavior change, two points of overlap were identified: 1) the use of Opower mailing and web-based resources; and 2) an in-house custom web-based platform with flexible and enhanced functionality. In developing the programs, the objective was to identify one or the other for implementation, as opposed to both tools, unless they are deployed in a phased manner. It is recommended that one of these tools be removed from the final implementation package, which will affect total program costs as well as GHG reductions.

The second area of overlap was identified in the area of commercial energy use reduction. Specifically, five overlaps were identified:

- Commercial Energy Efficiency Program: Ordinance Development
- Commercial Energy Efficiency Program: 10 for Change
- Commercial Energy Efficiency Program: Energy Smart Enhancement and Campaigns
- Energy Smart Industrial
- District-scale approaches

These overlaps were considered and addressed in subsequent analysis.

4.0 Investment Packages

On the basis of the program matrix and goals and funding analysis, a number of investment packages were developed to extend this report's analysis beyond individual programs to cumulative outcomes and impacts of combining key programs. The outcomes and impacts of investment packages account for the benefits of combined packages within the boundaries of the CAP funding level – $1.8 million. The six specific investment packages are summarized below and include estimated staffing needed to support the package. Again, it is anticipated that over time and with continuous improvement and measurement and verification, staffing levels can be adjusted along with other program efficiency refinements. The investment packages are described more fully in Appendix D.

1. **High GHG reductions** (combination of programs that achieves the highest emissions reductions of the packages developed in this section)
2. **Residential focus** (combination of residential only programs with highest efficiency and effectiveness evaluation criteria)
3. **Commercial focus** (combination of commercial only programs with highest efficiency and effectiveness evaluation criteria)
4. **Multiple benefits** (a combination of actions with the highest combined ranking of all evaluation criteria)
5. **Solar focus** (note that this solar photovoltaic only package assumed that all of the $1.8 million of CAP funding would be used for this program only)
6. **Renewable energy credit (REC) focus** (note that this REC only package assumed that all of the $1.8 million of CAP funding would be used for this program only)

Throughout the development period of this analysis SmartRegs was assumed to be a required element of any final package. As such, SmartRegs is not detailed in the program descriptions explored previously in this report. The development of the residential focus investment package (item number two above) prompted additional analysis, detailed as follows:

- **CAP Category:** Reduce Use
- **Mandatory vs. Voluntary:** Mandatory
- **Existing or New Program:** Existing
- **Description:** The SmartRegs ordinances update the City of Boulder Housing Code and Rental Licensing Code, and provide new baseline energy efficiency requirements for existing rental housing

- **Quantification Methodology:** Assumed continued program performance similar to calendar year 2011 with revised program costs based on a more streamlined level of service
- **Certainty (see evaluation criterion definition):** High
- **Total Costs Include:** CAP funding and estimated private cost of compliance
- **CAP Only Portion of Total Costs Include:** 0.5 FTE for minimal level of support, consulting on policy troubleshooting and changes, licensing fees for tracking process, and trainings
- **Key Assumptions**
    - **Level of Penetration/Participation Rate Assumption:** Continued performance at 2011 level
    - **GHG Reduction Assumptions:** Continued performance at 2011 level
    - **Staffing Level: 0.5 FTE included in CAP only portion costs**

5.0 Conclusion

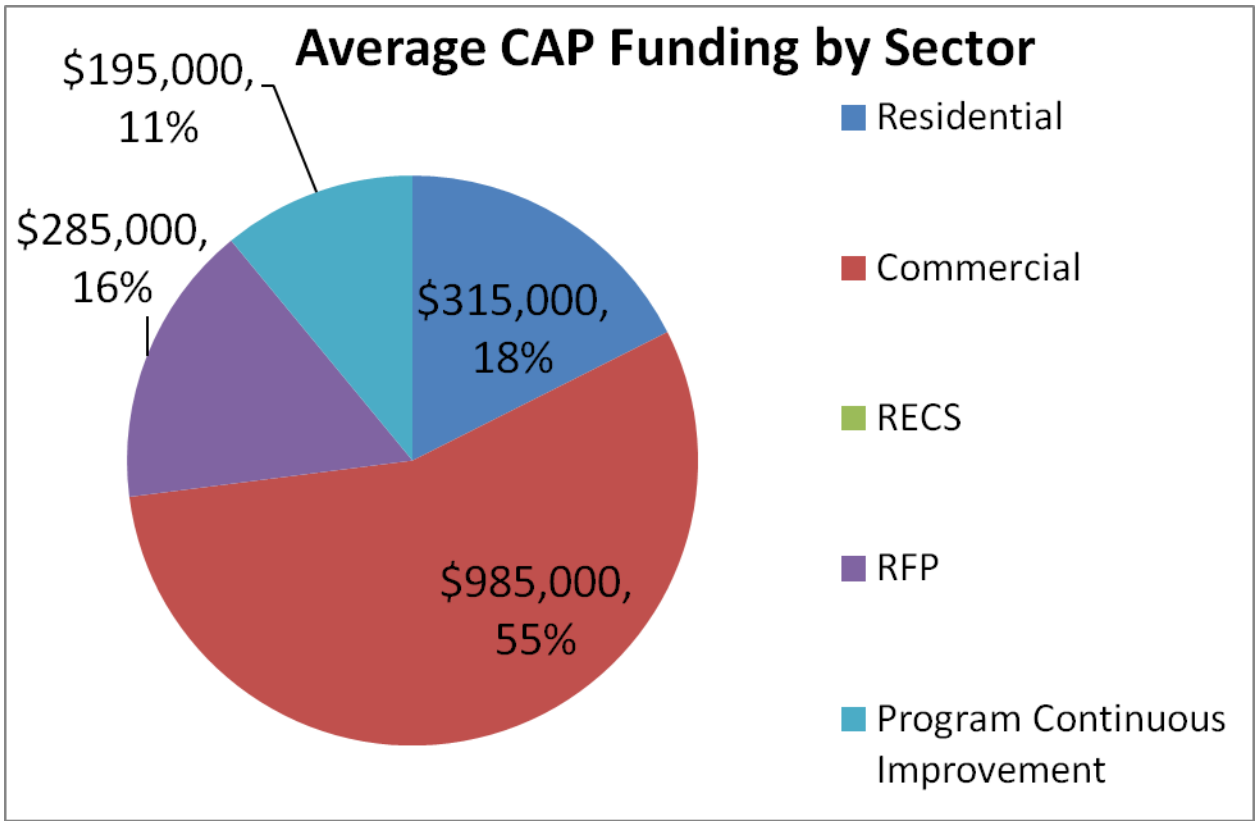
The investment package presented in this section addresses the lessons gathered from the analyses and reinforces the key findings outlined in Section 1.0., which include integrated management for continuous improvement, a mix of mandatory and voluntary approaches, renewables for both commercial and residential sectors, and market innovation triggers. It also achieves balance with the $1.8 million budget that is based on 2011 funding levels while incorporating the key findings identified in Section 1.0.

A key differentiator in this selected package compared to the packages captured in the previous section is the inclusion of the Open Request for Proposal (RFP) program. This selected package is a key part of a future EAP. In addition, these CAP tax funded programs need to be paired with private sector investment and efforts to change the supply of energy to make meaningful reductions in emissions.

Program	Average Annual CAP Funding	Year 5 Snapshot GHGs Avoided ($mtCO_2e$)	Year 10 Snapshot GHGs Avoided ($mtCO_2e$)
Commercial Energy Efficiency Program: Ordinance Development, EnergySmart Enhancements/ Campaigns, 10 for Change	$985,000	37,704	146,780
Residential EnergySmart Enhancements and Campaigns	$230,000	744	1,387
Residential SmartRegs	$85,000	4,810	9,620
Open RFP for GHG Emission Reductions	$285,000	25,000	50,000
Program Performance and Continuous Improvement	$195,000	0	0
Total	**$1,780,000**	**68,258**	**207,787**

On average, the collective costs of this selected package are globally estimated to represent at least six full-time equivalent positions. It is important to note for this estimate that staffing cost development varied in resolution based on the format of cost information available for a given program. As detailed in Appendix B, some program staffing costs are based on specific staffing levels. Other programs have staffing costs derived from a total cost per unit of program participation. (As an example, consider the total costs of a program reported by available data to be $100 for each participant (e.g., individual, business). Staffing cost is only one component of the total cost make-up for this program. Other components of the total costs could include funding for rebates to the participants, the cost of materials to market the program and/or any other cost aside required for the program's success).

For this selected package, the following pie chart depicts the average CAP funding for by sector:



In this selected package, the existing programs that continue are outlined below:

- **Commercial EnergySmart**: Receiving average annual CAP funding of about $570,000, this program will be funded to a level that allows for just over 3,000 business participants in 10 years.
- **10 for Change**: Receiving an average annual CAP funding of about $55,000 for 4 years into the 10-year planning period, this program will function at current levels. It is assumed that after Year 4, the program will ultimately be absorbed into the early voluntary element of the Commercial Energy Efficiency Ordinance Development.
- **Residential Energy Smart**: Receiving average annual CAP tax funding of about $230,000, this program will be funded to a level that allows for just over 2,300 rental and owner-occupied participants over 10 years. This level of participation represents a volume that is about 75 percent lower than current levels, which was necessary to stay within the $1.8 million package.
- **Residential SmartRegs**: Receiving average annual CAP funding of about $85,000, this program will be retained at the lowest level of service. Services at this lowest level would include general support in answering landlord/inspector questions, limited troubleshooting, and very limited data entry.

The new programs introduced in this package are described below:

- **Commercial Energy Efficiency Ordinance Development:** Receiving average annual CAP funding of near $360,000, this program's funding will ramp up annually according to the planned three phases

of implementation. For this selected package, this program builds on the program matrix and information detailed in Appendix B and adds $165,000 of CAP funding per city staff.

- **Open RFP for GHG Emissions Reductions:** This program will require RFP responses to achieve conditions of performance equivalent to the performance of current programs and will include $285,000 in CAP tax funding. Specifically, with CAP tax funding, climate reduction measures must achieve or exceed a required performance that matches the required performance of city programs to achieve current goals – or about $5 per ton of GHG reduction over a 10-year lifetime. As outlined in the program details in Appendix B, this option offers the flexibility to shift funding to higher performing programs if responses do not achieve required condition of performance. The consultant team identified $285,000 as the minimum level that will both promote meaningful market innovation and include staff time for program development and implementation.

In addition, reflecting the key finding regarding continuous improvement and ensuring program high performance, the city will incorporate a program component of planning, data management, and verification to carry on exploration of more cost effective options in the future. That is, as the city looks to extend the CAP, in whatever form it ultimately takes, this analysis will help to inform not only what programs should receive funding but also how to most efficiently manage these programs. Lessons learned from CAP performance to date, as well as best practices from local government and utility DSM programs, suggest that future CAP funding should be allocated in a way that promotes integrated program management. Each program will have a program manager as in the past, but a new integrated program management function would manage the interrelationship between programs under the CAP umbrella. As programs mature and evolve, adjustments in funding and program design can be made to individual programs that help to ensure an optimal performance of the overall mix. An integrated approach also provides consistent metrics and methodologies to measure and verify individual program performance, as well as a way to streamline shared activities between programs. From CAP performance to date, the consultant team knows that setting conditions for continuous improvement is very important to both new and mature programs. The integrated program management function would provide a platform for better planning and management, improved flexibility to support continuous improvement in program design, and greater efficiencies between programs.

Appendix A – Programs Brainstorm

More than 80 ideas from city staff, community stakeholders, and the team's knowledge of best practices were originally considered as part of this analysis. This list was consolidated and prioritized into the list of 15 prioritized programs described in detail in this Appendix B and introduced in the report.

- Open RFP for reductions
- Deep energy retrofits
- Net zero new construction
- Challenge programs (e.g. everyone change out porch light)
- Leverage Elevations Loan Program
- Commercial Lighting campaign
- Commercial HVAC program
- Separate focus on industrial customers
- Solar thermal
- Behavior change
- Point of sale
- Passive solar
- Commercial Energy Rating: Market Transformation
- Significantly expand EnergySmart – owner occupied housing as stand-alone (leverage building momentum)
- Continue EnergySmart – SmartRegs (note: recent NREL analysis) as stand-alone (high interest) http://www.nrel.gov/docs/fy12osti/54724.pdf
- EnergySmart model - value: ongoing relationship (personal energy advisor), can be extended to more of a clearinghouse for additional topics demand, solar installations, etc. and extended to water
- Marketing – big component to drive demand; focus key, needed; non-traditional marketing (referrals, organizations outreach, personal, coupon code) vs. traditional marketing (e.g., bus ads); social media
- EnergySmart – interaction, engagement with contractors (now: open, future: standardization) could result in greater savings
- Extend SmartRegs residential model in reasonable way to commercial side
- Opower concept/behavior modification (1% reduction)
- On-site UASBs (type of anaerobic digestion) for breweries and food processing plants that have high strength wastewater. This would provide on-site natural gas replacement for industrial/domestic hot water and potentially for boiler fuel. The CO2 emissions on-site would be a wash, but there would be reduction at the municipal wastewater treatment plant.
- Adding high strength waste to the wastewater treatment plant anaerobic digester (East Bay Municipal Utility District is doing this successfully in Oakland, CA). Currently have two CHP units,

but only have enough digester gas to power one. Without much infrastructure cost, they could produce an additional 1.5 million kWh per year.

- Expand food waste collection and digest it at the existing composting facility. Could be done with a dry digestion system. Assumption is that the existing compost operation's permit could be amended to accommodate this.
- Load shift using thermal storage
- Demand response measure similar to RDSI in which HVAC control takes place in office buildings in late afternoon. Therefore, there is energy savings available when the building shuts down at the end of the work day as opposed to load shifting if control takes place in the middle of the day and HVAC system comes back on later in the day.
- Analysis and implementation of program to fully deploy roof-top solar. This includes evaluation of existing, short term targets for installed watts, and analysis of existing sites. A secondary step is to work with local installers, and financial institutions to create a new incentive structure for full deployment.
- Small/medium business lighting retrofits
- Revolving Loan fund for new and innovative incentives (e.g., systems control training on the commercial/industrial sector, decommissioning, etc.)
- Regional passive and solar thermal
- Street lighting retrofit
- Behind the meter programs such as reactive power inverters for existing solar installations, micro-grid pilot project
- Net zero energy downtown district
- Business lighting retrofit trade-out (T8, T12)
- EnergySmart Lighting Campaign – Discussion about the role of T12s or not with federal mandates, but makes sense to create discrete campaigns. One for lighting is a good idea. Other technologies as well as sustainable purchasing practices and embedded carbon. Broaden education base.
- EnergySmart Heating and Cooling Campaign –new and efficient (optimized) equipment
- Incentivizing Solar Loans – adding incentives and advising for businesses nearing 15% energy efficiency target so they will be eligible for solar loans (revolving loan fund from Better Buildings' funds)
- EnergySmart for All Businesses – continue the assessment and/or quick with the goal of every business receiving something from the program
- EnergySmart Sector specific incentives, targeted offerings, networking, recognition and certification (10 for Change, PACE and EnergySmart combined) How do we be more effective and efficient with one program with many offerings?
- Commercial Energy Conservation Ordinance (CECO) – potential requirements could include benchmarking and disclosure; audits and implementation of key measures; periodic retrocommissioning; lighting upgrades; submetering.

- Energy Coaches for CECO Requirements
- Managing building energy use around peak demand reduction and bill analysis advising
- Green Lease requirement or incentives (lease renewal or new) under the Economic Vitality Flex Rebate menu
- Energy "Smartest" -- Net Zero Electric businesses
- Net Zero for New Construction
- Net Zero Districts – for redevelopment areas (e.g., Fort ZED)
- Promoting Solar Gardens, apartment carports, PPAs, Commercial Solar Map
- Office Building Automation Systems and Controls
- Incentivizes Energy Services Companies (ESCos) Aggregation Districts
- Heat Islands
- Greater Deployment of PV
- Street lighting upgrades/retrofits
- Energy management systems
- Lighting
- Demand response
- Zero energy districts
- Combined heat and power
- Geothermal
- City Council packet January 31, 2012 (starting on p.22-23) – long list of recommendations for improving existing programs
- REC purchases
- EnergySmart higher penetration, continued significant funding beyond ARRA,
- 10 for Change higher penetration
- Weatherization and insulation higher penetration for better cost-effectiveness
- EnergySmart focus on longer-term measures, deep-energy retrofit incentives, packages of improvements for better payback, load-reduction for cost savings
- Collaborative efficiency and renewable projects
- Energy efficiency in the commercial sector
- Energy localization
- Continued success of EnergySmart services
- Planning for the next generation of the Climate Action Plan
- Future plans for hydroelectric with contracts expire?
- Expanded microhydro
- Green button participation or other consumer behavior programs
- Increase education programs for behavior change
- Building automation systems for all commercial buildings
- Smart Building Renovation

- Demand Dispatch
- Hydroelectric Power
- Solar Thermal
- Plug-In Electric Vehicles
- Waste-to-energy/heat
- District Heat Island Program
- Biomethane
- Combined Heat and Power (including Biomass)
- Direct Use Geothermal
- Combined Heat and Power
- Wind and Hydroelectric Capacity Balancing
- 10 for Change for tenants
- Portfolio-wide property manager engagement
- Property management: three options before Council (voluntary, mandatory, combined with regulation of prescriptive measures (SmartRegs)
- Go out to bid for greenhouse gas reductions
    - Dovetail on existing programs & set some parameters for the proposals
- Develop a comprehensive plan around the built environment
    - Consider how to get deeper retrofits – look at building as a system
- Regulatory program for commercial buildings
- Net zero standards for new construction
- Reach all utility customers so everyone does one thing (e.g., change out porch lights)
    - Allows for holistic engagement
- Leverage Elevations Loan Program (Energy loan through EnergySmart) to encourage upgrades, utilizing revolving funds
- Commercial lighting campaign/change out; develop dynamic goals around lighting upgrades
- Commercial heating, cooling, and ventilation program
- Provide more resources to encourage energy conservation and energy upgrades
- Help residents & businesses understand and manage their bills
- Continue Energy Advisor role to help assist residents & business through the upgrade process
    - Incorporate this model into other programs, programs, and campaigns
- Break out industrial customers from commercial customers
    - Use lessons learned and case studies from what's already being done by industrial customers
- Solar thermal
- Low-income weatherization (county funding is getting cut for this)
- City pays residents/businesses to go off the grid
- Shift and broaden 10 for Change to an industry specific business networking program

- Add Advisors to EnergySmart commercial service to help business to comply with potential commercial energy conservation ordinance
- Encourage peak reduction – help save money
- Address multifamily units – codes? Direct installs?
- Develop & offer sector specific commercial programs
- Behavior change programs & competitions
- Point of sale incentives
- Separate residential owner occupied EnergySmart, SmartRegs EnergySmart, and multifamily unit EnergySmart
- Passive solar

Appendix B – 15 Core Programs

The program numbers referenced in this appendix match the evaluation matrix presented in Section 3 of the report. It is important to note that the details given in this appendix represent the standalone evaluation of these programs.

Program 1 Summary: Commercial Energy Efficiency Program - Ordinance Development

- **CAP Category:** Reduce Use.
- **Mandatory vs. Voluntary:** Begins as voluntary; concludes as mandatory.
- **Existing or New Program:** New.
- **Description:** This program entails developing a Commercial Energy Conservation Ordinance for the city over three phases. Such an ordinance would require commercial property owners to meet energy conservation targets based on voluntary benchmarking of energy consumption to similar business types and sectors, mandatory benchmarking, or some combination of benchmarking and prescriptive building retrofits.
- **Quantification Methodology:** Estimated penetration in commercial sector through three phases as structured by city staff.
- **Certainty (see evaluation criterion definition):** Medium-low.
- **Total Costs Include:** Program (increasing over time from roughly 0.25 to 5 full-time equivalents (FTEs) modeled off residential SmartRegs) + Private (modeled off $595/ton for Commercial Energy Smart – Jan 2012 Council Packet).
- **CAP Only Portion of Total Costs Include:** Program costs (i.e., FTEs).
- **Key Assumptions**
    - **Level of Penetration/Participation Rate Assumption:** Phase 1 - Years 1 and 2: 50 businesses per year; Phase 2 - Years 3 to 5: 2,500 businesses per year; then Phase 3 – Years 5 to 10: 1,500 businesses per year to get to 7,500 total – or reaching all businesses per Nexant study based on electric meters count.
    - **GHG Reduction Assumptions:** Varies by 3 phases. Level of GHG reduction – Phase 1: 3%; Phase 2: 1%; Phase 3: 10% (percentages not cumulative). Adds to lower level of certainty.
    - **Staffing Level/Costs:** 1 FTE ($100,000) in years 1 to 4. Ramps to 3 to 5 FTEs in years 6 to 10.
    - **Other:** $0.10/kWh average unit cost with 3% annual increase; $0.61/therm average unit cost with no annual increase.

Program 1 Analysis Details: Commercial Energy Efficiency Program - Ordinance Development

Year	1	2	3	4	5	6	7	8	9	10
Participants	50	50	2,500	2,500	2,500	1,500	1,500	1,500	1,500	1,500
Cumulative Participants (resets for each phase)	50	100	2,500	5,000	7,500	1,500	3,000	4,500	6,000	7,500
GHG Reduction	3%	3%	1%	1%	1%	10%	10%	10%	10%	10%
Free ridership	90%	90%	90%	90%	90%	20%	20%	20%	20%	20%
Savings depreciation or attrition rate										
New Gross Avoided MTCO2e	232	232	3,867	3,867	3,867	23,205	23,205	23,205	23,205	23,205
Cumulative Gross Avoided MTCO2e	232	464	3,867	7,735	11,602	11,602	46,409	69,614	92,818	116,023
Net Avoided MTCO2e	23	46	387	773	1,160	9,282	37,127	55,691	74,255	92,818
Net % of Total Sector Emissions	0.00%	0.00%	0.03%	0.07%	0.10%	0.80%	3.20%	4.80%	6.40%	8.00%
CAP $	$100,000	$100,000	$100,000	$100,000	$300,000	$400,000	$400,000	$400,000	$500,000	$500,000
Other $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Private $	$137,993	$137,993	$2,299,881	$2,299,881	$2,299,881	$13,799,283	$13,799,283	$13,799,283	$13,799,283	$13,799,283
Total $	$237,993	$237,993	$2,399,881	$2,399,881	$2,599,881	$14,199,283	$14,199,283	$14,199,283	$14,299,283	$14,299,283
Private Savings $	$17,203	$17,727	$304,446	$313,721	$323,278	$1,998,762	$2,059,655	$2,122,403	$2,122,403	$2,122,403
Cumulative Private Savings $	$17,203	$34,929	$339,375	$653,095	$976,374	$2,975,135	$5,034,790	$7,157,193	$9,279,595	$11,401,998
Private Sector Simple Payback	8	8	8	7	7	7	7	7	7	7

*Note that savings and avoided emissions assumed to continue to year 20.

Programs 2.1 and 2.2 Summaries: Behavior Change Platform - Residential

- **CAP Category:** Reduce Use.
- **Mandatory vs. Voluntary:** Voluntary.
- **Existing or New Program:** New.
- **Description:** This program would entail expanding behavior change-based approaches to energy efficiency and conservation in residential applications. Such approaches may include providing more access to data to better understand their energy consumption patterns, expanding education and engagement campaigns and initiatives, such as energy challenges between neighborhoods, to incent energy conservation.
- **Quantification Methodology:** 2.1: Opower approach model with mailings (residential); 2.2: Website only, no mailing approach (residential)
- **Certainty (see evaluation criterion definition):** Medium-high.
- **Total Costs Include:** 2.1: 2012-2013 Biennial Xcel DSM Plan; 2.2: Longmont pilot.
- **CAP Only Portion of Total Costs Include:** 100% program costs (no private investment).
- **Key Assumptions**
    - **Level of Penetration/Participation Rate Assumption:** Participation rate: 2% in Year 1 then smooth ramping up (ranging from 8 to 25% annually) to 90% of residential customers by Year 6. Assumption adds to lower level of certainty.
    - **GHG Reductions Assumptions:** Electricity savings, and thus GHG reduction, assumes 2% reduction for each participant; 0.6% for natural gas; then pro-rated based on actual Boulder residential utility use and lower effectiveness for 2.2.
    - **Staffing Level:** Estimated $50,000 in Year 1 (set-up year) and then ramping down to $10,000 by Year 6 and following.
    - **Other:** Delivers on the vision of getting utility information to consumer. Utility bill access key (also adds to lower level of certainty). $0.10/kWh average unit cost with 3% annual increase; $0.61/therm average unit cost with no annual increase.
- **Key Points/Highlights:** Xcel has pilot in progress.

Programs 2.1 and 2.2 Analysis Details: Behavior Change Platform – Residential

2.1

Year	1	2	3	4	5	6	7	8	9	10
Total Residential Customers	39,000	39,000	39,000	39,000	39,000	39,000	39,000	39,000	39,000	39,000
Participation Rate	2%	10%	25%	50%	75%	90%	90%	90%	90%	90%
Participants	780	3,900	9,750	19,500	29,250	35,100	35,100	35,100	35,100	35,100
Free ridership	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
kWh savings	98,722	493,610	1,234,025	2,468,049	3,702,074	4,442,489	4,442,489	4,442,489	4,442,489	4,442,489
Dth savings	263	1,314	3,284	6,568	9,852	11,823	11,823	11,823	11,823	11,823
Gross Avoided MTCO2e	84	418	1,044	2,088	3,132	3,759	3,759	3,759	3,759	3,759
Net Avoided MTCO2e	79	397	992	1,984	2,976	3,571	3,571	3,571	3,571	3,571
Net % of Total Sector Emissions	0.02%	0.12%	0.30%	0.60%	0.90%	1.08%	1.08%	1.08%	1.08%	1.08%
CAP $	$9,000	$45,000	$112,000	$224,000	$337,000	$404,000	$404,000	$404,000	$404,000	$404,000
Other $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Private $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total $	$9,000	$45,000	$112,000	$224,000	$337,000	$404,000	$404,000	$404,000	$404,000	$404,000
Private Savings $	$12,856.96	$65,999.14	$169,414.25	$347,930.39	$535,964.34	$660,554.04	$678,480.88	$696,953.87	$696,953.87	$696,953.87

*Note that savings and avoided emissions assumed to continue to year 20.

2.2

Year	1	2	3	4	5	6	7	8	9	10
Total Residential Customers	39,000	39,000	39,000	39,000	39,000	39,000	39,000	39,000	39,000	39,000
Participation Rate	2%	10%	25%	50%	75%	90%	90%	90%	90%	90%
Participants	780	3,900	9,750	19,500	29,250	35,100	35,100	35,100	35,100	35,100
Free ridership	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
kWh savings	74,041	370,207	925,519	1,851,037	2,776,556	3,331,867	3,331,867	3,331,867	3,331,867	3,331,867
Dth savings	219	1,095	2,737	5,474	8,210	9,852	9,852	9,852	9,852	9,852
Gross Avoided MTCO2e	64	319	798	1,595	2,393	2,872	2,872	2,872	2,872	2,872
Net Avoided MTCO2e	61	303	758	1,516	2,273	2,728	2,728	2,728	2,728	2,728
Net % of Total Sector Emissions	0.02%	0.09%	0.23%	0.46%	0.69%	0.82%	0.82%	0.82%	0.82%	0.82%
CAP $	$160,000	$50,000	$40,000	$30,000	$20,000	$10,000	$10,000	$10,000	$10,000	$10,000
Other $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Private $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total $	$160,000	$50,000	$40,000	$30,000	$20,000	$10,000	$10,000	$10,000	$10,000	$10,000
Private Savings $	$9,776.28	$50,167.13	$128,730.13	$264,286.66	$406,981.56	$501,425.50	$514,870.63	$528,725.37	$528,725.37	$528,725.37

*Note that savings and avoided emissions assumed to continue to year 20.

Program 2.3 Summary: Commercial Energy Efficiency Program - 10 for Change Enhancement

- **CAP Category:** Reduce Use.
- **Mandatory vs. Voluntary:** Voluntary.
- **Existing or New Program:** Existing.
- **Description:** 10 for Change has engaged Boulder businesses in a friendly challenge to save money by integrating sustainability practices into their facilities and operations. Efforts to save energy and water, reduce waste, and use alternative transportation all contribute to Boulder's community sustainability goals. This re-visioning would expand this voluntary program and include tenants and leased spaces.
- **Quantification Methodology:** Increased penetration of existing program.
- **Certainty (see evaluation criterion definition):** Medium-high.
- **Total Costs Include:** Existing 10 for Change program - $50,000 annually.
- **CAP Only Portion of Total Costs Include:** Limited program costs (overhead, marketing, consultant costs, etc.); primarily private investment.
- **Key Assumptions**
    - **Level of penetration/participation rate assumption:** Modeled a penetration rate of 10% (based on Nexant report electric meter counts) by Year 5.
    - **GHG Reduction Assumptions:** 15 metric tons per business per year (which is more aggressive rate than median results to date).
    - **Staffing Level**: Reflected existing 10 for Change program.
    - **Other:** $0.10/kWh average unit cost with 3% annual increase; $0.61/therm average unit cost with no annual increase.
- **Key Points/Highlights:** GHG reductions by business may degrade over time.

Program 2.3 Analysis Details: Commercial EE Program - 10 for Change Enhancement

Year	1	2	3	4	5	6	7	8	9	10
Participants	50	50	2,500	2,500	2,500	1,500	1,500	1,500	1,500	1,500
Cumulative Participants (resets for each phase)	50	100	2,500	5,000	7,500	1,500	3,000	4,500	6,000	7,500
GHG Reduction	3%	3%	1%	1%	1%	10%	10%	10%	10%	10%
Free ridership	90%	90%	90%	90%	90%	20%	20%	20%	20%	20%
Savings depreciation or attrition rate										
New Gross Avoided MTCO2e	232	232	3,867	3,867	3,867	23,205	23,205	23,205	23,205	23,205
Cumulative Gross Avoided MTCO2e	232	464	3,867	7,735	11,602	11,602	46,409	69,614	92,818	116,023
Net Avoided MTCO2e	23	46	387	773	1,160	9,282	37,127	55,691	74,255	92,818
Net % of Total Sector Emissions	0.00%	0.00%	0.03%	0.07%	0.10%	0.80%	3.20%	4.80%	6.40%	8.00%
CAP $	$100,000	$100,000	$100,000	$100,000	$300,000	$400,000	$400,000	$400,000	$500,000	$500,000
Other $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Private $	$137,993	$137,993	$2,299,881	$2,299,881	$2,299,881	$13,799,283	$13,799,283	$13,799,283	$13,799,283	$13,799,283
Total $	$237,993	$237,993	$2,399,881	$2,399,881	$2,599,881	$14,199,283	$14,199,283	$14,199,283	$14,299,283	$14,299,283
Private Savings $	$17,203	$17,727	$304,446	$313,721	$323,278	$1,998,762	$2,059,655	$2,122,403	$2,122,403	$2,122,403
Cumulative Private Savings $	$17,203	$34,929	$339,375	$653,095	$976,374	$2,975,135	$5,034,790	$7,157,193	$9,279,595	$11,401,998
Private Sector Simple Payback	8	8	8	7	7	7	7	7	7	7

*Note that savings and avoided emissions assumed to continue to year 20.

Programs 3.1 and 3.2 Summaries: EnergySmart Enhancements and Campaigns (Commercial and Residential)

- **CAP Category:** Reduce Use.
- **Mandatory vs. Voluntary:** Voluntary.
- **Existing or New Program:** Existing.
- **Description:** This program would focus on enhancing the EnergySmart program in both the residential and commercial sectors. These enhancements range widely and include support for other topics beyond energy efficiency and conservation, such as renewable energy, expanded contractor engagement to further build a trade ally network, continued support of weatherization efforts, expanding retrofits to be more extensive and other related efforts. Campaigns within the current EnergySmart program could be used to expand the program to target particular business sectors, particular technologies, or other similar focused efforts. Such campaigns could include targeted marketing of sectors or technologies and a streamlined approach for implementing a particular retrofit across a larger customer group, similar to components of the current EnergySmart program.
- **Quantification Methodology:** Build on existing program by increasing participation, converting on capital upgrades, and increasing GHG reduction per participant.
- **Certainty (see evaluation criterion definition):** Medium-high.
- **Total Costs Include:** Program + Private (both modeled equivalent Energy Smart programs – Jan 2012 Council Packet); estimated 30% program/70% private over entire 10 year program life.
- **CAP Only Portion of Total Costs Include:** Program only.
- **Key Assumptions**
    - **Level of penetration/participation rate assumption:**
        - Commercial - Proposed actions increase participation by 2 to 5% (cumulative) over current level. In other words, begin with 550 base participants (city's 2012 goal per Jan 2012 Council Packet) in Year 1 then add 116 per year for program lifetime.
        - Residential - Per city's 2012 goals Council packet, base is 850/yr owner-occupied base, ramping up; 3,200/yr rental, ramping down not to exceed total number of units.
    - **GHG Reduction Assumptions:**
        - Commercial - 14% beginning in Year 2 (cumulative from broaden scope, engaging industry and new technologies).
        - Residential - Current level of 1.7% per owner occupied, 0.5% per rental (per Jan 2012 Council Packet).
    - **Staffing Level:** Per existing program
    - **Other:**
        - Commercial itemized costs

        - $558 non-rebate cost per business for 550 annual participants
        - $1,322 rebate cost per 257 annual upgrades completed
        - $6,576 private investment per 257 annual upgrades completed
    - Residential itemized costs
        - $243 non-rebate cost per unit for 4,050 annual participants
        - $358 rebate cost per 1,875 annual upgrades completed
        - $89 Xcel rebate cost per 1,875 annual upgrades completed
        - $1,266 private investment per 1,875 annual upgrades completed
    - $0.10/kWh average unit cost with 3% annual increase; $0.61/therm average unit cost with no annual increase.
- **Key Points/Highlights:** Cost per ton checks against range from Rocky Mountain Institute report. Commercial area includes allowance for equipment-specific campaigns – e.g., evaporative cooling.

Programs 3.1 and 3.2 Analysis Details: EnergySmart Enhancements and Campaigns – Commercial and Residential

3.1 Commercial EnergySmart

Year	1	2	3	4	5	6	7	8	9	10
Cumulative businesses served	960	1510	2126	2742	3358	3974	4590	5206	5822	6438
Base Participants	550	550	550	550	550	550	550	550	550	550
Total Participants	550	616	616	616	616	616	616	616	616	616
Base Upgrade Conversion Rate	50%	60%	70%	80%	90%	100%	100%	100%	100%	100%
Upgrades achieved	275	413	474	536	598	616	616	616	616	616
Cumulative Upgrades achieved	257	532	945	1419	1955	2552	3168	3784	4400	5016
GHG Reduction per Business	11.06	11.06	11.06	11.06	11.06	11.06	11.06	11.06	11	11
Gross Avoided MTCO2e	3,041	5,203	5,979	6,756	7,532	7,765	7,765	7,765	7,765	7,765
Cumulative Avoided MTCO2e	3,041	7,939	13,124	18,568	24,243	29,584	34,390	38,716	42,610	46,114
Net Avoided MTCO2e	3,041	7,939	13,124	18,568	24,243	29,584	34,390	38,716	42,610	46,114
Net % of Total Sector Emissions	0.26%	0.68%	1.13%	1.60%	2.09%	2.55%	2.96%	3.34%	3.67%	3.97%
CAP $	$687,034	$914,232	$999,382	$1,084,532	$1,169,682	$1,195,227	$1,195,227	$1,195,227	$1,195,227	$1,195,227
Other $										
Private $	$1,808,451	$2,714,123	$3,119,217	$3,524,310	$3,929,403	$4,050,931	$4,050,931	$4,050,931	$4,050,931	$4,050,931
Total $	$2,495,485	$3,628,356	$4,118,599	$4,608,842	$5,099,085	$5,246,158	$5,246,158	$5,246,158	$5,246,158	$5,246,158
Private Savings $*	$336,461	$905,234	$1,542,029	$2,248,020	$3,024,565	$3,803,324	$4,555,973	$5,285,333	$5,816,838	$6,295,193
New Private Savings	$336,461	$593,193	$702,499	$817,913	$939,709	$998,286	$1,028,699	$1,060,038	$1,060,038	$1,060,038
SPB	5.4	4.6	4.4	4.3	4.2	4.1	3.9	3.8	3.8	3.8

*Note that savings and avoided emissions assumed to continue to year 20.

3.2 Residential EnergySmart

Year	1	2	3	4	5	6	7	8	9	10
Cumulative owner-occupied served	678	1,528	2,528	3,678	4,978	6,428	8,028	9,778	11,678	13,728
Cumulative rentals served	2,081	5,281	8,181	10,781	13,081	15,081	16,781	18,181	19,281	20,081
Cumulative total units served	2,759	6,809	10,709	14,459	18,059	21,509	24,809	27,959	30,959	33,809
Owner-occupied participating	850	1,000	1,150	1,300	1,450	1,600	1,750	1,900	2,050	2,200
Rental participating	3,200	2,900	2,600	2,300	2,000	1,700	1,400	1,100	800	500
Owner-occupied upgrade rate	70%	75%	80%	85%	90%	95%	100%	100%	100%	100%
Rental upgrade rate	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%
Owner-occupied upgrades	595	750	920	1,105	1,305	1,520	1,750	1,900	2,050	2,200
Rental upgrades	1,280	1,305	1,300	1,265	1,200	1,105	980	825	640	425
Cumulative owner-occupied upgrades	595	1,345	2,265	3,370	4,675	6,195	7,945	9,845	11,895	14,095
Cumulative rental upgrades	1,280	2,585	3,885	5,150	6,350	7,455	8,435	9,260	9,900	10,325
Cumulative upgrades	1,875	3,930	6,150	8,520	11,025	13,650	16,380	19,105	21,795	24,420
GHG Reduction Owner-occupied	1013	1277	1566	1881	2222	2588	2979	3235	3490	3745
GHG Reduction Rental	685	698	696	677	642	591	524	441	342	227
Gross Avoided MTCO2e	1,698	1,975	2,262	2,558	2,864	3,179	3,504	3,676	3,832	3,973
Cumulative Gross Avoided MTCO2e	1,698	3,503	5,415	7,431	9,552	11,775	14,102	16,368	18,563	20,680
Net Avoided MTCO2e	1,698	3,503	5,415	7,431	9,552	11,775	14,102	16,368	18,563	20,680
Net % of Total Sector Emissions	0.51%	1.06%	1.64%	2.24%	2.89%	3.56%	4.26%	4.94%	5.61%	6.25%
CAP $	$1,824,209	$1,868,225	$1,905,531	$1,936,128	$1,960,014	$1,977,192	$1,987,659	$1,948,923	$1,896,767	$1,831,191
Other $										
Private $	$2,373,554	$2,601,415	$2,810,288	$3,000,172	$3,171,068	$3,322,976	$3,455,895	$3,449,565	$3,405,259	$3,322,976
Total $	$4,197,763	$4,469,640	$4,715,819	$4,936,300	$5,131,083	$5,300,167	$5,443,554	$5,398,488	$5,302,026	$5,154,167
Private Savings $*	$196,865	$428,975	$698,055	$1,005,830	$1,354,025	$1,744,365	$2,178,575	$2,637,575	$3,119,805	$3,623,705
New Private Savings	$196,865	$232,110	$269,080	$307,775	$348,195	$390,340	$434,210	$459,000	$482,230	$503,900
SPB	12	11	10	10	9	9	8	8	7	7

*Note that savings and avoided emissions assumed to continue to year 20.

Program 4 Summary: EnergySmart Industrial

- **CAP Category:** Reduce Use.
- **Mandatory vs. Voluntary:** Voluntary.
- **Existing or New Program:** Existing.
- **Description:** The EnergySmart rebates are available to commercial and institutional properties within Boulder County (including non-profits, manufacturing facilities and multifamily housing) installing eligible retrofit measures. Under this program EnergySmart would be expanded to industrial facilities.
- **Quantification Methodology:** Applied similar performance metrics (payback, CAP fraction of total funding, etc.) as existing EnergySmart commercial program to industrial sector.
- **Certainty (see evaluation criterion definition):** Medium
- **Total Costs Include:** A per-customer rebate cap of $15,000
- **CAP Only Portion of Total Costs Include:** 37% of total costs per EnergySmart commercial program model
- **Key Assumptions**
    - **Level of Penetration/Participation Rate Assumption:** 25% penetration rate of roughly 290 industrial facilities (per Point 380 report).
    - **GHG Reduction Assumptions:** 100% of the modeled energy savings.
    - **Staffing Level:** Included in CAP only portion costs
    - **Other:** Payback of 2.5 years. Cost savings derive 75% from electricity reduction and 25% from natural gas reduction. Point 380 indicates that Boulder's industrial sector consists of approx. 75 large office, 133 warehouses, and 75 manufacturing facilities.
- **Key Points/Highlights:** Cost per ton equals EnergySmart commercial program.

Program 4 Analysis Details: EnergySmart Industrial

Year	1	2	3	4	5	6	7	8	9	10
Implementation Rate	2.5%	5.0%	7.5%	10.0%	12.5%	15.0%	17.5%	20.0%	22.5%	25.0%
Members	7	15	22	29	37	44	51	59	66	73
Gross Avoided MTCO2e	162	307	438	556	662	758	843	921	990	1,053
Net Avoided MTCO2e	162	307	438	556	662	758	843	921	990	1,053
Net % of Total Sector Emissions	0.01%	0.03%	0.04%	0.05%	0.06%	0.07%	0.07%	0.08%	0.09%	0.09%
CAP $	$109,875	$109,875	$109,875	$109,875	$109,875	$109,875	$109,875	$109,875	$109,875	$109,875
Other $	$40,015	$40,015	$40,015	$40,015	$40,015	$40,015	$40,015	$40,015	$40,015	$40,015
Private $	$45,147	$45,147	$45,147	$45,147	$45,147	$45,147	$45,147	$45,147	$45,147	$45,147
Total $	$195,037	$195,037	$195,037	$195,037	$195,037	$195,037	$195,037	$195,037	$195,037	$195,037
Private Savings $	$ 18,059	$ 36,117	$ 54,176	$ 72,235	$ 90,293	$ 108,352	$ 126,411	$ 144,469	$ 162,528	$ 180,587
New Savings	$ 18,059	$ 18,059	$ 18,059	$ 18,059	$ 18,059	$ 18,059	$ 18,059	$ 18,059	$ 18,059	$ 18,059
SPB	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5

*Note that savings and avoided emissions assumed to continue to year 20.

Program 4.1 Summary: Industrial Process Renewables/Generation – Combined Heat and Power

- **CAP Category:** Ramp-up Renewables.
- **Mandatory vs. Voluntary:** Voluntary.
- **Existing or New Program:** New.
- **Description:** A variety of industrial processes can be deployed to capture and/or generate energy. In combined heat and power (CHP), a heat engine or power station is used to simultaneously generate both electricity and useful heat.
- **Quantification Methodology:** Modeled new combined heat and power installations at individual industrial locations.
- **Certainty (see evaluation criterion definition):** Medium-low.
- **Total Costs Include:** $1250/kW for equipment + operating costs (e.g., fuel, O&M) – utility cost offset
- **CAP Only Portion of Total Costs Include:** CAP funding is 10% of total capital costs.
- **Key Assumptions**
    - **Level of Penetration/Participation Rate Assumption:** Ten individual locations.
    - **GHG Reduction Assumption:** Total utilities energy savings less the CO2 created by from genset operation.
    - **Staffing Level:** Included in CAP only portion costs
    - **Other:** System size of 1 MW per location. Electrical efficiency of 40%. Derated 'capturable' waste heat quantity by 25% of annual usability and 20% thermal losses. Assumed full load. $0.10/kWh average unit cost with 3% annual increase; $0.61/th average unit cost with no annual increase.
- **Key Points/Highlights:** Cost per ton of emission reduction is inversely proportional to annual run hours.

Program 4.1 Analysis Details: Industrial Process Renewables/Generation – Combined Heat and Power

Year	1	2	3	4	5	6	7	8	9	10
Implementation Rate	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Units	1	2	3	4	5	6	7	8	9	10
Gross Avoided MTCO2e	1,908	2,862	3,816	4,770	5,724	6,678	7,632	8,585	9,539	10,493
Net Avoided MTCO2e	191	286	382	477	572	668	763	859	954	1,049
Net % of Total Sector Emissions	0.02%	0.02%	0.03%	0.04%	0.05%	0.06%	0.07%	0.07%	0.08%	0.09%
CAP $	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000	$125,000
Other $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Private $	$1,125,000	$ 1,125,000	$ 1,125,000	$ 1,125,000	$ 1,125,000	$ 1,125,000	$ 1,125,000	$ 1,125,000	$ 1,125,000	$ 1,125,000
Total $	$1,250,000	$1,250,000	$1,250,000	$1,250,000	$1,250,000	$1,250,000	$1,250,000	$1,250,000	$1,250,000	$1,250,000
Private Savings $	$ 19,659	$ 39,318	$ 58,977	$ 78,637	$ 98,296	$ 117,955	$ 137,614	$ 157,273	$ 176,932	$ 196,591
New Savings	$ 19,659	$ 19,659	$ 19,659	$ 19,659	$ 19,659	$ 19,659	$ 19,659	$ 19,659	$ 19,659	$ 19,659
SPB	57	57	57	57	57	57	57	57	57	57

Program 4.2 Summary: Industrial Process Renewables/Generation - Anaerobic Digestion

- **CAP Category:** Ramp-up Renewables.
- **Mandatory vs. Voluntary:** Voluntary.
- **Existing or New Program:** New.
- **Description:** A variety of industrial processes can be deployed to capture and/or generate energy. In anaerobic digestion, micro-organisms break down biodegradable material without oxygen to release energy.
- **Quantification Methodology:** Modeled brewery waste-to-energy (hot water generation) projects based on industry waste stream and volatile solids destruction standards.
- **Certainty (see evaluation criterion definition):** Medium.
- **Total Costs Include:** $/kW for equipment + operating costs (e.g., fuel, O&M) – utility cost offset
- **CAP Only Portion of Total Costs Include:** CAP funding is 10% of total capital costs**.**
- **Key Assumptions**
    - **Level of Penetration/Participation Rate Assumption:** Large projects in 2 (total) breweries.
    - **GHG Reduction Assumption:** 100% offset of the equivalent natural gas use
    - **Staffing Level:** Included in CAP only portion costs
    - **Other:** One-half barrel of waste generated to 2 barrels of beer. 80% conversion of volatile to biogas. $0.10/kWh average unit cost with 3% annual increase; $0.61/th average unit cost with no annual increase.
- **Key Points/Highlights:** Current waste stream used as livestock feed. Digesting this waste stream will reduce livestock feed revenue value.

Program 4.2 Analysis Details: Industrial Process Renewables/Generation - Anaerobic Digestion

Year	1	2	3	4	5	6	7	8	9	10
Implementation Rate	50.0%	100.0%								
Units	1	2	0	0	0	0	0	0	0	0
Gross Avoided MTCO2e	272	544	544	544	544	544	544	544	544	544
Net Avoided MTCO2e	27	54	54	54	54	54	54	54	54	54
Net % of Total Sector Emissions	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CAP $	$93,794	$93,794	$0	$0	$0	$0	$0	$0	$0	$0
Other $	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Private $	$844,150	$844,150	$62,530	$62,530	$62,530	$62,530	$62,530	$62,530	$62,530	$62,530
Total $	$937,945	$937,945	$62,530	$62,530	$62,530	$62,530	$62,530	$62,530	$62,530	$62,530
Private Savings $	$31,265	$62,530	$62,530	$62,530	$62,530	$62,530	$62,530	$62,530	$62,530	$62,530
SPB	27									

Program 5 Summary: Solar Thermal

- **CAP Category:** Ramp-up Renewables.
- **Mandatory vs. Voluntary:** Voluntary.
- **Existing or New Program:** New.
- **Description:** Solar thermal is a technology for harnessing solar energy for generating thermal energy (heat). At an individual home or business scale, solar thermal can be used to heat water or for domestic hot water needs or radiant heating. At a larger scale, solar thermal electric energy generation concentrates the light from the sun to create heat, and that heat is used to run a heat engine, which turns a generator to make electricity. This program would support the increased deployment of solar thermal technologies at both an individual building and district scale in Boulder.
- **Quantification Methodology:** Installations on 19% of electric-only water heaters in commercial office space by year 10.
- **Quantification Certainty (see evaluation criterion definition):** Medium-high.
- **Total Costs Include:** Equipment (based on market bids) + Program (pro-rated off solar grant program, per CAP Expenditures for 2011).
- **CAP Only Portion of Total Costs Include:** 20% of total costs, modeling conservative DSM rebate program
- **Key Assumptions**
    - **Level of Penetration/Participation Rate Assumption:** Models equivalent annual adoption rate as solar PV program (Year 1 = 10%, 1% annual increase for 19% total by Year 10). Reflects about 30% of total electric water heating load.
    - **GHG Reduction Assumption:** 100% offset of the equivalent electricity generation.
    - **Staffing:** Minimal to manage incentive.
    - **Other:** Electric water heater loads of 1.1 kbtu/square foot based on federal Energy Information Administration data for small and large offices. $0.10/kWh average unit cost with 3% annual increase; $0.61/therm average unit cost with no annual increase.
- **Key Points/Highlights:** Extending program to natural gas water heaters will result in lower greenhouse gas reduction compared to electric water heaters.

Program 5 Analysis Details: Solar Thermal

Year	1	2	3	4	5	6	7	8	9	10
Year over year % adoption	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%
Production (ttl load x percent) - therms	12,444	13,688	$18,288	16,177	17,421	18,666	19,910	21,154	22,399	23,643
Production - equivalent kWh (29.3 kWh/th)	364,603	401,064	535,844	473,984	510,445	546,905	583,365	619,826	656,286	692,747
Annual GHG Reduction	257	283	378	334	360	386	411	437	463	488
New Gross Avoided MTCO2e	257	283	378	334	360	386	411	437	463	488
Gross Avoided MTCO2e	257	283	378	334	360	386	411	437	463	488
Net Avoided MTCO2e	257	283	378	334	360	386	411	437	463	488
Net % of Total Sector Emissions	0.02%	0.02%	0.03%	0.03%	0.03%	0.03%	0.04%	0.04%	0.04%	0.04%
Step 3 - CAP $	$67,370	$73,778	$97,330	$86,520	$92,891	$99,263	$105,634	$112,005	$118,376	$121,053
Step 2 - Private $	$269,480	$295,111	$389,319	$346,081	$371,566	$397,050	$422,535	$448,020	$473,505	$484,213
Step 1 - Total $ (equip + pgm)	$336,850	$368,889	$486,649	$432,601	$464,457	$496,313	$528,169	$560,025	$591,882	$605,267
Private Savings $	$7,591	$8,350	$11,156	$9,868	$10,627	$11,386	$12,145	$12,904	$13,663	$14,422

*Note that savings and avoided emissions assumed to continue to year 20.

Program 6 Summary: Hydroelectric Power

- **CAP Category:** Ramp-up Renewables.
- **Mandatory vs. Voluntary:** Voluntary.
- **Existing or New Program:** Mix.
- **Description:** Since 1985, the City of Boulder has run a hydroelectric program to turn water power into electricity, generate revenue, and provide sustainable, non-polluting electricity. This energy exists in water because of large changes in elevation between the city's diversion points from streams and the delivery points for treated water in the city. This program entails expanding Boulder's capacity to generate hydroelectric power. It also entails ensuring that all renewable energy credits (RECs) are captured from the city's hydroelectric generation facilities—currently, the city splits RECs with Xcel Energy, which retires 50% of hydroelectric RECs on behalf of the city.
- **Quantification Methodology:** Restructuring contracts to retain RECs for remaining 60% of existing capacity and expanded capacity.
- **Certainty (see evaluation criterion definition):** High.
- **Total Costs Include:** Calculations for capacity were based on previous City of Boulder projects. Calculations for RECs were based on $0.02/kWh and wholesale electricity price of $0.04/kWh.
- **CAP Only Portion of Total Costs Include:** 100% of total costs.
- **Key Assumptions**
    - **Level of Penetration/Participation Rate Assumption:** n/a
    - **GHG Reduction Assumption:** 100% of new generation capacity and also energy use associated with REC purchased for remaining 60% of existing capacity.
    - **Staffing:** Included in CAP only portion costs
    - **Other:** 43,000 MWH of existing generation. Expanded capacity of 4,500 MWH. CAP funds are cost of RECS and capacity construction minus revenue from expanded capacity.

Program 6 Analysis Details: Hydroelectric Power

Year	1	2	3	4	5	6	7	8	9	10
Balance of existing generation kWh					25,800,000	25,800,000	25,800,000	25,800,000	25,800,000	25,800,000
Boulder Canyon kWh		3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Carter Lake Pipeline					1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Gross Avoided mtCO2e	0	2,115	2,115	2,115	21,360	21,360	21,360	21,360	21,360	21,360
Net Avoided mtCO2e	0	2,115	2,115	2,115	21,360	21,360	21,360	21,360	21,360	21,360
Net % of Total Sector Emissions	0.00%	0.14%	0.14%	0.14%	1.43%	1.43%	1.43%	1.43%	1.43%	1.43%
Additional generation revenue	$0	$60,000	$60,000	$60,000	$90,000	$90,000	$90,000	$90,000	$90,000	$90,000
Balance of existing RECs cost	$0	$0	$0	$0	$516,000	$516,000	$516,000	$516,000	$516,000	$516,000
Boulder Canyon cost	$5,000,000									
Carter Lake cost		$5,500,000								
Total CAP $	$5,000,000	$5,440,000	-$60,000	-$60,000	$426,000	$426,000	$426,000	$426,000	$426,000	$426,000
Other $										
Private $										
Total $	$5,000,000	$5,440,000	-$60,000	-$60,000	$426,000	$426,000	$426,000	$426,000	$426,000	$426,000
Private Savings $										

Program 7 Summary: Solar Photovoltaic

- **CAP Category:** Ramp-up Renewables.
- **Mandatory vs. Voluntary:** Voluntary.
- **Existing or New Program:** New.
- **Description:** Increasing the deployment of solar PV systems in Boulder could include both roof-top systems as well as solar "gardens" that could be constructed on city land or in neighborhood/district applications. Such solar gardens can include a mechanism by which residents and businesses can purchases "shares" to help offset their own electricity use.
- **Quantification Methodology:** Increase number of participants by 19% by year 10.
- **Quantification Certainty (see evaluation criterion definition):** High.
- **Total Costs Include:** Costs include equipment and program considerations. The equipment cost is based on an assumption of $5 for each watt of installed solar PV. Program costs are pro-rated off solar grant program, per CAP Expenditures for 2011.
- **CAP Only Portion of Total Costs Include:** CAP funding is modeled to cover 20% of equipment purchase costs which is a similar level of funding to conservative DSM rebate programs. The CAP funding is also assumed to cover 100% of the city's program costs.
- **Key Assumptions**
  - **Level of Penetration/Participation Rate Assumption:** Year 1 = 10% increase in participants over 2011 Solar Rebate participants; 1% cumulative annual increase in participants for a 19% increase over 2011 by Year 10.
  - **GHG Reduction Assumption:** 100% offset of the equivalent electricity generation
  - **Staffing:** Included in CAP only portion costs
  - **Other:**
    - $0.10/kWh average unit cost with 3% annual increase
    - electricity production of 1,459 kWh/kW/yr based on Solar Grant and Rebate assumption
    - Base load is modeled off 2011 solar rebate results with 27 participants and a 4.6 kW average system size.
- **Key Points/Highlights:** Increase solar PV installations by an average of 18 kW per year or 181 kW over a 10 year period.

Program 7 Analysis Details: Solar Photovoltaic

Year	1	2	3	4	5	6	7	8	9	10
Year over Year % Increase	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%
New Participants	2.7	3	3	4	4	4	4	5	5	5
Cumulative New Participants	3	6	9	12	16	20	25	29	34	39
New kW	12	14	15	16	17	19	20	21	22	24
New kWh	18,221	20,044	21,866	23,688	25,510	27,332	29,154	30,976	32,799	34,621
Cumulative kWh	18,221	38,265	60,131	83,819	109,329	136,661	165,815	196,792	229,590	264,211
Participant Net PV Cost	$49,970	$53,593	$56,996	$60,186	$63,169	$65,953	$68,543	$70,946	$73,167	$75,212
Gross Avoided mtCO2e	13	27	42	59	77	96	117	139	162	186
Net Avoided mtCO2e	13	27	42	59	77	96	117	139	162	186
Net % of Total Sector Emissions	0.001%	0.002%	0.003%	0.004%	0.005%	0.006%	0.008%	0.009%	0.011%	0.012%
CAP $	$14,321	$15,753	$17,186	$18,618	$20,050	$21,482	$22,914	$24,346	$25,778	$27,210
Other $ (sales tax rebate)	$279	$306	$334	$362	$390	$418	$446	$474	$501	$529
Private $	$34,700	$37,208	$39,563	$41,768	$43,828	$45,749	$47,534	$49,188	$50,715	$52,119
Total $	$49,300	$53,268	$57,083	$60,748	$64,268	$67,649	$70,894	$74,008	$76,995	$79,859
Apply PV REC Payment	0	0	0	0	0	0	0	0	0	0
Solar PV REC Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Private Savings $	$1,421	$3,076	$4,980	$7,154	$9,615	$12,385	$15,485	$18,938	$22,094	$25,426

*Note that savings and avoided emissions assumed to continue to year 20.

Program 8 Summary: Open RFP for GHG Emissions Reductions

- **CAP Category:** Innovative Ideas.
- **Mandatory vs. Voluntary:** Voluntary.
- **Existing or New Program:** New.
- **Description:** Using this approach the city would maintain an open, continuous request for proposals process whereby any entity or organization may submit ideas to the city for ways to reduce GHG emissions. Such submissions may also include opportunities for outside investment/funding for reduction measures. RFP responses must achieve conditions of performance that are equivalent to the performance of current programs. Specifically, climate reduction measures must achieve a required performance of $5 per ton or less over a 10-year lifetime.
- **Evaluation Methodology:** RFP projects achieve 0.1% of total Boulder emissions.
- **Certainty (see evaluation criterion definition):** Low.
- **Total Costs Include:** Private (constant $500/mtCO2e) + CAP.
- **CAP Only Portion of Total Costs Include:** CAP funding assumes $70/mtCO2e and increasing annually by 5%.
- **Key Assumptions**
  - **Level of Penetration/Participation Rate Assumption:** n/a
  - **GHG Reduction Assumption:** Annual percent reduction of 0.1% is commensurate with other existing programs.
  - **Staffing:** Minimal 10% of an FTE assumed to administer RFP.
  - **Other:** $0.10/kWh average unit cost with 3% annual increase; $0.61/th average unit cost with no annual increase
- **Key Points/Highlights:** Program offers flexibility to shift funding to better performing programs if responses do not achieve required condition of performance. Maximum funding threshold set to minimize impact of program uncertainty. Minimum funding threshold set to prompt meaningful market innovation and attract participation.

Program 8 Analysis Details: Open RFP for GHG Emissions Reductions

Year	1	2	3	4	5	6	7	8	9	10
% of Total COB Emissions	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
New Avoided mtCO2e	1,491	1,491	1,491	1,491	1,491	1,491	1,491	1,491	1,491	1,491
Cumulative Avoided mtCO2e	1,491	2,983	4,474	5,965	7,456	8,948	10,439	11,930	13,421	14,913
CAP $/mtCO2e	$45	$47	$50	$52	$55	$57	$60	$63	$66	$70
Private $/mtCO2e	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500
Avoided Electricity, kWh	1,057,738	2,115,475	3,173,213	4,230,951	5,288,688	6,346,426	7,404,164	8,461,901	9,519,639	10,577,377
Avoided Natural Gas, therms	140,527	281,054	421,581	562,107	702,634	843,161	983,688	1,124,215	1,264,742	1,405,269
Gross Avoided mtCO2e	1,491	2,983	4,474	5,965	7,456	8,948	10,439	11,930	13,421	14,913
Net Avoided mtCO2e	1,491	2,983	4,474	5,965	7,456	8,948	10,439	11,930	13,421	14,913
Net % of Total Sector Emissions	0.10%	0.20%	0.30%	0.40%	0.50%	0.60%	0.70%	0.80%	0.90%	1.00%
CAP $	$67,107	$70,463	$73,986	$77,685	$81,569	$85,648	$89,930	$94,427	$99,148	$104,105
Other $										
Private $	$745,636	$745,636	$745,636	$745,636	$745,636	$745,636	$745,636	$745,636	$745,636	$745,636
Total $	$812,743	$816,098	$819,621	$823,320	$827,205	$831,283	$835,566	$840,062	$844,783	$849,741
Private Savings $*	$206,303	$419,954	$641,288	$870,653	$1,108,415	$1,354,951	$1,610,654	$1,875,934	$2,110,426	$2,344,918
Private Payback	3.6	1.8	1.2	0.9	0.7	0.6	0.5	0.4	0.4	0.3

*Note that savings and avoided emissions assumed to continue to year 20.

Program 9 Summary: City Lead by Example

- **CAP Category:** City Organization.
- **Mandatory vs. Voluntary:** Voluntary.
- **Existing or New Program:** Existing (expansion).
- **Description:** Municipalities have significant opportunities to lead communities by example with respect to energy management in their own operations. Beyond the efficient use of energy in existing buildings, this program may include upgrading street lights to more efficient ballasts and lighting, integrating energy efficiency into the design of new municipal buildings, and deploying more renewable energy on municipal buildings such as rooftop PV systems.
- **Quantification Methodology:** City organization implements LED street lighting, new high performance buildings and solar PV.
- **Certainty (see evaluation criterion definition):** Medium.
- **Total Costs Include:** By project based market costs.
- **CAP Only Portion of Total Costs Include:** CAP costs are 100% of related, incremental upgrades.
- **Key Assumptions**
    - **Level of Penetration/Participation Rate Assumption:** n/a
    - **GHG Reduction Assumption:** 100% offset of the equivalent energy reduction and generation.
    - **Staffing:** Included in CAP only portion costs
    - **Other:** 3,400 street lights. 50,000 square feet of planned new building with energy use intensity target of 30 kbtu/square foot. 2 MW of additional solar PV. $0.10/kWh average unit cost with 3% annual increase; $0.61/th average unit cost with no annual increase.
- **Key Points/Highlights:** Xcel currently owns street lights, although the city is involved at the state utility commission in an ongoing docket on metering street lights that may provide additional flexibility. Performance of city office buildings in 2008 was 130 kbtu/square foot**.**

Program 9 Analysis Details: City Lead by Example

Year	1	2	3	4	5	6	7	8	9	10
New Street Light Implementation	20%	20%	20%	20%	20%					
Cumulative % Implementation	20%	40%	60%	80%	100%	100%	100%	100%	100%	100%
Cumulative Avoided kWh	231,264	462,528	693,792	925,056	1,156,320	1,156,320	1,156,320	1,156,320	1,156,320	1,156,320
New High-perf Building sqft	0	0	25,000				25,000			
Avoided Electricity, kWh	0	0	261,880	261,880	261,880	261,880	523,761	523,761	523,761	523,761
Avoided Natural Gas, therms	0	0	8,565	8,565	8,565	8,565	17,129	17,129	17,129	17,129
Solar PV kW Installed	200	200	200	200	200	200	200	200	200	200
Cumulative Avoided kWh	280,000	560,000	840,000	1,120,000	1,400,000	1,680,000	1,960,000	2,240,000	2,520,000	2,800,000
Net PV Cost	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
Gross Avoided mtCO2e	360	721	1,311	1,672	2,032	2,229	2,657	2,854	3,052	3,249
Net Avoided mtCO2e	360	721	1,311	1,672	2,032	2,229	2,657	2,854	3,052	3,249
Net % of Total Sector Emissions	0.05%	0.10%	0.18%	0.23%	0.28%	0.31%	0.37%	0.39%	0.42%	0.45%
CAP $	$1,236,000	$1,236,000	$1,423,500	$1,236,000	$1,236,000	$1,000,000	$1,187,500	$1,000,000	$1,000,000	$1,000,000
Total $	$1,236,000	$1,236,000	$1,423,500	$1,236,000	$1,236,000	$1,000,000	$1,187,500	$1,000,000	$1,000,000	$1,000,000
Solar PV REC Payment	$39,200	$78,400	$117,600	$156,800	$196,000	$235,200	$274,400	$313,600	$352,800	$392,000
Total City Savings $	$71,563	$143,127	$241,605	$313,829	$386,073	$436,251	$516,131	$567,097	$616,573	$666,049
New City Savings	$71,563	$71,563	$98,478	$72,224	$72,244	$50,178	$79,880	$50,966	$49,476	$49,476
SPB	17	17	14	17	17	20	15	20	20	20

*Note that savings and avoided emissions assumed to continue to year 20.

Program 10 Summary: District-scale Approaches

- **CAP Category:** Build Better.
- **Mandatory vs. Voluntary:** Voluntary.
- **Existing or New Program:** New.
- **Description**: District-scale energy approaches focus energy efficiency and conservation and/or energy supply efforts at a neighborhood, district, or other geographic subset of a community. District approaches may include energy efficiency initiatives tailored to a district's existing building stock, local production of energy through renewable energy or other locally distributed energy generation sources, energy efficiency and/or renewable energy standards for new construction, and/or the ability for a district to respond to peak electricity prices by shedding load.
- **Quantification Methodology:** Demand control, energy efficiency and renewable energy benefits form a defined energy district.
- **Certainty (see evaluation criterion definition):** Low.
- **Total Costs Include:** Program costs are modeled off 10 for Change program costs. Equipment costs also included in total costs.
- **CAP Only Portion of Total Costs Include:** 50% of non-PV equipment, 20% of PV systems and 100% of program costs.
- **Key Assumptions**
    - **Level of Penetration/Participation Rate Assumption:** Implementation rate 60% of district total square footage by year 10.
    - **GHG Reduction Assumption:** 100% offset of the energy reduction and generation
    - **Staffing:** Assumes $60,000 or approximately 0.5 FTE to manage program based on 10 for Change overhead. $0.10/kWh average unit cost with 3% annual increase; $0.61/th average unit cost with no annual increase.
- **Key Points/Highlights:** District has 1 million square feet of commercial building space. Commercial sectors and percentages modeled of Point 380 report. Implementation defined as 10% annual energy savings, 330 monthly peak kW reduction by year 10 and 600 kW of solar PV. CAP costs are 50% of efficiency and demand reduction system costs plus 20% of PV costs.

Program 10 Analysis Details: District-scale Approaches

Year	1	2	3	4	5	6	7	8	9	10
% Implementation	5%	7%	10%	14%	19%	25%	32%	40%	49%	59%
New Sqft	50,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000	90,000	100,000
Cumulative Avoided Electricity, kWh	71,425	99,995	142,850	199,990	271,415	357,125	457,120	571,400	699,965	842,815
Avoided Natural Gas, therms	26,238	36,733	52,475	73,465	99,703	131,188	167,920	209,900	257,128	309,603
Controllable Air Conditioning kW	85	119	170	238	323	425	544	680	833	1,003
Air Conditioning kW Reduced	28	39	56	79	107	140	180	224	275	331
Avoided kWh	281	393	561	785	1,066	1,403	1,795	2,244	2,749	3,310
Solar PV % Installed	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
New Solar PV kW Installed	60	60	60	60	60	60	60	60	60	60
Solar PV kW Installed	60	120	180	240	300	360	420	480	540	600
Solar PV kWh	84,000	168,000	252,000	336,000	420,000	504,000	588,000	672,000	756,000	840,000
Net PV Cost	$240,000	$240,000	$240,000	$240,000	$240,000	$240,000	$240,000	$240,000	$240,000	$240,000
Gross Avoided mtCO2e	249	384	557	768	1,017	1,304	1,629	1,992	2,393	2,831
Net % of Total Comm/Ind Emissions	0.02%	0.03%	0.05%	0.07%	0.09%	0.11%	0.14%	0.17%	0.21%	0.24%
CAP $	$145,000	$190,000	$255,000	$320,000	$385,000	$450,000	$515,000	$580,000	$645,000	$710,000
Other $										
Private $	$193,000	$178,000	$183,000	$188,000	$193,000	$198,000	$203,000	$208,000	$213,000	$218,000
Total $	$338,000	$368,000	$438,000	$508,000	$578,000	$648,000	$718,000	$788,000	$858,000	$928,000
Solar PV REC Payment	$11,760	$23,520	$35,280	$47,040	$58,800	$70,560	$82,320	$94,080	$105,840	$117,600
Private Savings $	$36,924	$60,838	$89,384	$122,675	$160,835	$203,992	$252,284	$305,855	$362,798	$424,419
SPB	5									

*Note that savings and avoided emissions assumed to continue to year 20.

Appendix C – Evaluation Criteria Descriptions

Please note that for each chart labeled "Results and Conclusions," "Count" means the number of programs at each level and "Program List" identifies specific programs according to their numbers in the program matrix and in Appendix B.

Evaluation Criterion 1: Efficiency

Definition

Getting the most output for the amount of input, where outputs include both carbon reductions and cost savings and inputs incorporate CAP spending as well as private sector spending (where applicable, private investments were included in total cost development).

Evaluation Methodology

Quantitative Metrics (and associated data fields):

- Total $/ton: Total $; metric tons of CO_2e avoided tons
- Private Sector Simple Payback: Private sector $; cost savings

Qualitative Metrics: None

Approach for Determining Scale (High-Medium-Low)

Scale	Total Dollars Per Ton	Payback (Years)
High = 1	1-100	>5
Med = 2	100-200	5-10
Low = 3	200+	<10

Results and Conclusions

Efficiency Level	Count	Program List
High	4	2.1, 2.2, 3.1, 9
Medium-High	2	1, 4
Medium	2	6, 13
Medium-Low	2	2.3, 3.2
Low	5	4.1, 4.2, 5, 8, 11

Based on the distribution of the 15 program across the scale of high to low, the **Efficiency** criterion can and should be the leading factor, along with Effectiveness, for prioritizing programs. By removing the worst-performing and least effective programs and adjusting assumptions/design parameters to increase efficiency and effectiveness for the remaining programs, revised scenario(s) can be analyzed

with the objective of minimizing (ideally closing) the identified gaps between available funding (e.g., $1.8 million for CAP) and funding needed to maximize a given program, as well as GHG reduction targets and projected GHG reductions.

Evaluation Criterion 2: Effectiveness

Definition

Beyond efficiency, how well does the output address the size/nature of the problem? This criterion demonstrates the magnitude and relevance of the program.

Evaluation Methodology

Quantitative Metrics:

- GHG emissions reduction (cumulative metric tons of CO_2e)
- Estimated GHG reductions as a proportion of total GHG emissions from a particular sector (%)

Qualitative Metrics:

- Program maturity

Approach for Determining Scale (High-Medium-Low)

Scale	Tons	Percent of Total GHG Emissions goal	Maturity[4]
High = 1	>150,000	>1	Established
Medium = 2	50,000-150,000	0.2-1	Emerging
Low = 3	<50,000	<0.2%	New

Results and Conclusions

Effectiveness Level	Count	Program List
High	3	1, 3.1, 3.2
Medium-High	2	6, 9
Medium	1	11
Medium-Low	4	2.1, 2.2, 2.3, 4.1
Low	5	4, 4.2, 5, 8, 13

Based on the distribution of the 15 program across the scale of high to low, the **Effectiveness** criterion can and should be a leading factor, along with Efficiency, for prioritizing programs.

[4] Established - most elements of program in place; Emerging - significant expansion of existing elements; New - no elements of program in place.

Evaluation Criterion 3: Equity

Definition

Equity takes into consideration two factors. First, where does the money for a program come from and where is it spent? In other words, is there strong overlap between who pays for the program and who benefits from the program? The second factor considers whether there are disadvantaged subgroups unfairly impacted by the program – low-income residents, small businesses, non-profits, etc.

Evaluation Methodology

Quantitative Metrics:

- Percent overlap between the funding source for the program and where it is spent
- Data fields: Sources of funding and spending

Qualitative Metrics:

- Degree that disadvantaged sub-groups are negatively impacted

Approach for Determining Scale (High-Medium-Low)

Scale	Who Pays vs. Where Spent	Disadvantaged Subgroups
High = 1	>50% overlap	No effect
Medium = 2	25-50%	Moderate
Low = 3	<25%	Significant (adjustment needed in design)

Results and Conclusions

Equity Level	Count	Program List
High	8	2.1, 2.3, 4.1, 4.2, 5, 8, 9, 13
Medium-High	4	2.2, 3.1, 3.2, 4
Medium	3	1, 6, 11
Medium-Low	0	
Low	0	

Based on the distribution of the 15 program across the scale of high to low, rather than use the **Equity** criterion to prioritize programs (as is the recommendation with the Efficiency and Effectiveness evaluation criteria), the best use of the Equity criterion is as a tool for program design/refinement during implementation. Programs analyzed generally scored well on the equity criterion.

Evaluation Criterion 4: Externalities

Definition

Externalities are co-benefits that are not directly quantified in the program analysis.

Evaluation Methodology

Quantitative Metrics: None

Qualitative Metrics:

- Water or other sustainability benefits
- Jobs and/or support of Boulder tech and service companies
- Marketing and branding Boulder through high visibility or innovative projects
- Education and engagement potential

Approach for Determining Scale (High-Medium-Low)

Scale	Water and Other Sustainability	Jobs	Brand Visibility/ Innovation	Education and Engagement Level
High = 1	>1 link	Target industries (e.g., solar installer)	Grows[5]	High
Med = 2	1 link	General effect (e.g., electrical trade)	Aligns[6]	Med
Low = 3	No effect	No effect	No effect	Low

Results and Conclusions

Externalities Level	Count	Program List
High	0	
Medium-High	1	13
Medium	10	1, 2.1, 2.2, 2.3, 3.1, 3.2, 4, 5, 8, 9
Medium-Low	3	4.1, 4.2, 11
Low	1	6

Based on the distribution of the 15 program across the scale of high to low, rather than use the **Externalities** criterion to prioritize programs (as is the case with the Efficiency and Effectiveness evaluation criteria), the best use of the criterion is as a tool for identifying and communicating the beyond-carbon benefits of the CAP program. It also could be used during program design to determine

[5] This is the "wow factor."
[6] This means more of what already exists in programs.

the costs and benefits for adding features to address other sustainability aspects, water conservation and efficiency being the most common opportunities. The majority of the programs as analyzed scored medium on the Externalities criterion. This means that despite being designed as energy programs, additional benefits will accrue for water efficiency, job growth, positive visibility for Boulder as a place of innovation, or growing the sustainability education and engagement level of Boulder as a community.

Evaluation Criterion 5: Certainty

Definition

Certainty refers to how confident the team is that the program would perform as evaluated.

Evaluation Methodology

- Quantitative Metrics: None
- Qualitative Metrics: Certainty

Approach for Determining Scale (High-Medium-Low)

Scale	Level of Assumptions	Sensitivity[7]	Maturity[8]
High = 1	Few	Stable	Established
Medium = 2	Moderate	Moderate	Emerging
Low = 3	Many	Large swings	New

Results and Conclusions

Certainty Level	Count	Program List
High	2	6, 11
Medium-High	7	2.1, 2.2, 2.3, 3.1, 3.2, 5, 8
Medium	2	4, 4.2
Medium-Low	2	1, 4.1
Low	2	9, 13

Based on the distribution of the 15 program across the scale of high to low, rather than use the **Certainty** criterion to prioritize programs (as is the case with the Efficiency and Effectiveness evaluation criteria), the best use of the criterion is as a tool for interpreting the quantitative estimates for the programs in the proposed CAP program. Based on available data, some of the programs' quantitative results are more reliable than others. The strongest areas of concern would be the few programs with

[7] High: assumption has a large impact on GHG emissions and total costs; and so forth for medium and low.
[8] Established: most elements of program in place.
Emerging: significant expansion of existing elements would be required.
New: no elements of program in place.

relatively low certainty but high efficiency and effectiveness because this represents vulnerabilities in the plan's ability to deliver projected results.

Appendix D – Investment Package – $1.8 million funding level

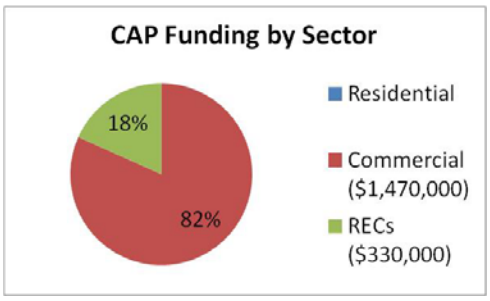
A number of investment packages were developed to extend the analysis beyond individual programs to cumulative outcomes and impacts from combining key programs. This appendix details the six specific investment packages.

Investment Package 1: High Greenhouse Gas Reductions

Description: This package represents a combination of actions to result in high GHG emissions reductions within the $1.8 million CAP tax funding limit. The biggest "bang for the buck" programs involve the commercial sector and hydroelectric RECs.

Associated Emissions Reduction:

Snapshot of Year 1: 3,300 mtCO2e
Snapshot of Year 5: 51,000 mtCO2e
Snapshot of Year 10: 177,000 mtCO2e
Quantification Certainty: Medium-high



Specific programs to be funded in the package (using annual, average CAP funding):

- Commercial Energy Efficiency Ordinance ($270,000)
- Commercial EnergySmart ($1,200,000)
- Hydroelectric RECs ($330,000)

Pros:

- High level of greenhouse gas reduction
- Energy cost savings for participants
- Participant cost savings
- Captures more existing, local, renewable hydroelectric generation

Cons:

- Does not include a residential component
- May be difficult to negotiate purchasing additional hydroelectric RECs

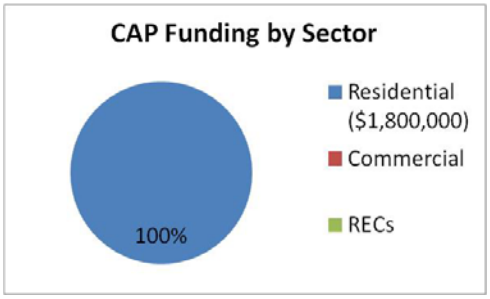
- Involves a large investment in RECs rather than long-term investments in energy efficiency measures

Investment Package 2: Residential Focus

Description: This package represents a combination of actions focused on residential programs and services, including a behavior change platform developed by city staff and enhancements and campaigns related to the existing EnergySmart Residential.

Associated Emissions Reduction:

Snapshot of Year 1: 1,600 mtCO2e
Snapshot of Year 5: 11,200 mtCO2e
Snapshot of Year 10: 22,000 mtCO2e
Quantification Certainty: Medium-high



Specific programs to be funded in the package (using annual, average CAP funding):

- Behavior change platform ($40,000)
- Residential EnergySmart ($1,760,000)

Pros:

- Participant cost savings with good simple payback periods
- Achieves greenhouse gas reductions beyond CAP period
- Residential accounts are the primary source of CAP funding and would receive the bulk of services under this package

Cons:

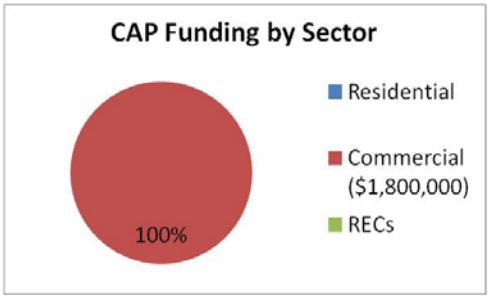
- Does not achieve maximum greenhouse gas reduction for funding level
- Does not include a commercial component
- Does not maintain existing residential SmartRegs program

Investment Package 3: Commercial Focus

Description: This package represents a combination of actions related to developing a Commercial Energy Efficiency Ordinance achieved in three phases, expanding the existing 10 for Change program, and enhancing the existing Commercial EnergySmart program.

Associated Emissions Reduction:

Snapshot of Year 1: 5,500 mtCO2e
Snapshot of Year 5: 48,000 mtCO2e
Snapshot of Year 10: 173,000 mtCO2e
Quantification Certainty: Medium



Specific programs to be funded in the package (using average annual CAP funding):

- Commercial Energy Efficiency Ordinance ($540,000)
- Commercial EnergySmart ($1,200,000)
- 10 for Change ($60,000)

Pros:

- Participant cost savings
- Achieves greenhouse gas reductions beyond CAP period
- Funding is focused on sector with largest emissions
- Largely builds on and consolidates existing programs toward a more unified delivery of services to commercial sector

Cons:

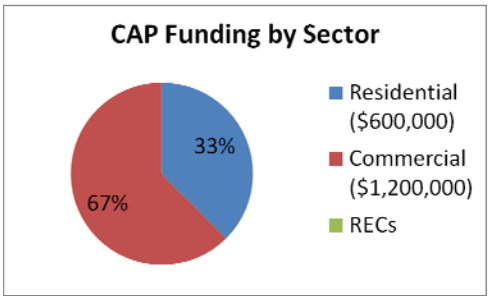
- Does not achieve maximum greenhouse gas reduction for funding level
- Does not include a residential component
- Does not including funding to maintain mandatory SmartRegs compliance program

Investment Package 4: Multiple Benefits

Description: This package represents a combination of actions with the highest combined ranking of all evaluation criteria considered: efficiency, effectiveness, equity, externalities and certainty. The programs are enhancements and campaigns related to the existing Commercial EnergySmart program and a residential behavior change platform developed by city staff.

Associated Emissions Reduction:

Snapshot of Year 1: 3,400 mtCO2e
Snapshot of Year 5: 29,000 mtCO2e
Snapshot of Year 10: 54,000 mtCO2e
Quantification Certainty: Medium



Specific programs to be funded in the package (using average annual CAP funding):

- Commercial EnergySmart ($1,200,000)
- Behavior Change Platform (Opower) ($275,000)
- Residential EnergySmart ($325,000)

Pros:

- Participant cost savings
- Includes both commercial and residential sector components

Cons:

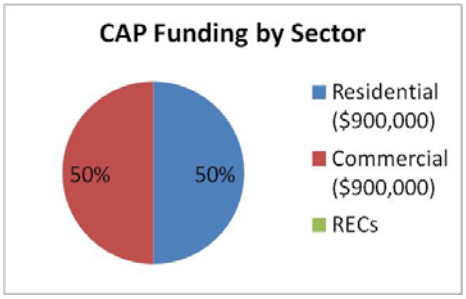
- Does not achieve maximum greenhouse gas reduction for funding level
- Focuses considerable funding on behavior change, which has uncertain persistence

Investment Package 5: Solar Focus

Description: This package models the impact if all of the available funding was used to invest in local solar PV installations.

Associated Emissions Reduction:

Snapshot of Year 1: 590 mtCO2e
Snapshot of Year 5: 3,100 mtCO2e
Snapshot of Year 10: 6,400 mtCO2e
Quantification Certainty: Medium-high



Specific programs to be funded in the package (using annual, average CAP funding):

- Solar photovoltaics ($1,800,000)

Pros:

- Greenhouse gas reductions beyond CAP period
- Participant cost savings
- Visibility

Cons:

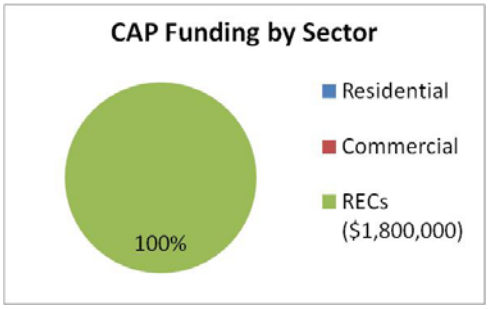
- Does not achieve maximum greenhouse gas reduction for funding level
- Relatively high cost per reduction due to large incentive required
- Payback periods on private savings exceed efficiency options
- If participants also take advantage of Xcel's Solar*Rewards program, all RECs will be purchased by Xcel

Investment Package 6: Renewable Energy Credits Focus

Description: This package models the impact if all of the available funding was used to purchase renewable energy credits (RECs).

Associated Emissions Reduction:

Snapshot of Year 1: 59,000 mtCO2e
Snapshot of Year 5: 77,000 mtCO2e
Snapshot of Year 10: 127,000 mtCO2e
Quantification Certainty: High



Specific programs to be funded in the package (using annual, average CAP funding):

- RECs ($1,800,000)

Pros:

- Ease
- Public familiarity
- Can include residential and commercial components

Cons:

- Does not achieve maximum greenhouse gas reduction for funding level
- No participant cost savings for residents or businesses
- RECs need to be purchased each year. There is no "cumulative" savings effect that is seen in on-site energy efficiency, solar investments, etc.