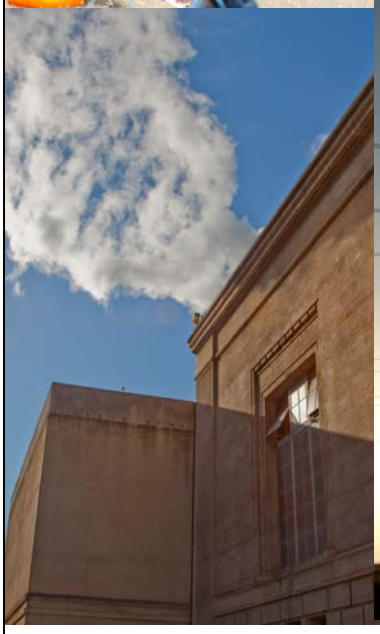
2009
CLIMATE ACTION PLAN

University of California, Berkeley



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Acknowledgements

The 2009 Climate Action Plan has been produced by the UC Berkeley Office of Sustainability.

Much of the background information and guiding principles contained in this document are from the *CalCAP Feasibility Study* that was finalized in 2007. This milestone document and the campus climate action pioneers who worked to produce it continue to contribute to campus climate action. A comprehensive listing of the contributors can be found in the *2007 CalCAP Feasibility Study*.

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UNIVERSITY OF CALIFORNIA, BERKELEY Office of Sustainability

Cal's Climate Action Partnership

Executive Summary

In the fall of 2007, the campus finalized UC Berkeley's first climate action plan, the *2007 CalCAP Feasibility Study*. This study met the current near-term requirement of the University of California *Policy on Sustainable Practices* for submittal of a climate action plan. The Office of Sustainability has subsequently produced this 2009 Climate Action Plan (Plan) – one reflective of the progress and lessons learned since the publication of the original plan.

The 2009 UC Berkeley Climate Action plan does not replace the *2007 CalCAP Feasibility Study*, but provides new and additional insights that have emerged as data is clarified, dialogue expands, and implementation advances.

UC Berkeley has taken the first steps toward carbon neutrality by setting an initial goal of reducing emissions to 1990 levels by 2014, faster than required by California law. The campus intends to set additional, interim targets to progressively lower emissions until climate neutrality is achieved.

The 2009 Climate Action Plan examines campus progress to date on climate action, discusses future strategies, and includes these notable elements:

- Presents and evaluates data on the campus 2009-2011 Strategic Energy Plan - the most noteworthy climate action advancement of the last year - that includes emission reduction projects and funding mechanisms that will help get the campus half way to our 2014 target
- Updates the 1990 emissions level baseline resulting from the most recent emissions inventory, putting the 2014 target at 162,000 metric tons of carbon dioxide equivalent (MTCO2e) - meaning the campus will need to reduce emissions by 61,000 MTCO2e to meet the target
- Identifies new potential projects and expands on financial strategies to accomplish the 2014 target – minimizing or eliminating the need to purchase renewable energy credits
- Expands the discussion on carbon neutrality
- Calls for the campus to set its next interim target for the year 2020 or 2025 in 2011, building upon several years of experience implementing the Strategic Energy Plan and a better understanding of potential advancements in international greenhouse gas emissions commitments
- Begins examination of equity and inclusion in climate action at UC Berkeley – how to develop a broader base of diverse stakeholders and incorporate principles of equity into planning and mitigation strategies.

In an effort to keep campus climate action planning current and to address the various issues that this Plan does not, the Office of Sustainability will produce an updated Climate Action Plan annually.

Introduction

The 2009 Climate Action Plan is a brief accounting of the campus' current progress towards meeting the 2014 emissions reduction goal, return to 1990 levels, while identifying and beginning to explore areas that still need deeper analysis and decision-making.

The 2009 Climate Action Plan includes:

- a summary of the recent achievements in campus climate action
- a review of the emissions inventory methodologies and a report on the results of the most recent inventory
- an update on the implementation status of identified mitigation projects
- an evaluation of the GHG emissions reduction potential and financial feasibility of new reductions projects that have been committed to by the campus
- an initial review of what new mitigation projects the campus might pursue to reach the 2014 target
- a summary of what CalCAP will do in the 2009 year to further campus progress in reaching climate neutrality
- an expanded discussion on the financial strategies and funding needed to meet the target
- an opportunity to explore new areas of importance such as equity and inclusion in climate action
- an outline of what still needs to be addressed in order to achieve the climate goals of the campus including setting the next interim target

Continuing engagement and evaluation by the CalCAP Steering Committee and the community at large will help ensure that that we meet our commitments to reduce campus climate impacts. This Plan is intended to assist in this process by documenting our progress to date, identifying what is still unknown, and framing next steps.

What is CalCAP

The Cal Climate Action Partnership (CalCAP), formed in 2006, is a collaboration of faculty, administration, staff, and students working to reduce greenhouse gas (GHG) emissions at UC Berkeley.

In 2007, the initial work of CalCAP led Chancellor Birgeneau to commit the campus to its **first greenhouse gas emissions reduction target: to reduce GHG emissions to 1990 levels by the year 2014.** This goal is six years earlier than State of California and the UC Policy on Sustainability Practices requires.

The Office of Sustainability, created in 2008, currently manages CalCAP activities in consultation with the CalCAP Steering Committee. CalCAP activities are guided by campus-identified strategies to meet its climate goals and UC's Policy on Sustainable Practices. CalCAP's work consists of understanding the campus carbon footprint through annual greenhouse gas inventories and planning and implementing strategies to reduce it.

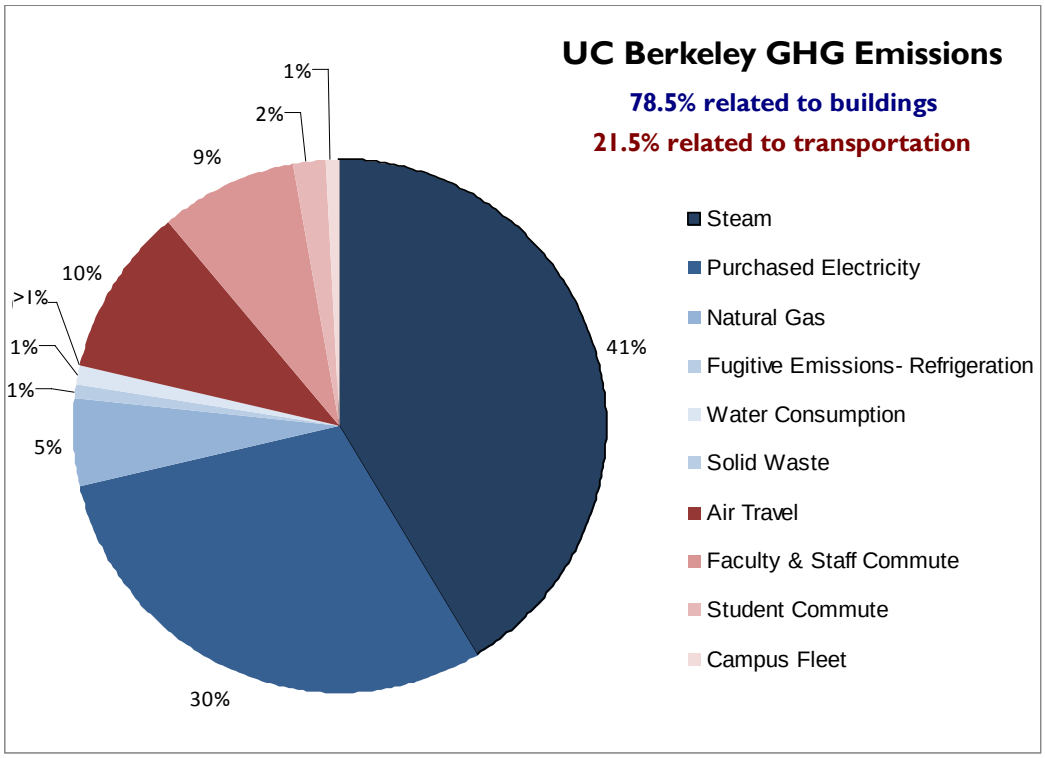
Greenhouse Gas Emissions Inventory

UC Berkeley reports on ten emissions sources that include:

1. electricity consumption
2. steam use
3. natural gas consumption
4. university fleet
5. student commuting
6. faculty and staff commuting
7. business air travel
8. fugitive emissions-coolants
9. solid waste
10. water use

The campus reports its GHG inventory annually to both the California Climate Action Registry (CCAR) and the American College and University Presidents Climate Commitment (ACUPCC) and makes it available to the public. Third party verification of the inventory is completed as part of the CCAR reporting process.

Greenhouse gas inventories reveal that electricity and steam usage account for over 70% of campus emissions and close to 80% of our emissions are associated with campus buildings. The majority of the remaining emissions come from campus related travel.



Climate Planning & Emissions Mitigation Strategies

CalCAP engages in on-going strategic planning and implementation of measures to reduce the campus carbon footprint. The *2007 CalCAP Feasibility Study* identified 14 initial GHG reduction projects. This Plan summarizes UC Berkeley's current emissions mitigation strategy by adding the energy efficiency GHG reduction projects committed to through the campus Strategic Energy Plan (SEP). The SEP projects, along with the original projects, are predicted to accomplish about half of what is needed to meet the 2014 target. All of the mitigation projects are evaluated using the same criteria of emissions reduction potential and financial feasibility (see Appendix B). The intention of the campus is to meet the GHG emissions reduction targets through investments on campus, using renewable energy credits (not offsets) only as a last measure.

CalCAP continues to plan strategies to meet the 2014 target, intending to set a series of additional interim targets until the campus reaches climate neutrality which is defined in the UC Policy on Sustainable Practices as reducing GHG emissions as much as possible through mitigation strategies so as to "have a net zero impact on the Earth's climate."

2008 Climate Action Achievements

In 2008 the campus employed various strategies to reduce greenhouse gas emissions, as the first part of its implementation phase for climate mitigation. The activities highlighted below have built a strong foundation for more improvements in the year to come.

Institutionalizing Climate Action

- The campus established the Office of Sustainability and hired a Director and new Sustainability Specialist. The Office reports to the Vice Chancellor of Administration with on-going interaction with the other two administrative leaders from the CalCAP Steering Committee: the Vice Provost-Academic Planning and Facilities and the Vice Chancellor of Facility Services
- Facilities Services has designated multiple sustainability personnel including the Assistant Director of Green Buildings, the Campus Energy Efficiency Manager and positions in Physical Plant-Campus Services. These staff are tasked with implementing the majority of CalCAP initiatives
- The Office of Sustainability produced the *2008 Campus Sustainability Assessment* - the second of what will become an annual report on progress toward sustainability goals. The report highlights progress UC Berkeley has made in addressing its carbon footprint, reducing water use and waste, and implementing numerous innovative projects by faculty, students and staff. The Assessment unveils an initial set of Sustainability Metrics to be used by the campus to monitor overall success.

Campus Greenhouse Gas Emission Inventory Activities

- In addition to the California Climate Action Registry, the campus and the UC System, as one of the charter signatories, began reporting our emissions inventory to the American College & University Presidents' Climate Commitment registry
- The 2007 emissions inventory reveals a minor increase in total GHG emissions relative to the 2006 inventory, but an improvement over projected business-as-usual emissions.

Campus Greenhouse Gas Emission Mitigation Activities

- The campus completed most of its 2006-2008 Higher Education Energy Efficiency Partnership projects, which are expected to reduce annual GHG emissions by about 4,500 metric tons
- The campus committed to joining the 2009-2011 Strategic Energy Plan. The currently identified suite of SEP projects are anticipated to accomplish about one-third of the emission reductions needed to meet the 2014 target
- Of the GHG emissions reduction projects currently identified by CalCAP (including SEP), 12 are in the early stages of implementation while the high priority bicycle plan projects are about 50% complete and the 2006-2008 Higher Education Energy Efficiency Projects are close to completion

- The Berkeley Institute for the Environment (BIE), in partnership with the Office of Sustainability, established the Carbon Footprint Calculator to help the campus community estimate their carbon footprint from air travel and make a charitable contribution to the Climate Action Fund to implement climate action projects
- Several campus projects have been awarded funding for emissions reducing projects. The Green Initiative Fund selected its first set of projects, including an energy dashboard pilot and several energy efficiency projects. The Bears Breaking Boundaries Contest funded a campus bikeshare program now underway, and Chancellor's Advisory Committee on Sustainability's Green Fund provided money for four energy efficiency related programs.

Climate Education & Outreach Activities

- Communications regarding campus climate action and sustainability are being expanded through improvements to the CalCAP website, the Office of Sustainability website and the Chancellor's Advisory Committee on Sustainability (CACS) website. The Office of Sustainability launched a newsletter, *Bright Green News*, and variety of additional outreach efforts are in the planning stages
- The Berkeley Institute for the Environment (BIE) launched an extensive environmental web based portal. The Portal is a content management system that allows faculty, staff, and student organizations to easily share information about their respective programs and provides up-to-date one-stop-shopping for environmental resources. The portal identifies 400 environmental courses, some 300 faculty, 86 academic degree programs, and dozens of research centers and campus groups working in the fields of environment and sustainability at UC Berkeley
- The campus held two significant events: UC Berkeley joined 1,500 institutions across the country to hold an all day Focus the Nation event to highlight global warming solutions, and CACS' 5th Annual Sustainability Summit drew a record 500+ crowd and included many sessions addressing climate
- Stakeholders continue to be engaged through the CalCAP Steering Committee (periodic meetings) and the Chancellor's Advisory Committee on Sustainability (monthly meetings)
- Student involvement continues to expand – with undergraduate and graduate courses and research focused on advancing campus climate neutrality, emerging renewable energy technology, growing sustainable practices through student audits and education in campus buildings, and student sustainability internship positions with various campus units.

Campus Greenhouse Gas Emissions (GHG) Inventory

Campus GHG Emissions Inventory Background

The following summarizes key aspects of the campus emissions inventory process that are detailed in the *2007 CalCAP Feasibility Study*. UC Berkeley's GHG emissions inventory analyzes emissions in three different categories:

***Scope I* – Direct Emissions**: natural gas, campus fleet, fugitive emissions from coolants
***Scope II* – Indirect Emissions (electricity):** purchased electricity, purchased steam
***Scope III* – Indirect Emissions (other):** business air travel, student commute, faculty/staff commute, solid waste, water consumption

The UC Berkeley inventory includes all six major greenhouse gases, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), HFC-13A, HFC – 404A, and sulfur hexafluoride (SF_6). The campus uses a greenhouse gas inventory calculator, developed by Clean Air-Cool Planet (CA-CP) specifically for universities, to calculate the six major gas emissions types into a common unit of measurement - metric tons of carbon dioxide equivalent (MTCO2e). The emissions factors used by California Climate Action Registry and CA-CP are those generally used by the campus, with the exception of electricity, steam and air travel that have been customized based on the data available to the campus and approved by a third party through the inventory verification process.

The geographic boundary for the inventory is generally defined as those buildings central to the University mission and under operational control of the campus. This includes central campus buildings, all student housing, and off-central campus facilities in the Bay area owned by the University including the Richmond Field Station. Emissions associated with electricity and gas use in buildings leased by the campus are not included in the inventory, as they are not in direct operational control of the campus, but transportation emissions associated with the occupants of these buildings are. As the campus boundaries adjust moving forward and the emissions inventory is refined, all of these changes will be reflected in the 1990 baseline. This structural change of significance standard is of particular importance as it relates to new purchases of real property to be occupied by the campus.

For the purpose of forecasting future emissions, the population and square footage growth factors in UC Berkeley's 2020 Long Range Development Plan are utilized. Similar factors are used to estimate emissions from 1990 to 2005 for sources without actual data for those years.

The campus reports its GHG inventory annually to both the California Climate Action Registry (CCAR) and the American College and University Presidents Climate Commitment (ACUPCC) and makes it available to the public. Third party verification of the inventory is completed as part of the CCAR reporting process; inventories for 2005 and 2006 have been successfully verified.

The campus emissions inventory is the basis for its 2014 emission reduction goal, but it is not fully reflective of the entire campus' carbon footprint. The inventory is only a subset of emissions, since it excludes the full lifecycle emissions associated with certain campus activities. The campus used lifecycle assessment tools developed on campus to analyze the additional emissions associated with procurement, construction, and elements of electricity use, showing the carbon footprint of the campus is actually much larger than what is reflected in the ten source inventory. Initially completed for 2005 and 2006, the campus will continue to examine the full lifecycle emissions from these and other sources in future years.

More information on data and emissions factors used in the UCB inventory will be maintained in a separate document that catalogs sources, assumptions, and changes in methodologies. This document will be available on the CalCAP website in 2009.

1990 GHG Emissions Levels & The 2014 Target

UC Berkeley's 1990 emissions levels (the baseline for our 2014 target) have changed slightly since the *2007 CalCAP Feasibility Study*, for the methodology reasons discussed below in the section on the 2007 inventory. Further refinements are anticipated to be minimal and the baseline should remain close to 162,000 MTCO2e – the target level of emissions for 2014.

Based on this current baseline, the campus will need to reduce emissions by 61,000 MTCO2e in order to achieve its target.

TABLE 1 – Current 2014 GHG Reduction Target

CURRENT GHG REDUCTION TARGET	
Refined Target Based on 2007 Inventory	
Year	**MTCO2e**
1990	162,000
Actual 2007	206,000
2014 - projection	223,000
2014 - target	162,000
Reduction Required	**61,000**

Based on 2007 inventory contained in document: CACP_2007_2.12.11.08

2007 GHG Emissions Inventory

The 2007 emissions inventory reveals a minor increase in total GHG emissions relative to the 2006 inventory, but an improvement over projected business-as-usual emissions. This slight downward movement from the projection – seen mostly in electricity and natural gas usage - may be attributable to implemented energy efficiency projects and conservation measures at

Richmond Field Station and in campus housing. There were some minor methodological changes and data changes in the 2007 inventory that have also slightly adjusted data from previous years back to 1990. The most notable adjustments include:

FLEET: The increase in this emissions source is due to more accurate calculation by fleet staff of emissions from light duty trucks and the addition of campus shuttle emissions that had been excluded from previous inventories.

REFRIGERANTS: Actual data for 2005, 2006, and 2007 is now available. The three years of data has been averaged and this average number used to determine both the 1990 and the 2014 levels of emissions. A growth factor has not been applied to the projections as refrigerant leaks do not correlate as directly to population or square footage growth as other sources.

AIR TRAVEL: Air travel emissions have reduced due to improved accuracy in the calculation. An overestimate was discovered in the 2005 data that had made estimates high.

TABLE 2 – GHG Emission Inventories: 1990, 2006, & 2007

Emissions Sources	1990	2006	2007	2007 Inventory Percentage Contribution
Steam	67,114	81,187	85,436	41.5%
Purchased Electricity	38,985	64,127	61,443	29.8%
Air Travel	20,307	20,474	20,998	10.2%
Faculty & Staff Commute	17,608	17,096	17,433	8.5%
Natural Gas	8,105	12,647	10,470	5.1%
Student Commute	4,053	3,735	3,736	1.8%
Fugitive Emissions- Refrigeration	1,947	1,775	1,791	0.9%
Water Consumption	1,528	1,964	1,955	0.9%
Solid Waste	958	933	981	0.5%
Campus Fleet	1,313	1,821	1,751	0.9%
Total Emissions	161,918	205,759	205,994	100%

Based on 2007 inventory contained in document: CACP_2007_2.12.11.08

2009 Action Items for the GHG Emissions Inventory

- The 2008 inventory calculation process began in January 2009. Once completed, the inventory will be reported to both the CCAR and the ACUPCC
- Third party verification of 2007 and 2008 emissions will be completed
- Emissions inventories back to 1990 will be reported through the ACUPCC
- Documentation of inventory sources, data, changes, and assumptions will be expanded and made public on the CalCAP website

- Additional research on data and emissions factors related to air travel will be completed as part of the 2008 inventory calculations, and used to make any necessary adjustments to previous annual inventories
- Calculations of the lifecycle emissions from procurement, construction, and electricity (and potentially additional areas) will be further examined
- CalCAP staff will work with Physical and Environmental Planning to align emissions inventories and climate planning with the environmental impact review process
- An evaluation will be conducted on the possibility of changing the inventory boundary to include all emissions associated with leased space utilized by the campus
- A mechanism will be developed to track individual buildings included in the inventory boundary (as buildings are built, bought, or sold)

Campus Greenhouse Gas Emissions Mitigation Scenarios

The campus is committed to reducing GHG emissions to 1990 levels by 2014, an estimated 61,000 MTCO2e. This section describes scenarios that show how the campus can meet the target.

Initial Mitigation Scenario for Achieving 2014 Target

The *2007 CalCAP Feasibility Study* examined the GHG emission sources for campus and identified 14 initial reduction projects. The study evaluated these projects for emissions reduction potential, as well as financial feasibility with a simple payback of four years or less. These projects fall into two general categories – infrastructure (mostly energy efficiency) and behavioral (encourage individuals to conserve energy). The identified projects had an estimated capital cost of approximately $14 million and were anticipated to accomplish about 12,000 MTCO2e in reductions. These projects were further anticipated to have annual energy cost savings of approximately $4.6 million annually. This initial mitigation reduction scenario also assumed a purchase in 2014 of around $2.6 million in Renewable Energy Credits (RECs) or offsets to meet the target.

Current Mitigation Scenario for Achieving 2014 Target

Over the last year, the campus has expanded its implementation plans and committed to additional energy efficiency GHG reduction projects through a Strategic Energy Plan (SEP). The SEP expands on the 2006-2008 energy efficiency work and is another effort to advance energy efficiency at each of the campuses served by California's four large utilities.

The **2006-2008 Energy Efficiency Partnership** projects will be completed during the first half of the 2009 year. The Partnership focused on building retrofits to reduce energy use. Outcomes and lessons learned from the Partnership include:

- HVAC retrofits focused on reducing ventilation in buildings with excessive air flows. Smaller-sized motors and variable frequency drives were installed, and building systems re-balanced, resulting in energy use reduction and improved occupant comfort (temperature and noise)
- Paybacks for lighting turned out to be longer than HVAC retrofits, as the campus completed a 6-year, $6M lighting efficiency upgrade for the whole campus in the early 1990s. New technologies, though, have still allowed further lighting efficiency
- Steam Trap replacement resulted in about 80K therms of steam saved in the last year
- Monitoring based retro-commissioning of existing buildings resulted in much shorter paybacks than anticipated, typically less than two years, as many opportunities to improve the operation of building systems emerged. Total electrical and gas energy use reduction is ranging from 9 to 30 % in the commissioned buildings.

TABLE 3 – 2006-2008 Energy Efficiency Partnership

- UC/CSU & Investor Owned Utilities (IOU) Program
  - Electric & gas incentives for retrofit & monitoring based commissioning projects
- 20 Campus projects
- Total Project Cost: $4 million
  - Rebate: $1.8 million from PG&E
- Annual Purchased Utilities Savings
  - 9M kWh and 280K therms per year
  - Approximately $900,000/year
  - 2.5 year payback
- Greenhouse Gas Emissions
  - With these projects, estimated annual GHG reduction is 4,500 MTCO2e
- Lighting Retrofit
  - T12 toT8 fluorescent conversion, compact fluorescent, occupancy, time & wireless controls, bi-level stairwell fixtures, integrated classroom lighting system in 43 buildings
- HVAC System Retrofit
  - Ventilation reduction in 3 buildings
  - Variable Air Ventilation Fume hood conversion
  - Steam trap replacement
  - Renovations: library & server room cooling, mechanical system
- Monitoring Based Commissioning
  - Cooling, heating, ventilation, control systems measures in 5 buildings

Based on information as of January 2009

The **Strategic Energy Plan** employs four key strategies to meet its goals: energy efficiency retrofits, monitoring based commissioning, emerging technology demonstrations, and training and education. The SEP focuses primarily on 200 energy efficiency retrofit projects in campus buildings over 50,000 square feet. Like the previous partnership, the projects largely consist of lighting, HVAC and commissioning measures. The SEP though includes some additional opportunities including:

- Energy efficiency measures in new construction and renovated buildings based on the projected campus 5-year state and non-state funded capital programs (new construction, renovation and deferred maintenance/capital renewal)
- Refrigerator and CRT monitor replacement program
- Use of computer power management systems for networked computers.

Criteria for selection of the current set of SEP projects at UC Berkeley is based on achieving cost-effective savings in electricity and natural gas usage on projects achieving a simple payback of 10 years or less along with other factors. 23K MTCO2e is the expected reduction from SEP projects. There is still some uncertainty in this reduction, as the initial project studies were

based on standard efficiencies related to square footage and do not take into account unique details of individual buildings.

TABLE 4 – 2009-2011 Strategic Energy Partnership

- Almost 200 New Energy Efficiency Projects Planned
- Total Cost: $25 million
  - Rebate: $9 million from PG&E (remaining $16M debt financed)
- Budget Savings
  - $3M annually after loan payments
- Greenhouse Gas Emissions
  - Anticipated reduction of 23,000 MTCO2e
- Building Performance
  - Better learning and working environments

Based on information as of January 2009

The current mitigation scenario below in Table 5 includes the 2006-08 energy efficiency partnership projects and the 2009-2011 SEP projects. The emissions reductions associated with these projects are planning estimates – with the completion of 2006-08 partnership and initial implementation of the SEP, a more accurate reduction potential will emerge.

The current mitigation scenario list now contains 17 project categories, with a capital cost of approximately $22.5 million, and is anticipated to accomplish about 32,500 of the 61,000 metric tons of the CO_2 equivalent reduction goal (see Appendix B for project financial analysis). This current mitigation scenario would still require a one-time purchase of $1.5 million in RECs, though the intention is to meet the 2014 target through investments on campus. The CalCAP Steering Committee is therefore continuing to develop additional projects and scenarios to bridge this gap.

TABLE 5 – Current Mitigation Scenario

Infrastructure Projects

Project	Category	Implementation Status	Annual GHG Reduction Potential (MTCO2e)
Water : Install new technologies or retrofit current infrastructure for higher levels of water conservation in university restrooms.	energy efficiency	**Partial.** Some mprovements have been made when re-models are performed.	313
SEP - Computer: Energy Star Setting and active sleep/standby mode management for 8,000 compatible computers and replace 320 CRT monitors with LCD monitors.	energy efficiency	**Partial.** Campus is piloting the power management on 1,200 computers. The remaining aspects of the project will be implemented between 2009 and 2011.	515
SEP - Monitoring-Based Commissioning (MBCx): Install networked building meters to automatically track electricity, steam, hot water, chilled water and/or natural gas use. Includes whole system review of building operations, the functionality of controls, the appropriateness of sequences of operations, time scheduling, and numerous other building operation parameters.	energy efficiency	**Partial.** Initial project planning has been completed; projects will be implemented between 2009 and 2011.	7,077
SEP - HVAC Projects: Variable air volume with economizers, direct digital controls, demand control ventilation, static pressure reset, fume hoods, kitchen hoods, chillers, boilers, and steam traps.	energy efficiency	**Partial.** Initial project planning has been completed; projects will be implemented between 2009 and 2011.	11,050
SEP - Energy Efficiencies in New/Retrofit Building Projects: Integrate energy efficiency with new construction and renovation of campus facilities. This is currently implemented through the Savings By Design process administered PG&E.	energy efficiency	**Partial.** Initial project planning has been completed; projects will be implemented between 2009 and 2011.	2,200
SEP - Energy Star Equipment and Other: 300 refrigerator replacements with energy star equipment and swimming pool covers.	energy efficiency	**Partial.** Initial project planning has been completed; projects will be implemented between 2009 and 2011.	382
SEP - Lighting: Installation of high frequency efficient ballast in fluorescent lighting fixtures and a variety of lighting controls to reduce operating hours of lighting systems. Lighting controls include motion sensing, light sensing and wireless based control technologies. Daylighting where feasible.	energy efficiency	**Partial.** Initial project planning has been completed; projects will be implemented between 2009 and 2011.	1,842
2006-2008 Partnership: Lighting retrofits and controls, steam trap repair, fume hood and HVAC retrofits; monitoring based commissioning; computer power management/monitor replacement.	energy efficiency	**Partial.** Projects will be complete in first part of 2009.	4,426
Capital Projects - Perform survey of CoGen plant steam capture and repair.	Steam	**Partial.** Steam trap repair done under 2006-08 partnership, accomplishing about 80K therms or 424 MTCO2e in savings.	632
Capital Projects - Install on-site PV System: ~7612 kW maximum capacity unit system, based on rough quote from MMA Renewable for power purchase agreement at $0.12/KWh). Estimation based on roof space	renewable - solar	**Partial.** Research on Power Purchase Agreement and potential siting underway.	1,441
			29,877

Behavioral Projects

Specific Project	Category	Implementation Status	Annual GHG Reduction Potential (MTCO2e)
Fleet - Introduce Fleet Biking	Fleet	**No.** Project has not been implemented yet.	3
Fleet - Expand electric vehicle fleet	Fleet	**Partial.** Additional electric vehicles added through department initiated requests -18 electric vehicles now in fleet.	17
Commute - Implement High Priority Bicycle Plan Projects & Programs.	Commuting	**Partial.** More than 50% of projects implemented.	123
Education - Department Level Energy Reduction Effort	Energy Efficiency	**Partial.** Green Department certifications are being developed.	500
Campus Behavior: Increasing occupant awareness and electricity curtailment.	Energy Efficiency	**Partial.** Building Sustainability at Cal and internship efforts in over 10 campus buildings.	1,625
Air Travel - Increase utilization of videoconference rooms	Air Travel	**Partial.** Part of green event certification being developed.	114
Campus Behavior - Introduce Campus Composting program	Solid waste	**No.** Financing yet to be identified.	294
			2,677
TOTAL GHG Reduction Potential			**32,553**

Additional Mitigation Scenario for Achieving the 2014 Target

The campus is committed to meeting the 2014 emissions reduction target through campus investment reducing or eliminating the need to purchase renewable energy credits. To do this, the following strategies have been identified – some under the direct control of campus, some provided by others. At this time there has been no formal analysis of these options – in the upcoming year these options will be further explored.

TABLE 6 – Additional Mitigation Scenario

Emissions Reduction Project	Emissions Reduction Potential (MTCO2e)	Direct Campus Control	Indirect Paths
Energy Efficiency: 0 to 10% more energy efficiency achieved in buildings	1,000 to 3,000	Through the 2011-2014 SEP program, implement additional projects	
Energy Efficiency: Steam Delivery System and Plant Improvements	0 to 10,000	Through the 2011-2014 SEP program, implement steam delivery system improvement projects. Implement improvements to plant equipment and operations	
Energy Efficiency: Improvements in laboratories (1-2% energy savings)	1,000 to 2,000	Through the 2011-2014 SEP program, implement steam delivery system improvement projects. Implement improvements to plant equipment and operations	
Building Program: Slower campus building program	2,000 to 6,000	For financial or programmatic reasons the campus could choose to slow the additions of square footage to the campus	
Renewable Sources: Wind power installations on campus and UC system-wide 200 MW installation	0 to 10,000	Preliminary review indicates that wind may be feasible in campus hills or at Richmond Field Station	System-wide installation of a large facility would be initiated by UCOP and supported by campuses
Renewable Sources: Improved PG&E use of non-carbon based fuels	2,000 to 5,000		PG&E has been expanding use of non-carbon based fuels annually. Continuing on a similar trajectory between now and 2014, these additional reductions could be achieved
Fleet: replace older fleet vehicles with more fuel efficient vehicles such as hybrids	0 to 500	Between 2005 and 2008 Fleet has been increasing the fuel efficiency of the fleet. Continuing on a similar trajectory between now and 2014, these additional reductions could be achieved	
Commute: decrease faculty and staff drive alone rate	0 to 500	Between 2001 and 2006 faculty and staff drive alone rate decreased while public transit use and carpooling increased. Continuing on a similar trajectory between now and 2014, these additional reductions could be achieved	
Air Travel: reduce the number of business air travel trips	0 to 500	Resulting from financial constraints and travel policy restrictions air travel could be reduced between now and 2014	
TOTAL NEW SCENARIOS	**6,000 to 37,500**		
TOTAL 2008 - 2009 SCENARIOS	**32,500**		
TOTAL ALL SCENARIOS	**38,500 to 70,000**		

2009 Mitigation Action Items

- Further analyze and develop the potential of the above scenarios for achieving the 2014 target, with specific attention to those in direct control of the campus and the potential for a system-wide installation of renewable energy that could provide up to 20MW of power to the UC Berkeley campus; determine which of these projects will be implemented
- Begin a more thorough review and analysis of the Steam Plant by Facilities Services
- Work with various campus units to further define emissions reduction goals and strategies in their areas of responsibility
- Complete 2006-2008 energy efficiency projects
- Implement first year of SEP projects – includes projects in at least 13 buildings, expands the computer efficiency program, funds a refrigerator replacement program, and provides a contingency for newly identified projects
- Continue to look for additional SEP projects in smaller campus buildings not currently included in the program
- Implement energy efficiency education programs for inhabitants in the first year SEP building projects, to potentially achieve an additional 3% to 5% energy savings in those buildings
- Implement Green Department certification initiative, and further explore options to provide incentives for groups and individuals to adopt energy-saving practices
- Advance the solar power initiative on campus through a power purchase agreement or some other mechanism and further research wind potential
- Continue to advocate for the UC system-wide installation of a large renewables facility on UC owned land
- Reduce fuel usage of fleet through more electric vehicle purchase options via the State Vehicle Contract
- Complete the funded portions of the high priority bicycle projects
- Through better understanding of air travel and the purposes of trips, identify additional viable alternatives for certain types of business travel
- Identify new opportunities for collaboration with other agencies such as the City of Berkeley
- Continue to evaluate the efficacy and value of projects in meeting goals and identify new projects

Funding Scenarios for Achieving the Target

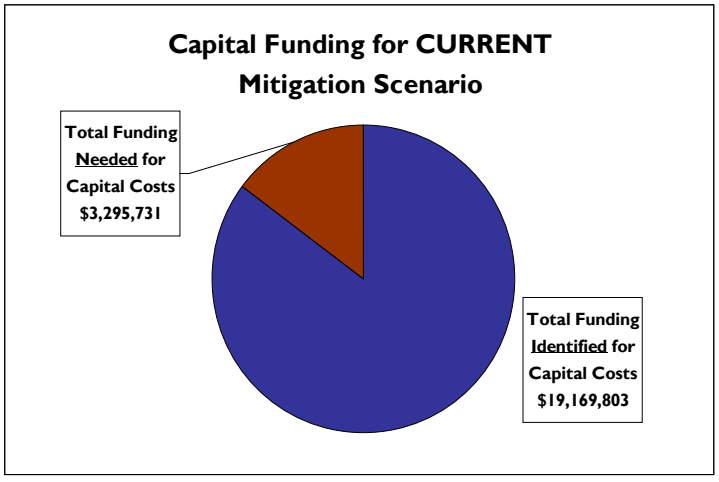
Implementing emissions reductions strategies requires millions of dollars annually for initial costs, even when those strategies ultimately reduce overall expenses through energy savings. This financial obligation is extremely challenging for the campus as it faces budget cuts and a utility bill that annually exceeds what is allocated to pay it. Though challenging, the campus is employing a variety of successful financial strategies to meet the emissions reduction target.

Current Funding Scenario for Achieving the 2014 Target

The most significant source of funding identified to date is the 2009-2011 Strategic Energy Efficiency Partnership and its predecessor, the 2006-2008 partnership. These projects will cost about $25.5 million dollars – about $9 million will be paid for by incentives through Pacific, Gas & Electric with the remaining costs funded through a 15-year loan coordinated through UC Office of the President. Other funding sources include:

- The Climate Action Fund – BIE, in partnership with the Office of Sustainability, established the Carbon Footprint Calculator to help the campus community estimate their carbon footprint from air travel and make a charitable contribution to this fund for climate action projects on campus
- Campus Grants –The Green Initiative Fund (TGIF) and the CACS Green Fund have provided funding for CalCAP related interns and projects
- The campus is institutionalizing climate action projects and programs as more departments/units are budgeting for sustainable practices that are part of their operation
- Discretionary funds from Vice Chancellors are being requested by operational departments through the annual budget cycle to fund climate action projects
- Funding for initiatives outside of the annual budget process are being funded by Vice Chancellor's Administrative Council (VCAC) allocations.

Resulting primarily from the SEP, about 86% of the capital money needed to complete the current mitigation projects has been identified. The capital costs for the water, composting, transportation, and education projects remain largely unfunded. Though some operational or on-going costs associated with current mitigation projects have been included in the project analysis, they may be under estimated and need further vetting. Funding for these project operations has yet to be identified. (See Appendix B for additional financial analysis).



Based on information as of January 2009

Additional Funding Scenario for Achieving the 2014 Target

- Energy Efficiency Projects: The campus may have opportunities in the future through the SEP to identify additional projects, taking advantage of both utility provided incentives and favorable financing. This could likely be a source for some of the potential energy efficiency projects framed in the previous section. It is less clear how improvements to the steam plant might be funded at this time.
- Renewable Energy Projects: The capital expenses associated with these projects could potentially be funded through power purchase agreements (PPA) with a third party. Traditionally under this type of agreement, the campus would have to commit to purchase the power generated over a 20 to 25 year period at a pre-negotiated rate. Power generated from renewable sources may cost more than purchased electricity from the utility provider, but the rate will be guaranteed over the time period of the agreement. Variations on the power purchase agreement could be explored that could prove more beneficial for the campus than the typical PPA
- Commute and Fleet Projects: These projects are likely to be funded by the units that operate the programs and by the customers that use their services. Potentially, grant sources and requests through the budget process could supplement the associated costs
- Other Project Types: Slowing building growth and reducing air travel could result from financial constraints related to the economic downturn. The campus could enhance this result by policy decisions, such as ones in place already restricting some business travel for campus staff.

2009 Funding Action Items

- Continue to develop energy efficiency projects that could be funded by SEP – additional projects are likely to emerge as monitoring-based commissioning of buildings begins in 2009
- Do more research and analysis on the financial and contractual feasibility of efficiency improvements to the steam plant
- Further evaluate the true operational costs associated with the mitigation strategies
- Work with BIE to market the Climate Action Fund to a broader audience
- Apply for TGIF and the CACS Green Fund grants to support student internships and projects
- Research and pursue grants and funding from new outside sources and partnerships
- Expand opportunities for funding through donors by exploring new options with alumni and working with the Development office to potentially fold a green component into the current campus campaign.

Climate Education & Outreach

In 2008 the campus educational and communications efforts continued to expand – from the development of several sustainability related websites, to multiple new internship opportunities and expanded courses and field work for students. See above section on 2008 Climate Action Achievements for more detail.

2009 Climate Education & Outreach Action Items

- Building Sustainability at Cal - A student-led program and class that trains and utilizes students to help reduce the environmental footprint of buildings by educating building inhabitants and identifying structural and operational changes will continue in spring 2009 and is anticipated to be funded again during the next academic year. During 2009 the program will work more closely with the Office of Sustainability to align project priorities
- The Green Campus Program – Another student led program and class focusing on educating faculty, staff and students about energy efficiency to achieve savings is anticipated to continue its work in the upcoming year
- Residential and Student Services Program offers a variety of student-led energy efficiency programs in the housing facilities – these programs will continue with potential expansion in 2009
- Current CACS and TGIF student internships will continue, and the Office of Sustainability and other groups will seek additional CalCAP related internship position opportunities in the 2009-10 grant funding cycles
- CalCAP project and policy related independent studies will continue, with the potential for another student run class
- Berkeley Institute of the Environment (BIE) will continue researching and identifying sustainability curriculum programs for the campus, and Berkeley's University Extension will be offering several new climate action related courses
- The Office of Sustainability, Facilities Services and a student intern will launch an energy and water conservation campaign for the campus in response to the Chancellor's call to save money by reducing the campus utility costs
- The Office of Sustainability will continue to expand web communication, produce newsletters, and provide more targeted outreach to the campus and community.

Climate Neutrality

As a signatory to the ACUPCC, UC Berkeley is committed to achieving "climate neutrality as soon as possible." Climate neutrality, as defined in the *UC Policy on Sustainable Practices* (March 22, 2007), "means that the University will have a net zero impact on the Earth's climate, and will be achieved by minimizing GHG emissions as much as possible and using carbon offsets or other measures to mitigate the remaining GHG emissions."

UC Berkeley has taken the first steps toward neutrality by setting an initial goal of reducing emissions to 1990 levels by 2014, faster than required by California law. The campus intends to set additional, interim targets to progressively lower emissions until climate neutrality is achieved.

The next interim target is anticipated to be set in 2011 for the year 2020 or 2025, following several years of experience implementing the Strategic Energy Plan and having a clearer sense of international climate commitments.

UC Berkeley will take two general approaches to achieving climate neutrality and emissions reductions. Direct actions will be those that reduce energy usage on campus and through campus-related activities. These actions are at the heart of this 2009 Climate Action Plan. Over time, though, the actions of others will indirectly move us closer to climate neutrality, by reducing the carbon intensity of purchased energy and providing more efficient or lower carbon options. For example, at the same time that the campus is reducing its electricity usage and possibly installing renewable energy generation on campus, Pacific, Gas & Electric will be complying with the state renewable energy portfolio standard and increasing its use of lower carbon sources. The latter will impact the campus emissions inventory through a lower emissions factor. Additional indirect activities that can move the campus towards carbon neutrality include advancement and deployment of new technologies and regional and national policy and funding for development of infrastructure for cleaner energy delivery.

Two student members of CalCAP completed a report outlining some strategies that might enable UC Berkeley to move closer to climate neutrality, including additional energy efficiency and renewables measures and policy recommendations. This report can be found on the CalCAP website. CalCAP will review the key findings of this report during 2009 year - along with other strategies – in the effort to set the next interim target and eventual climate neutrality.

TABLE 7 – Climate Neutrality - Potential Actions by Emission Source

Emissions Source	% of Total (2007)	Direct Actions	Indirect Paths
Purchased electricity	30%	• Decrease energy usage in existing buildings (infrastructure) • Make new buildings more energy efficient than average • Decrease energy usage in all buildings (behavior) • Increase use of renewable energy sources on campus	• Purchase lower-carbon electricity (utilities change power mix)
Purchased steam	41%	• Decrease energy usage in existing buildings (infrastructure) • Make new buildings more energy efficient than average • Decrease energy usage in all buildings (behavior) • Maintain/improve distribution system	• Utility switches to a lower carbon fuel for co-generation
Natural gas	5%	• Decrease energy usage in existing buildings (infrastructure) • Make new buildings more energy efficient than average • Decrease energy usage in all buildings (behavior)	• Switch to a lower carbon fuel
Campus fleet	>1%	• Reduce number of vehicles in fleet • Drive fewer miles • Increase fuel efficiency/switch to alternative fuel vehicles	• More efficient/better alternative fuel vehicles are developed
Student commute	2%	• Decrease drive alone rate	• More efficient/better alternative fuel vehicles are developed
Faculty/staff commute	8%	• Decrease drive alone rate	• More efficient/better alternative fuel vehicles are developed
Air travel	10%	• Decrease miles travelled	• More efficient planes are developed
Waste disposal	>1%	• Divert more waste	• Landfill recovers more methane
Refrigerants	>1%	• Fewer fugitive emissions • Use of non-GHG refrigerants	• Development of more non-GHG refrigerants
Water supply	>1%	• Use less water	• Lower carbon electricity used to transport water

Equity, Inclusion & Climate Action

Equity and inclusion are a high priority for the campus – how these values and goals can be further expressed in campus climate action will be explored by the CalCAP Steering Committee in the upcoming year. While equity and inclusion are not absent from climate planning and implementation today, leadership and a defined framework will yield more comprehensive and transparent outcomes. Some areas for consideration include:

- How can CalCAP build a more diverse and multi-disciplinary stakeholder group of faculty, staff, and students?
- In what ways does a more inclusive set of active stakeholders create a more effective and innovative greenhouse gas reduction program?
- By evaluating emissions mitigation strategies with attention to issues of equity, how might the planning and implementation of infrastructure and behavioral emission reduction projects be adjusted or enhanced?
- What are the synergies between equity and inclusion goals and climate action goals and how do these crossovers advance a campus culture of sustainability?

2009 Equity & Inclusion Action Items

- Identify and invite additional members to join the CalCAP Steering Committee that can provide new perspectives and guidance on this issue
- Meet with the Vice Chancellor for Equity & Inclusion's office and other experts and stakeholders to review and get guidance on the considerations above
- Explore ways to work with the City of Berkeley and the Berkeley Unified School District
- Begin to develop a framework and actionable items related to equity and inclusion in the CalCAP program

Appendix A

CalCAP Steering Committee Members (2008-2009)	
Administration	
Brostrom, Nathan	Vice Chancellor, Administration
Denton, Ed	Vice Chancellor, Facilities Services
Koshland, Cathy - CHAIR	Vice-Provost, Academic Planning and Facilities
Yeary, Frank	Vice Chancellor, Chancellor's Immediate Office
Faculty and Researchers	
Arens, Ed	Professor, Environmental Design, Center for Built Environment
Cohen, Ron	Professor, Department of Chemistry
Horvath, Arpad	Assistant Professor, Civil Engineering; Director, Consortium on Green Design and Manufacturing
Jones, Chris	Staff Research Associate, Berkeley Institute of the Environment
Kammen, Dan	Professor, Energy and Resources Group and Goldman School of Public Policy
Madanat, Samer	Professor, Civil Engineering; Director, Institute of Transportation Studies
McGrath, Dan	Executive Director, Berkeley Institute of the Environment
Nazaroff, William	Chair, Energy and Resources Group; Professor, Civil Engineering
Payne, Cymie	Associate Director, California Center for Environmental Law and Policy (Boalt); Lecturer, Boalt Hall
Rosen, Christine	Associate Professor, Haas Business School
Smith, Kirk	Professor, Environmental Health Sciences, School of Public Health
Organizations	
Burroughs, Timothy	Climate Action Coordinator, City of Berkeley
Kelly, Tom	KyotoUSA
Selkowitz, Stephan	LBNL, Department Head, Environmental Energy Technologies Division
St. Clair, Matthew	Sustainability Manager, UCOP
VanUlden, Dirk	Associate Director, Energy and Utility Services, UCOP
Staff	
Abesamis, Raul	Utilities Engineer, PPCS, Facilities Services
Bauer, Lisa	Manager, Campus Recycling and Refuse Services, Facilities Services
Chang, Cecilia	Principal Budget Analyst, Budget Office
Chess, Judy	Assistant Director of Green Buildings, Capital Projects, Facilities Services
Duvall, La Dawn	Designee for Scott Biddy-Vice Chancellor, University Relations
Escobar, Gilbert	Utilities Engineering Manager, PPCS, Facilities Services
Freiberg, Mark	Director, Office of Environment, Health & Safety
Haet, Greg	Associate Director, Environmental Protection, Office of Environment, Health & Safety
MacArdle, Patrick	Energy Efficiency Manager, Facilities Services
Marthinsen, Emily	Assistant Vice Chancellor, Physical & Environmental Planning, Facilities Services
McNeilly, Lisa	Director of Sustainability, Office of Sustainability
Nathe, Sarah	Chief of Staff, Vice Academic Planning and Facilities
Persyk, Eli	Designee for Sam Davis - Acting Dean, College of Environmental Design
Robinson, Eric	Manager, Fleet Services
Satz, Kathleen	Director, Strategic Planning and Communications, Administration
Shaff, Christine	Communications Manager, Facilities Services
Stoll, Kira	Sustainability Specialist, Office of Sustainability
Students	
Borgeson, Sam	Master's Candidate, Center for Environmental Design
Kunkel, Cathy	PhD candidate, ERG
Hepworth, Ian	Master's Candidate, Haas Business School
Oatfield, Christina	Undergraduate, ASUC Sustainability Team Coordinator
Ortega Hinojosa, Alberto	External Affairs Vice President, Graduate Assembly
Payne McKanna, Kelley	Undergraduate, CACS Co-Chair, CalCAP Course Coordinator

Appendix B: CalCAP Current Mitigation Projects–Financial Analysis

Current CalCAP Projects for Greenhouse Gas Emissions Reduction at UC Berkeley

Infrastructure Projects

Project	Category	Annual Financing Expense (SEP: 15 year bonds at 6.5% interest rate)	Annual Operating Expenses (including FTE & Other Costs)	Capital Cost (less SEP incentives where applicable)	Annual Net Savings/Cost (includes annual operations, maintenance & financing expenses)	Simple Payback (years)	Total Years in Project	Total Net Present Value (NPV)	Annual GHG Reduction Potential (MTCO2e)
Water : Less energy use through better water conservation technology (SCALABLE)	energy efficiency		$ -	$ 1,142,000	$ (298,000)	3.8	**8**	$ (711,000)	313
SEP & Other Computer: Install Energy Star (EPA) computer settings & 320 CRT Monitors Replaced with LCD. (SCALABLE)	energy efficiency	$ 11,000	$ -	$ 243,000	$ (131,000)	1.9	**15**	$ (1,031,000)	515
SEP - Monitoring based commissioning (SCALABLE)	energy efficiency	$ 503,305	$ -	$ 4,732,000	$ (833,000)	5.7	**15**	$ (3,356,000)	7,077
SEP - HVAC Projects (SCALABLE)	energy efficiency	$ 347,022		$ 3,263,000	$ (1,678,000)	1.9	**15**	$ (13,030,000)	11,050
SEP - Energy Efficiencies in New/Retrofit Building Projects (SCALABLE)	energy efficiency	$ 365,273	$ -	$ 3,435,000	$ (102,000)	33.8	**15**	$ 2,448,000	2,200
SEP - Energy Star Equipment and Other Miscellaneous Projects (SCALABLE)	energy efficiency	$ 18,898	$ -	$ 178,000	$ (63,000)	2.8	**15**	$ (436,000)	382
SEP - Retrofit Fluorescent Lighting, Install Automated Lighting Controls and Daylighting (SCALABLE)	energy efficiency	$ 522,644	$ -	$ 4,914,000	$ 15,000	n/a	**15**	$ 5,057,000	1,842
2006-2008 Partnership – Fluorescent lighting retrofits and lighting controls (SCALABLE)	energy efficiency		$ -	$ 2,205,000	$ (882,000)	2.5	**15**	$ (6,358,000)	4,426
Capital Projects - Perform survey of CoGen plant steam capture and repair (SCALABLE)	Steam		$ 6,000	$ 50,000	$ (50,000)	1.0	**15**	$ (436,000)	632
Capital Projects - Install on-site PV System (Based on Quote from MMA Renewable Ventures) - SCALABLE	renewable -solar		$ 581,000	$ -	$ 150,000	n/a	**50**	$ 2,366,000	1,441
Infrastructure Projects		**Total Annual Financing Expense**	**Total Annual Operating Expenses**	**Total Capital Cost to Campus**	**Total Annual Net Savings/Cost**			**Total Net Present Value**	**Total Annual GHG Reduction Potential (MTCO2e)**
		$ 1,767,957	**$ 587,000**	**$ 20,162,000**	**$ (3,872,000)**			**$ (15,488,000)**	**29,877**

Appendix B: CalCAP Current Mitigation Project–Financial Analysis (Continued)

Behavioral Projects

Specific Project	Category	Annual Financing Expense	Annual Operating Expenses (including FTE & Other Costs)	Capital Cost (less SEP incentives where applicable)	Annual Net Savings/Cost (includes annual operations, maintenance & financing expenses)	Simple Payback (years)	Total Years in Project	Total Net Present Value (NPV)	Annual GHG Reduction Potential (MTCO2e)
Fleet - Introduce Fleet Biking (VERY SCALABLE)	Fleet			$ 4,000	$ (86,000)	0.1	8	$ (528,000)	3
Fleet - Expand electric vehicle fleet (VERY SCALABLE)	Fleet		$ 10,000	$ 210,000	$ (195,000)	1.1	8	$ (1,000,000)	17
Commute - Implement High Priority Bicycle Plan Projects & Programs (VERY SCALABLE)	Commuting		$ 50,000	$ 450,000	$ (162,000)	2.8	15	$ (1,126,000)	123
Education - Department Level Energy Reduction Effort	Energy Efficiency		$ 170,000	$ 1,340,000	$ (530,000)	2.5	8	$ (1,951,000)	500
Campus Behavior: Increasing occupant awareness and electricity curtailment (VERY SCALABLE)	Energy Efficiency		$ 13,000	$ 300,000	$ (473,000)	0.6	15	$ (4,296,000)	1,625
Air Travel - Increase utilization of videoconference room(s)	air travel		$ 35,000	$ -	$ (40,000)	0.1	8	$ (664,000)	114
Campus Behavior - Introduce Campus Composting program (SCALABLE)	Solid waste		$ 327,000	$ -	$ 227,000	n/a	8	$ 3,776,000	294

Behavioral Projects	Total Annual Financing Expense	Total Annual Operating Expenses	Total Capital Cost to Campus	Total Annual Net Savings/Cost	Total Net Present Value	Total Annual GHG Reduction Potential (MTCO2e)
	$ -	**$ 605,000**	**$ 2,304,000**	**$ (1,259,000)**	**$ (5,790,000)**	**2,677**

TOTAL- Infrastructure & Behavioral Projects	**$ 1,767,957**	**$ 1,192,000**	**$ 22,466,000**	**$ (5,131,000)**	**$(21,277,473)**	**32,553**
RECs needed to meet 2014 target		**$ 1,536,000**		**$ 1,536,000**		**28,447**
TOTAL (Projects & RECs to meet target)		**$ 2,728,000**	**$ 22,466,000**	**$ (5,131,000)**		**61,000**

Total Funding Identified for Capital Costs	**$ 19,169,803**
Total Funding Needed for Capital Costs	**$ 3,295,731**

Based on information as of January 2009.

Note: lighting projects require further analysis to determine simple payback and net present value.