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June 3, 2009

NOTICE OF AVAILABILITY
UC BERKELEY 2020 LONG RANGE DEVELOPMENT PLAN AMENDMENT AND 2020 LRDP ENVIRONMENTAL IMPACT REPORT ADDENDUM TO ADDRESS CLIMATE CHANGE

Proposed Action: UC Berkeley 2020 Long Range Development Plan Amendments to Sustainable Campus Chapter

County: Alameda County, California

Addendum to: UC Berkeley 2020 Long Range Development Plan EIR, certified by The Regents January 2005, SCH #2003082131

On behalf of the University of California, Berkeley, I am pleased to notify you of the publication of proposed minor amendments to the UC Berkeley 2020 Long Range Development Plan, Sustainable Campus chapter, which codify existing campus commitments to reduce campus contributions to climate change. These minor amendments are also supported by an Addendum to the environmental impact report that analyzed effects of the campus long range development plan.

Copies of the proposed 2020 LRDP Amendment and 2020 LRDP EIR Addendum are available for review during normal operating hours at our campus offices, Room 300 A&E Building on the UC Berkeley campus; at the main branch of the Berkeley Public Library, 2090 Kittredge Avenue; and online at http://www.cp.berkeley.edu/LRDP_2020.htm. Comments are welcome up until 5 pm on Monday, July 6. The amendments, the addendum, and all comments received will be considered by the University prior to adoption of the amendments in July, 2009.

If you have any questions about the action or environmental review for the action, please contact Jennifer McDougall, Principal Planner, Physical and Environmental Planning, at (510) 642-7720, but please note that she will be unavailable June 29 through July 5. During that time, please direct any questions to me.

Sincerely,

Emily Marthinsen

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PROPOSED ACTION

The action under consideration in this document is amendment of Chapter 11, Sustainable Campus, of the UC Berkeley 2020 Long Range Development Plan (hereafter, 2020 LRDP or LRDP), in order to explicitly reference existing campus climate change commitments. The Sustainable Campus chapter and proposed amendments appear upon the following pages.

The 2020 LRDP anticipates development of up to 2.2 million gross square feet of net new academic and support space on the core campus and adjacent blocks by 2020. The LRDP and an environmental impact report analyzing it (SCH #2003082131) were published in April 2004. Federal, regional and local agencies and more than 320 people reviewed and commented on the Draft EIR. The 2020 LRDP and EIR are published on the web at lrdp.berkeley.edu. The proposed action would be the first amendment to the 2020 LRDP since its adoption by The Regents in January 2005.

PURPOSE OF THIS REPORT

This document describes existing climate change conditions and evaluates the potential for development under the UC Berkeley 2020 LRDP, with minor amendments to reflect current campus policy, to affect climate change. This document also provides a summary of the current regulatory framework applicable to climate change.

Under the California Environmental Quality Act, new information of substantial importance to a project, or substantial changes in circumstances, can result in the need to alter certified environmental documents prior to a subsequent discretionary approval based on that environmental document.

The CEQA Guidelines establish types of actions to be taken under CEQA, according to the significance or severity of incremental environmental impacts that could result from project changes, new information, changing circumstances, or project changes.

This document discusses the existing global, national, and statewide conditions for greenhouse gases (GHG) and global climate change and evaluates the potential impacts on global climate from the implementation of the UC Berkeley 2020 Long Range Development Plan (hereafter, the UC Berkeley 2020 LRDP or 2020 LRDP), as amended to document existing UC Berkeley climate action strategies. This document also provides a discussion of the applicable federal, state, regional, and local agencies that regulate, monitor, and control GHG emissions.

This document serves as an environmental assessment in accordance with CEQA, the CEQA Guidelines, and University of California Guidelines for the Implementation of CEQA, to determine the appropriate course for addressing potential impacts on global climate from the implementation of the 2020 LRDP.

When an EIR has been certified for a project, no additional environmental review is required except as provided for in Sections 15162 - 15164 of the California Environmental Quality Act (CEQA) Guidelines (Title 14, California Code of Regulations,

Sections 15000 et seq), which sets forth the circumstances under which a project may warrant a Subsequent EIR or Negative Declaration:

(a) When an EIR has been certified or a negative declaration adopted for a project, no subsequent EIR shall be prepared for that project unless the lead agency determines, on the basis of substantial evidence in the light of the whole record, one or more of the following:

(1) Substantial changes are proposed in the project which will require major revisions of the previous EIR or negative declaration due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects;

(2) Substantial changes occur with respect to the circumstances under which the project is undertaken which will require major revisions of the previous EIR or Negative Declaration due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects; or

(3) New information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous EIR was certified as complete or the Negative Declaration was adopted, shows any of the following:

> (A) The project will have one or more significant effects not discussed in the previous EIR or negative declaration;
> (B) Significant effects previously examined will be substantially more severe than shown in the previous EIR;
> (C) Mitigation measures or alternatives previously found not to be feasible would in fact be feasible, and would substantially reduce one or more significant effects of the project, but the project proponents decline to adopt the mitigation measure or alternative; or
> (D) Mitigation measures or alternatives which are considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment, but the project proponents decline to adopt the mitigation measure or alternative.

Under Section 15163, a supplement to a certified EIR may be prepared when any of the conditions requiring preparation of a subsequent EIR are met, but only minor additions or changes would be necessary to make the previous EIR adequately apply to the project in the changed situation. Under Section 15164, in cases where only minor technical changes or additions are necessary to make the previous EIR adequately apply to a given project, and none of the conditions calling for a subsequent or supplemental EIR have occurred, an EIR addendum may be prepared. If none of the above conditions are present, no further environmental review is required.

This environmental assessment finds the potential impacts on global climate from the implementation of the UC Berkeley 2020 LRDP do not constitute new information of substantial importance regarding significant environmental impacts. Implementation of the 2020 LRDP would not cause significant effects upon global climate; implementation of the 2020 LRDP facilitates implementation of the campus climate action plan (discussed further below) and would reduce greenhouse gas emissions of UC Berkeley.

Accordingly, the University has determined that an Addendum to the 2020 LRDP EIR is the appropriate document for discussion of the potential impacts on global climate from the implementation of the UC Berkeley 2020 LRDP. The University has completed other 2020 LRDP EIR addenda to document projects tiered from the EIR; therefore, this would be Addendum #5 to the 2020 LRDP EIR[1]. Only this Addendum, however, is formatted to match other environmental issue area chapters of the 2020 LRDP EIR. As with other chapters of the 2020 LRDP EIR, following this introduction and the proposed amendments to the Sustainable Campus chapter of the 2020 LRDP (pp 4-6), the outline of this document is:

[1] Earlier addenda to the UC Berkeley 2020 LRDP EIR were completed for the Naval Architecture Building Restoration and Addition (Addendum #4, December 2008); the Durant Hall Renovation Project (Addendum #3, March 2008); the Campbell Hall Replacement Building (Addendum #2, March 2008); and the Center for Biomedical and Health Sciences (Addendum #1, May 2007).

3.1.11 SUSTAINABLE CAMPUS

PLAN EVERY NEW PROJECT AS A MODEL OF RESOURCE CONSERVATION AND ENVIRONMENTAL STEWARDSHIP.

As one of the world's great research universities, UC Berkeley has a special obligation to serve as a model of how creative design can both minimize resource consumption and enhance environmental quality. Each new capital investment at UC Berkeley has the potential to advance the state of the art in responsible, sustainable design, and thereby contribute to our mission of public service.

In July 2003 the UC Regents adopted a university-wide Green Building Policy and Clean Energy Standard to reduce the consumption of non-renewable energy, through a combination of energy conservation measures, local renewable power measures for both existing and new facilities, and the purchase of energy derived from renewable sources. ~~In support of this policy, UC Berkeley should develop a strategy for the campus that reflects the specific characteristics of our site, climate, and facility inventory.~~ As of 2009, that policy has been regularly revised and its scope expanded. In a complementary effort, UC Berkeley continues to implement a multi-faceted approach to environmental stewardship in word and deed.

The principles of sustainable design are not separate and discrete. On the contrary, they are interdependent, and require a comprehensive approach to design. Therefore, while standard criteria can be very useful as a framework for analysis, sustainable design ultimately depends on the integrated efforts of a multidisciplinary project team. This comprehensive approach is particularly critical during the feasibility phase of a project, where a range of alternate solutions is evaluated and the optimal solution is defined.

POLICY: INCORPORATE SUSTAINABLE DESIGN PRINCIPLES INTO CAPITAL INVESTMENT DECISIONS.

The policies in Strategic Investment require UC Berkeley to consider a range of alternate solutions at the feasibility phase of the project approval process. This analysis should include an evaluation of how each option supports the principles of sustainable design, which include:

- preserving and restoring the integrity and biodiversity of natural systems,
- minimizing energy use in travel to and within the campus,
- minimizing building energy use and peak energy demand,
- minimizing water use and maximizing on-site conservation and reuse,
- minimizing the use of nonrenewable energy and material resources,
- minimizing adverse impacts to air and water quality,
- optimizing the use, and adaptive reuse, of existing facilities,
- concentrating growth on sites served by existing infrastructure,
- maximizing the productive life of new facilities through durable, flexible design, and
- creating environments that enhance human health, comfort, and performance.

POLICY: BASE CAPITAL INVESTMENT DECISIONS ON LIFE CYCLE COST, INCLUDING THE COST OF KNOWN FUTURE EXPENDITURES.

Sustainable design also depends on analyses based on true life cycle cost. While the best environmental solutions often have a lower life cycle cost, their first cost is often greater. The policies in **Strategic Investment** require the campus to evaluate alternate design solutions based on their life cycle cost,

including the discounted costs of future expenditures: the policy is repeated here because it is essential to an effective strategy for sustainable design. It is also essential to consider initial capital cost in the context of the building as a whole, since an upgrade in one system can sometimes reduce the capital cost of others. For example, investing in a high-performance window system may reduce the required capacity, and thus the initial capital as well as the future operating cost, of the space conditioning systems.

POLICY: DESIGN NEW PROJECTS TO MINIMIZE ENERGY AND WATER CONSUMPTION AND WASTEWATER PRODUCTION.

Toward this end, substantial savings in water and energy consumption can often be achieved through architecture and landscape design: for example, by the careful selection of landscape materials, and by orienting and configuring building volumes and composing building facades to optimize energy performance. The **Campus Park Guidelines** include several such provisions, which should inform every future capital project.

POLICY: DESIGN NEW BUILDINGS TO A MINIMUM STANDARD EQUIVALENT TO LEED ~~2.1 CERTIFICATION~~ SILVER OR SYSTEMWIDE SUSTAINABILITY POLICY STANDARDS, WHICHEVER IS MORE STRINGENT.

DESIGN NEW LABORATORY BUILDINGS TO A MINIMUM STANDARD EQUIVALENT TO LEED 2.1 CERTIFICATION AND LABS 21 ENVIRONMENTAL PERFORMANCE CRITERIA OR SYSTEMWIDE SUSTAINABILITY POLICY STANDARDS, WHICHEVER IS MORE STRINGENT.

DESIGN NEW BUILDINGS TO OUTPERFORM THE REQUIRED PROVISIONS OF TITLE 24 OF THE CALIFORNIA ENERGY CODE BY AT LEAST 20 PERCENT OR SYSTEMWIDE SUSTAINABILITY POLICY STANDARDS, WHICHEVER IS MORE STRINGENT.

Many other institutions have adopted the LEED (Leadership in Energy & Environmental Design) system as their reference standard for sustainable design. The LEED system offers a reference standard that is well established and well supported by the design industry. However, it is also generic: it does not address particular building types or physical environments, nor does it address multi-building campus environments. As a research university, with a wide range of laboratories and other specialized buildings, UC Berkeley would be best served in the long run by performance guidelines more specific to our unique facility inventory and our temperate climate.

However, given the intensive pace of new construction and renovation on the Berkeley campus, it is imperative that we begin now to incorporate the principles of sustainable design into every new project. The LEED system is our best option today, and UC Berkeley should use version 2.1 as an interim reference standard while we investigate a more customized approach. Given the importance of sustainable design in laboratory facilities, UC Berkeley should supplement the LEED criteria with LABS 21 (Laboratories for the 21st Century) environmental performance criteria. ~~Moreover, the aforementioned objectives should serve only as a minimum standard for design.~~ UC Berkeley should strive for a standard equivalent to LEED Silver wherever program needs, site conditions and budget parameters permit.

POLICY: DESIGN ALL ASPECTS OF NEW PROJECTS TO ACHIEVE CAMPUS SHORT AND LONG TERM CLIMATE CHANGE EMISSIONS TARGETS ESTABLISHED IN THE CAMPUS CLIMATE ACTION PLAN.

State law as of 2009 (SB 375) recognizes the link between land use planning and greenhouse gas emissions due to vehicle travel. Within a regional and statewide context and in contrast to similar activities at more rural or suburban campuses, activities implementing the UC Berkeley LRDP would directly and indirectly

engender fewer new vehicle miles traveled and concomitant GHG emissions, because Berkeley's context is comparatively rich in jobs, housing and transportation infrastructure.

As one of the nation's leading public universities, however, climate-sensitive land use planning is not enough. UC Berkeley must be a model of administrative leadership as well as academic leadership, continually advancing efforts to reduce its own contributions to climate change. UC Berkeley targets achievement of 1990 GHG emission levels by 2014, six years ahead of state mandated targets, and seeks to achieve climate neutrality at the earliest possible time, but not later than 2050. All aspects of new projects, from planning and construction through operations, should support this achievement.

~~**POLICY: DEVELOP A CAMPUS STANDARD FOR SUSTAINABLE DESIGN SPECIFIC TO OUR SITE, CLIMATE, AND FACILITY INVENTORY.**~~

~~In consultation with the UC Office of the President, UC Berkeley should develop an internal evaluation and certification standard based on LEED and LABS 21 criteria as well as other sustainable design measures and guidelines, one which reflects both the unique composition of the UC Berkeley facility inventory and our temperate, semi-arid climate.~~ Deleting to replace with discussion above and LEED-Silver minimum standard.

Q.1 ANALYTICAL METHODS

2020 LRDP

CAMPUS GREENHOUSE GAS EMISSIONS INVENTORY

UC Berkeley became a member of the California Climate Action Registry in October, 2006 and voluntarily committed to performing an inventory of its annual greenhouse gas (GHG) emissions, starting in 2005. This inventory is audited annually by a third-party verifier and made available to the public. The Registry inventory is primarily designed to allow companies and institutions "to establish GHG emissions baselines against which any future GHG emissions reductions requirements may be applied" (California Climate Action Registry, 2006).

UC Berkeley reports on ten emissions sources that include: electricity consumption, steam use, natural gas consumption, the University fleet, student commuting, faculty and staff commuting, business air travel, fugitive emissions from coolants, solid waste, and 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.

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 the 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 included. As the campus building inventory expands through purchase of real property, changes will be reflected in the 1990 baseline, and the campus will take responsibility for ensuring emission reduction targets include these buildings.

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. The University population is expected to grow by 0.609% per year and the annual increase in gross square feet is estimated to be 1.14% per year (UC Berkeley LRDP, 2005).

For the 1990 – 2004 inventories, the University uses actual data where it exists. For sources without actual data, the campus generally uses the annual growth estimates to create a trend analysis for the years between 1990 and 2004. Any deviations from this methodology are detailed in the 2007 CalCAP Feasibility Study (http://sustainability.berkeley.edu/calcap/feasibility.html) or the 2009 UCB Climate Action Plan (http://sustainability.berkeley.edu/calcap/cap2009.html).

In accordance with California Climate Action Registry standards, the standard emissions inventory omits 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. Although not a current regulatory focus, the campus will continue to examine the full lifecycle emissions from these and other sources in future years.

CONSTRUCTION EMISSIONS

The URBEMIS2007 (Version 9.2.4) model was used to estimate emissions of carbon dioxide, a greenhouse gas associated with construction, under the 2020 LRDP. The model run assumes a construction cycle of 12 months. The total area assumed to be disturbed over the course of any given 12-month period is 45.9 acres. This level of activity was assumed in the April 2004 Draft EIR to be representative of a maximum construction year under the 2020 LRDP. As in the URBEMIS2002 analysis performed for the air quality analysis in the 2020 LRDP Draft EIR in 2004, emissions from "grading" and "building" periods during the 12-month construction scenario were estimated by URBEMIS2007. The construction activities were modeled assuming a construction period of June 1, 2005 through May 31, 2006, to match the assumed start of construction used in the 2020 LRDP EIR analysis. The specific equipment assumptions used in the URBEMIS2007 runs assumed the model's default factors. The methodology reflects that at any moment in time, more than one LRDP project could be under construction, and each project could be at different points in the construction process. Of greater interest for the assessment of potential greenhouse gas emissions are annual CO_2 emission estimates. These are also provided (see Attachment 1) for the total annual disturbed area of 45.9 acres assumed in the 2020 LRDP EIR.

Q.2 REGULATORY AND PRE-REGULATORY FRAMEWORK

FEDERAL

HOUSE RESOLUTION 6 – THE 2007 ENERGY BILL

House Resolution (HR) 6, the 2007 Energy Bill, mandates improved national standards for vehicle fuel economy (Corporate Average Fuel Economy [CAFE] standards). These standards require a fleetwide average of 35 miles per gallon (mpg) to be achieved by 2020. The National Highway Traffic Safety Administration is directed to phase-in requirements to achieve this goal. Analysis by the California Air Resources Board (CARB) suggests that achieving this goal will require an annual improvement in fleetwide average fuel economy of approximately 3.4 percent between now and 2020.[2] Although the explicit purpose of requiring improved national standards for fuel economy was not to address climate change, these requirements would improve the fuel economy of the nation's vehicle fleet, and therefore incrementally lower the amount of fuel use and GHG emissions associated with vehicle trips generated under the 2020 LRDP.

In 2009, Congress is expected to consider additional climate action legislation.

STATE

There are numerous State plans, policies, regulation and laws related to GHG and global climate change. Following is a brief discussion of these plans which are presented in chronological order.

CALIFORNIA CLIMATE ACTION REGISTRY (SENATE BILLS 1771 AND 527)

The California Climate Action Registry (CCAR) was established in 2001 by Senate Bill (SB) 1771 and SB 527 as a nonprofit voluntary registry for GHG emissions. The purpose of CCAR is to help companies and organizations with operations in the state establish GHG emissions baselines against which any future GHG emissions reduction requirements may be applied. CCAR has developed a general reporting protocol and additional industry-specific protocols that provide guidance on how to inventory GHG emissions for participation in the registry. UC Berkeley is a member of the CCAR.

CALIFORNIA'S RENEWABLE ENERGY PORTFOLIO STANDARD PROGRAM AND SENATE BILL 107

In 2002, California established its Renewable Energy Portfolio Standard Program, which originally included a goal of increasing the percentage of renewable energy in the state's electricity mix to 20 percent by 2017. SB 107 requires investor-owned utilities such as Pacific Gas and Electric, Southern California Edison, and San Diego Gas and Electric (SDG&E) to meet the 20 percent renewable energy goal by 2010. The state's most recent Energy Action Plan (2005) raised the renewable energy goal to 33 percent by 2020.

[2] www.arb.ca.gov/cc/ccms/ab1493_v_cafe_study.pdf

ASSEMBLY BILL 1493

In 2002, Governor Gray Davis signed AB 1493. AB 1493 required CARB to develop and adopt, by January 1, 2005, regulations that achieve "the maximum feasible reduction of GHGs emitted by passenger vehicles and light-duty truck and other vehicles determined by CARB to be vehicles whose primary use is noncommercial personal transportation in the state."

To meet the requirements of AB 1493, CARB approved amendments to the California Code of Regulations (CCR) adding GHG emission standards to California's existing motor vehicle emission standards in 2004. Amendments to CCR Title 13 Sections 1900 (CCR 13 1900) and 1961 (CCR 13 1961) and adoption of Section 1961.1 (CCR 13 1961.1) require automobile manufacturers to meet fleet average GHG emission limits for all passenger cars, light-duty trucks within various weight criteria, and medium-duty passenger vehicle weight classes beginning with the 2009 model year. Emission limits are further reduced each model year through 2016.

In December 2004 a group of car dealerships, automobile manufacturers, and trade groups representing automobile manufacturers filed suit against CARB to prevent enforcement of CCR 13 1900 and CCR 13 1961 as amended by AB 1493 and CCR 13 1961.1 (Central Valley Chrysler-Jeep et al., v. Catherine E. Witherspoon, in her official capacity as Executive Director of the California Air Resources Board, et al.). The suit, heard in the U.S. District Court for the Eastern District of California, contended that California's implementation of regulations that in effect regulate vehicle fuel economy violates various federal laws, regulations, and policies. In January 2007, the judge hearing the case accepted a request from the State Attorney General's office that the trial be postponed until a decision is reached by the U.S. Supreme Court on a separate case addressing GHGs. In the Supreme Court Case, *Massachusetts vs. EPA*, the primary issue in question is whether the federal Clean Air Act provides authority for EPA to regulate CO_2 emissions. In April 2007, the U.S. Supreme Court ruled in *Massachusetts'* favor, holding that GHGs are air pollutants under the Clean Air Act. On December 11, 2007, the judge in the *Central Valley Chrysler-Jeep* case rejected each plaintiff's arguments and ruled in California's favor. On December 19, 2007, the EPA denied California's waiver request. California filed a petition with the Ninth Circuit Court of Appeals challenging EPA's denial on January 2, 2008. On January 26, 2009 President Obama signed a Presidential Memorandum directing EPA to assess whether denial was appropriate under the Clean Air Act (http://epa.gov/oms/climate/ca-waiver.htm). California's waiver request has not been granted as of this writing.

EXECUTIVE ORDER S-20-04 – THE CALIFORNIA GREEN BUILDING INITIATIVE

Governor Schwarzenegger signed Executive Order S-20-04 ("The California Green Building Initiative") establishing California's priority for energy and resource-efficient high performance buildings on December 14, 2004. The Executive Order sets a goal of reducing energy use in state-owned and private commercial buildings by 20 percent in 2015 using nonresidential Title 20 and 24 standards adopted in 2003 as the baseline. The California Green Building Initiative also encourages private commercial buildings to be

retrofitted, constructed, and operated in compliance with the state's Green Building Action Plan.

EXECUTIVE ORDER S-3-05

Executive Order S-3-05, signed by Governor Arnold Schwarzenegger on June 1, 2005, proclaims that California is vulnerable to the impacts of climate change. It declares that increased temperatures could reduce the Sierra Nevada's snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. In an effort to avoid or reduce the impacts of climate change, Executive Order #S-3-05 calls for a reduction in GHG emissions to the year 2000 level by 2010, 1990 levels by 2020, and 80 percent below 1990 levels by 2050.

In order to meet the targets established under Executive Order S-3-05, the Governor directed the Secretary of the California EPA to lead a Climate Action Team (CAT) comprised of representatives from the Business, Transportation and Housing Agency, the Department of Food and Agriculture, the Resources Agency, the Air Resources Board, the Energy Commission, and the Public Utilities Commission. The 2006 CAT Report to the Governor contains a number of recommendations and strategies to help ensure that the targets established in Executive Order S-3-05 are met. The Secretary will submit biennial reports to the governor and state legislature describing progress made toward reaching the emission targets established by the executive order and on the impacts of climate change on California, including impacts to water supply, public health, agriculture, the coastline, and forestry, and shall prepare and report on mitigation and adaptation plans to combat these impacts. The first of these reports on the impacts to California, "Scenarios of Climate Change in California: An Overview" (Climate Scenarios report), was published in February 2006 (California Climate Change Center 2006).

SENATE BILL 1505

SB 1505 of 2006 establishes environmental performance standards for the production and use of hydrogen fuel for transportation purposes in the state. In general, SB 1505 specifically requires that hydrogen-fueled vehicles reduce GHG emissions by at least 30 percent compared to emissions from new gasoline vehicles; at least one-third of the hydrogen produced or dispensed for transportation purposes in the state must be made from renewable sources of electricity; well-to-tank emissions of smog-forming pollutants from hydrogen fuel dispended in the state must be reduced by at least 50 percent when compared to gasoline; and emissions of toxic contaminants must be reduced to the maximum extent feasible compared to gasoline on a site-specific basis.

ASSEMBLY BILL 32

The State Legislature adopted the public policy position that global warming is, "a serious threat to the economic well-being, public health, natural resources, and the environment of California" (Health and Safety Code § 38501). Further, the State Legislature has determined that, "the potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in the quality and supply of water to the state from the Sierra Nevada snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to marine

ecosystems and the natural environment, and an increase in the incidences of infectious disease, asthma, and other human health-related problems," and that, "(g)lobal warming will have detrimental effects on some of California's largest industries, including agriculture, wine, tourism, skiing, recreational and commercial fishing, and forestry (and)…will also increase the strain on electricity supplies necessary to meet the demand for summer air-conditioning in the hottest parts of the State" (Health and Safety Code § 38501). These public policy statements became law with the enactment of Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006, signed by Governor Arnold Schwarzenegger in September 2006. Assembly Bill (AB) 32 is now codified as Health & Safety Code sections 38500-38599.

AB 32 requires that statewide GHG emissions be reduced to 1990 levels by 2020. This reduction is to be accomplished through an enforceable statewide cap on GHG emissions to be phased in starting in 2012. AB 32 directs that the California Air Resources Board (CARB) establish this statewide cap based on 1990 GHG emissions levels; disclose how it arrived at the cap; institute a schedule to meet the emissions cap; and develop tracking, reporting, and enforcement mechanisms. Emission reductions under AB 32 are to include carbon sequestration projects and best management practices that are technologically feasible and cost-effective.

GHGs as defined under AB 32 include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). General discussions of climate change often include water vapor, ozone, and aerosols in the category of greenhouse gases. Water vapor and atmospheric ozone are not gases that are formed directly in the construction or operation of development projects nor can they be controlled in these projects. Aerosols are not gases. While these elements have a role in climate change, they are not considered by either regulatory bodies, such as CARB, or climate change groups, such as CCAR as gases to be reported or analyzed for control. Therefore, no further discussion of water vapor, ozone, and aerosols is provided.

SENATE BILL 1368 (PUBLIC UTILITIES CODE §§ 8340-41)

Senate Bill (SB) 1368 is the companion bill of AB 32 and was signed by Governor Schwarzenegger in September 2006. SB 1368 required the California Public Utilities Commission (PUC) to establish a GHG emission performance standard for baseload generation from investor-owned utilities by February 1, 2007. Similarly, the California Energy Commission (CEC) was tasked with establishing a similar standard for local publicly owned utilities by June 30, 2007. These standards cannot exceed the GHG emission rate from a baseload combined-cycle natural gas fired plant. The legislation further requires that all electricity provided to California, including imported electricity, must be generated from plants that meet the standards set by the PUC and the CEC. In January 2007, the PUC adopted an interim Greenhouse Gas Emissions Performance Standard, which requires that all new long-term commitments for baseload generation entered into by investor-owned utilities have emissions no greater than a combined cycle gas turbine plant (i.e., 1,100 pounds of CO_2 per megawatt-hour). A "new long-term

commitment" refers to new plant investments (new construction), new or renewal contracts with a term of 5 years or more, or major investments by the utility in its existing baseload power plants. In May 2007, the CEC approved regulations that prohibit the state's publicly owned utilities from entering into long-term financial commitments with plants that exceed the standard adopted by the PUC of 1,100 pounds of CO_2 per megawatt hour.

CARB "EARLY ACTION MEASURES"

On June 21, 2007, CARB approved a list of discrete early action measures to address climate change as required by AB 32. The three measures include (1) a low-carbon fuel standard, which will reduce the carbon intensity in California's transportation fuels by at least 10 percent by 2020, thereby reducing total CO_2 emissions; (2) reduction of refrigerant losses from motor vehicle air conditioning system maintenance through the restriction of "do-it-yourself" automotive refrigerants; and (3) increased CH_4 capture from landfills through the required implementation of state-of-the-art capture technologies.

SENATE BILL 97

SB 97, signed August 2007, (Public Resources Code Sections 21083.05, 21097) directs the Governor's Office of Planning and Research (OPR) to prepare, develop, and transmit to the Resources Agency guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions, for evaluation under CEQA by July 1, 2009. (OPR submitted proposed amendments in April 2009.) The Resources Agency is required to certify or adopt those guidelines by January 1, 2010. This bill also protects projects (retroactive and future) funded by the Highway Safety, Traffic Reduction, Air Quality and Port Security Bond Act of 2006 (Proposition 1B or 1E) from claims of inadequate analysis of GHGs as a legitimate cause of action. This latter provision will be repealed on January 1, 2010.

CARB RESOLUTION 07-55

The adoption of CARB Resolution 07-55 on December 6, 2007, established 427 million metric tons of carbon dioxide equivalent ($MMTCO_2e$) as the statewide GHG emissions limit to be achieved by 2020 as required by AB 32.

CAPCOA WHITE PAPER ON CEQA AND CLIMATE CHANGE

In January 2008 the California Air Pollution Control Officers Association (CAPCOA) issued a white paper on CEQA and Climate Change (CAPCOA Guidance). The informal CAPCOA Guidance presents a number of approaches that air districts could use to determine the significance of climate change impacts in CEQA documents. The CAPCOA Guidance itemizes over 20 different potential thresholds of significance and leaves to the lead agency discretion on which of these methods, or other methods not itemized therein, to use to determine significance.

GOVERNOR'S OFFICE OF PLANNING AND RESEARCH

On June 19, 2008, the State of California Governor's Office of Planning and Research (OPR) issued a Technical Advisory on addressing climate change impacts of a proposed project under CEQA (OPR Climate Change Advisory). The OPR Climate Change

Advisory recommends that lead agencies quantify, determine the significance of, and (as needed) mitigate the cumulative climate change impacts of a proposed project. The OPR Climate Change Advisory identifies that each lead agency is required under CEQA to exercise its own discretion in choosing how to determine significance, in the absence of adopted thresholds or significance guidelines from the State, CARB, or the applicable local air district.

In January 2009 OPR presented informational workshops on proposed amendments to the CEQA Guidelines to address climate change; a draft of proposed amendments was published in April 2009. The target adoption date for revisions is January 2010. The proposed amendments urge lead agencies to "make a good-faith effort, based on available information, to describe, calculate or estimate the amount of GHG emissions associated with a project" (§15064.4(a)). The proposed amendments urge lead agencies to consider all feasible means of mitigating GHG emissions (§15126.4(c)). The proposed amendments allow a lead agency to determine that a project's incremental contribution to a cumulative effect is not cumulatively considerable if the project will comply with the requirements of a previously approved plan or mitigation program which provides specific requirements that will avoid or substantially lessen the cumulative problem within the geographic area in which the project is located (§15064(h)(1)).

CALIFORNIA AIR RESOURCES BOARD (CARB) SCOPING PLAN

As discussed previously, CARB is required by AB 32 (Health and Safety Code § 38500 et seq.) to develop a Scoping Plan to lower the state's GHG emissions to meet the 2020 limit. A Draft Scoping Plan was released for public comment on June 26, 2008. The Draft was revised and the Proposed Scoping Plan was released for public comment on October 15, 2008. The Proposed Scoping Plan was adopted by CARB at the December 2008 board meeting and establishes a work program for rulemaking: the measures in the Scoping Plan adopted by the Board will be developed over the next three years and be in place by 2012. Key elements of the Scoping Plan include expansion and strengthening of existing energy efficiency programs and building and appliance standards, achieving a statewide renewable energy mix of 33 percent, development of a California cap-and-trade program linked with other similar programs, establishing targets for transportation-related GHG emissions for regions throughout California, and pursuing policies and incentives to achieve those targets, implementation of existing laws and standards such as California's clean car standards (AB 1493), goods movement measures, and the Low Carbon Fuel Standard, and targeted fees to fund the State's long-term commitment to AB 32 administration.

Table Q-5, AB 32 Scoping Plan Measures, lists CARB's final scoping plan recommendations for achieving greenhouse gas reductions under AB 32 along with a brief description of the requirements and applicability.

CALIFORNIA ATTORNEY GENERAL

Relying on a federal public nuisance theory, the California Attorney General has sued companies in the power industry and the auto industry for their contributions to global

warming. These two industries are among the largest sources of greenhouse gases in the world. Citing United States Supreme Court precedent that dates back one hundred years, the cases seek judicial relief for the injuries from global warming that defendants' emissions cause. The California Attorney General has also filed complaints under the California Environmental Quality Act accusing agencies of failure "to fully evaluate and disclose the reasonably foreseeable effects" of their actions upon climate change. The Attorney General's office has prepared a fact sheet, most recently updated in December 2008, listing mitigation measures agencies may adopt to offset or reduce global warming (Source: http://ag.ca.gov/globalwarming/ceqa.php) . Tables Q-6 and Q-7 list these measures and indicate measures addressed or under consideration by UC Berkeley.

SENATE BILL 375

On September 30, 2008, Governor Schwarzenegger signed Senate Bill 375 (Steinberg) which establishes mechanisms for the development of regional targets for reducing passenger vehicle greenhouse gas emissions. Through the SB 375 process, regions will work to integrate development patterns and the transportation network in a way that achieves the reduction of greenhouse gas emissions while meeting housing needs and other regional planning objectives. This new law reflects the importance of achieving significant additional reductions of greenhouse gas emissions from changed land use patterns and improved transportation to help achieve the goals of AB 32. SB 375 requires CARB to develop, in consultation with metropolitan planning organizations (MPOs), passenger vehicle greenhouse gas emissions reduction targets for 2020 and 2035 by September 30, 2010.

Implementing SB 375, the Association of Bay Area Governments in the Bay Area will prepare regional sustainable land use plans to reach SB 375 targets, and the Metropolitan Transportation Commission in the Bay Area will work to ensure that regional transportation plans are consistent with and support the regional sustainability plans. Many infill development projects consistent with these plans will be exempt from CEQA. The process of establishing targets and plans is expected to take several years, based on timelines in SB 375. However, the ABAG has already begun preparing revised Policy-Based Projections for its 2009 land use projections, and has estimated GHG impacts as part of its initial assessment of alternative projection scenarios. Overall the Bay Area is expected to grow by approximately 2 million people by 2035. Draft *Projections 2009* have been released for jurisdictional staff review. In order to accommodate the increased population and meet the mandates of AB 32, the draft projections have a significantly increased focus on higher intensity transit-oriented development as a key strategy (source: City of Berkeley Draft DAP EIR January 2009, p. 4-65).

REGIONAL

Regional agencies, partly motivated by provisions of SB 375, are working to address climate change. Representatives of each of the following agencies meets together as a Joint Policy Committee; the JPC is developing initiatives for the region as a whole through its regional agencies to address climate change. See http://www.abag.ca.gov/jointpolicy/jpc_climate_change.htm.

ASSOCIATION OF BAY AREA GOVERNMENTS

Implementing SB 375, the Association of Bay Area Governments in the Bay Area will prepare regional sustainable land use plans to reach SB 375 targets, and the Metropolitan Transportation Commission in the Bay Area will work to ensure that regional transportation plans are consistent with and support the regional sustainability plans.

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

In April 2009 the BAAQMD promulgated an options framework it may use for developing new guidelines for CEQA significance determinations for air quality impacts of development (BAAQMD and EDAW, 2009). BAAQMD suggests that its threshold criteria related to greenhouse gases may be critical in helping the state to achieve AB 32 greenhouse gas reduction goals, by addressing regional land use and transportation-related emissions. The options paper considers construction-related and operation-related emissions. BAAQMD assumes that new land use development in the San Francisco Bay Area should achieve a reduction of 2.0 million metric tons per year to achieve statewide goals (options study page 24). BAAQMD is considering a bright line numeric mass emissions threshold per project, or a performance standard threshold, or a combination threshold, for determining the significance of GHG emissions.

At a plan level, the options paper suggests that if a general plan demonstrates, through dividing the emissions inventory projects (MT CO2e) by the amount of growth that would be accommodated in 2020, that it could meet the GHG efficiency metrics proposed (either 6.4 MT CO2e per capita or 4.4 MT CO2e per service population) BAAQMD believes that the amount of GHG emission associated with the general plan would be less than significant, regardless of its size and magnitude of emissions, because it would accommodate growth in a manner that would not hinder the state's ability to achieve AB 32 goals (options study page 38).

Although not clearly applicable to a campus environment, preliminary calculations indicate that campus per capita emissions given emissions reductions targets would be 3.3 MT CO2e in 2014, possibly rising to 3.4 MT CO2e in 2020 if no further reductions are taken. Campus emissions would be well below the proposed plan-level significance threshold.

BAY CONSERVATION AND DEVELOPMENT COMMISSION

One impact of higher global temperatures is accelerated sea level rise. BCDC has created a series of maps indicating the potential impacts of climate change on key local resources, including the Oakland International Airport. The goals of BCDC's Climate Change Planning Program are to identify and report on the impacts of climate change on San Francisco Bay; identify strategies for adapting to climate change; develop a regional task force to inform and coordinate local governments, stakeholders, and land use planning bodies in the Bay area regarding the potential Bay-related impacts of and approaches for adapting to global climate change; identify the findings and policies in the San Francisco Bay Plan pertaining to climate change, such as the findings and

policies on sea level rise, and update other relevant Bay Plan policies to incorporate new information about the impacts of climate change.

METROPOLITAN TRANSPORTATION COMMISSION

With transportation accounting for more than 40 percent of the region's greenhouse gas emissions, the Metropolitan Transportation Commission 2035 Plan, published in December 2008, targets regional transportation improvements as a critical climate change measure. MTC also published, in February 2009, a comment draft Bay Area Resource Guide on strategies for reducing GHG emissions, evaluating 45 strategies in five major categories: improving vehicles and fuels, improving infrastructure; focusing growth; transportation behavior, and other.

Q.3 LOCAL PLANS AND POLICIES

Although the University is constitutionally exempt from local land use regulations when using University property in furtherance of its educational purposes, it is University policy to evaluate proposed projects for consistency with local plans and policies. Therefore, this section outlines the plans and policy goals of the cities of Berkeley and Oakland related to climate change.

CITY OF BERKELEY

BERKELEY GENERAL PLAN

Goal #3 of the Berkeley General Plan is to "Protect local and regional environmental quality". As noted, "This Plan emphasizes the protection of the environment, both locally and regionally. It addresses City programs and actions, the importance of regional solutions, and the importance of the actions of the individual in day-to-day decisions on the health of the environment." (Berkeley General Plan, page I-5). It further notes that the City has adopted "the Resource Conservation and Global Warming Abatement Plan." (page I-6).

Goal #5 of the General Plan is "Create a Sustainable Berkeley". It notes that the "Berkeley General Plan is committed to the challenge of creating and maintaining a truly sustainable community – locally, regionally, and globally." (page I-6). It notes as one of its critical strategies the "development of multi-family, affordable housing on transit corridors and near job centers such as the Downtown and the University of California". (Berkeley General Plan, page I-6)

Sustainability policies are distributed throughout the plan in the Land Use, Transportation, Environmental Management, and other sections in support of these underlying goals.

CITY OF BERKELEY SUSTAINABILITY PROGRAMS

Berkeley has an extensive array of programs and activities relevant to climate change and global warming, including the following:

- Chicago Climate Exchange – Berkeley is a participant in the Chicago Climate exchange, an organization that independently monitors the climate impacts of its governmental activities.
- Energy Efficiency – Berkeley has adopted a Residential Energy Conservation Ordinance and a Commercial Energy Conservation Ordinance (RECO and CECO) to improve the energy efficiency of existing buildings when they are sold or when substantial investment is made in these structures.
- Renewable Energy – The city has implemented an innovative program to give city-backed loans to property owners who install rooftop solar-power systems. The loans, likely to total up to $22,000 apiece, would be paid off over 20 years as part of the owners' property-tax bills.
- Green Building – Berkeley has committed itself to meeting LEED standards for its own buildings and is exploring adopting enhanced standards for private buildings.
- Waste Reduction and Recycling –Berkeley has a goal of entirely eliminating waste sent to landfills by 2020, while meeting the Alameda County Measure D goal of reducing waste sent to landfills 75% by 2010.
- Stormwater Management (Watershed Improvement)
- Healthy Food Systems (Community Gardens and Farmer's Markets)

CLIMATE ACTION PLAN

The city's draft Climate Action Plan commits the city to a variety of activities to reduce its GHG emissions by 80% by the year 2035, as directed by the voters when they passed Berkeley Proposition G in 2006. Among the extensive list of implementation measures is intensification of land uses along major transit corridors and in Downtown to allow for and encourage the use of transit, bicycles and walking for commuting and everyday needs. Scores of other measures are also recommended, including measures to improve transit, increase building energy efficiency, and reduce the generation of waste. The comment period on the Draft Plan closed January 16, 2009, and the plan was endorsed with amendments by the City Council on May 5, 2009, and considered for adoption June 2, 2009. A negative declaration has been prepared by the City in support of the plan, finding generally that the plan would have no impact, because it is a policy document that does not in itself trigger new development, or that the plan would have beneficial impacts upon the environment by, for example, reducing energy use.

FINDINGS OF THE BERKELEY DOWNTOWN AREA PLAN DRAFT EIR

The City of Berkeley's Downtown Area Plan Draft EIR, published in January 2009, is the first plan level environmental document in the city to address potential impacts of climate change. The EIR identifies "no significant GHG-related impacts" due to the sustainable nature of development envisioned under the Plan.

The area of the downtown plan is adjacent to the Campus Park to the west, and includes a number of parcels owned by UC Berkeley. The plan anticipates 3,100 new residential units in the next 20 years under the DAP, generating approximately 30.5 million pounds of CO_2 annually, or about 15,250 tons (DAP Draft EIR p. 4-80). The DAP EIR notes that the following activities associated with a typical development could contribute to the generation of GHG emissions:

Removal of vegetation: the removal of vegetation for construction results in the loss of carbon sequestration in plants. However, planting of additional vegetation would result in additional carbon sequestration.

Demolition of existing buildings: Existing buildings have embedded energy related to the energy involved in their initial construction that is then lost when they are demolished. The disposal of demolished building materials may also have GHG emissions related to transport to recycling facilities and other locations, including the disposal of some materials. There are no reliable measures for measuring the GHG emissions associated with demolition.

Construction activities: Construction equipment typically uses fossil-based fuels to operate. The combustion of fossil-based fuels creates GHGs such as carbon dioxide, methane and nitrous oxide. Furthermore, methane is emitted during the fueling of heavy equipment.

Gas, electricity and water use: Natural gas use results in the emissions of two GHGs – methane and carbon dioxide. Electricity use can result in GHG production if the electricity is generated by combusting fossil fuel. California's water conveyance system is energy intensive. Preliminary estimates indicate that total energy used to pump and treat this water exceed 15,000 GWh per year, or at least 6.5 percent of the total electricity used in the state per year.

Motor vehicle use: Transportation associated with development projects would result in GHG emissions from the combustion of fossil fuels in daily automobile and truck trips. However, these emissions would not be "new" since drivers are likely relocated from another area and the DAP is designed to limit auto trips.

CITY OF OAKLAND

The City of Oakland has worked for many years to reduce GHG emissions. Currently, the City's Public Works Agency is drafting an Energy and Climate Action Plan (ECAP) to identify, evaluate and prioritize opportunities to reduce energy consumption and GHG emissions in its own government operations and throughout the Oakland community. The Energy and Climate Action Plan will clarify policy direction and recommend priority actions for reducing energy use and GHG emissions to the Oakland City Council. See www.sustainableoakland.com for additional information.

Q.4 EXISTING SETTING

GENERAL DESCRIPTION OF GLOBAL CLIMATE CHANGE

Global climate change is currently an important and controversial environmental, economic, and political issue. Climate change is a recorded change in the average weather of the earth, measured by variables such as wind patterns, storms, precipitation, and temperature. Historical records show that global temperature changes have occurred naturally in the past, such as during previous ice ages. Recent scientific research indicates very high confidence (i.e., at least 90 percent) that the rate and magnitude of current global temperature changes are anthropogenic (i.e., human caused), and that global warming will lead to adverse climate change effects around the globe (IPCC 2007).

GREENHOUSE GASES

Atmospheric greenhouse gases (GHGs) and clouds within the Earth's atmosphere influence the Earth's temperature by absorbing most of the infrared radiation rising from the Earth's sun-warmed surface that would otherwise escape into space. This process is commonly known as the Greenhouse Effect. GHGs are emitted by natural processes and human activities. The Earth's surface temperature averages about 58°F because of the Greenhouse Effect. Without it, the Earth's average surface temperature would be somewhere around an uninhabitable 0°F (Henson 2006). The resulting balance between incoming solar radiation and outgoing radiation from both the Earth's surface and atmosphere keeps the planet habitable.

Anthropogenic[3] emissions of GHGs into the atmosphere enhance the Greenhouse Effect by absorbing the radiation from other atmospheric GHGs that would otherwise escape to space, thereby trapping more radiation in the atmosphere and causing temperature to increase. Carbon dioxide (CO_2) is the most important anthropogenic GHG. The global atmospheric concentration of CO_2 has increased from a preindustrial (roughly 1750) value of about 280 parts per million (ppm) to 379 ppm in 2005, primarily due to fossil fuel use, with land use change providing a significant but smaller contribution. The annual rate of growth in CO_2 concentrations continues to increase, with a larger annual CO_2 concentration growth rate during the last 10 years (1995-2005 average: 1.9 ppm), than since the beginning of continuous direct measurements in 1960. The human-produced GHGs responsible for increasing the Greenhouse Effect and their relative contribution to global warming (i.e., their relative ability to trap heat in the atmosphere) are CO_2 (53 percent); methane (CH_4) (17 percent); near-surface ozone (O_3) (13 percent); nitrous oxide (N_2O) (12 percent); and chlorofluorocarbons (CFCs) (5 percent). The most common GHG is CO_2, which constitutes approximately 84 percent of all GHG emissions in California (CEC 2006). Worldwide, the State of California ranks as the 12th to 16th largest emitter of CO_2 (the most prevalent GHG) and is responsible for approximately 2 percent of the world's CO_2 emissions (CEC 2006a).

[3] Anthropogenic effects, processes, objects, or materials are those that are derived from human activities, as opposed to those occurring in natural environments without human influences.

Like CO_2, the global atmospheric concentration of CH_4 in 2005 exceeded its preindustrial value. CH_4 growth rates have declined since the early 1990s with total emissions being nearly constant during this period. The observed increase in CH_4 concentration is very likely (at least 90 percent likelihood) due to anthropogenic activities, primarily agriculture and fossil fuel use. The atmospheric concentrations of CO_2 and CH_4 in 2005 greatly exceeded the natural range over the last 650,000 years. The global concentration of N_2O in 2005 also exceeded the preindustrial value. The growth rate in N_2O concentration has been approximately constant since 1980. More than a third of all N_2O emissions are anthropogenic and primarily due to agriculture.

Eleven of the 12 years from 1995-2006 rank among the 12 warmest years in the instrumental record of global surface temperature (since 1850). An increase in global surface temperature of 0.74°C (0.56°C to 0.92°C) occurred during the 100-year period from 1906-2005.

The increasing emissions of GHGs—primarily associated with the burning of fossil fuels (during motorized transport, electricity generation, consumption of natural gas, industrial activity, manufacturing, etc.) and deforestation, as well as agricultural activity and the decomposition of solid waste—have led to a trend of anthropogenic warming of the Earth's average temperature, which is causing changes in the Earth's climate. This increasing temperature phenomenon is known as global warming and the climatic effect is known as climate change or global climate change. Climate change is a global problem. GHGs are global pollutants, unlike criteria air pollutants (CAPs) and toxic air contaminants (TACs), which are pollutants of regional and local concern. While pollutants with localized air quality effects have relatively short atmospheric lifetimes (generally on the order of a few days), GHGs have relatively long atmospheric lifetimes ranging from 1 year to several thousand years. The long atmospheric lifetimes allow for GHGs to disperse around the globe. In addition, the impacts of GHGs are borne globally, as opposed to the localized air quality effects of CAPs and TACs.

GHGs vary widely in the power of their climatic effects; therefore, climate scientists have established a unit called global warming potential (GWP). The GWP of a gas is a measure of both potency and lifespan in the atmosphere as compared to carbon dioxide. For example, since CH_4 and N_2O are approximately 21 and 310 times more powerful than CO_2, respectively, in their ability to trap heat in the atmosphere, they have global warming potentials of 21 and 310 (CO_2 has a global warming potential of 1). Carbon Dioxide Equivalent (CO_2e) is a figure that enables all GHG emissions to be considered as a group despite their varying GWP. The GWP of each GHG is multiplied by the prevalence of that gas to produce CO_2e.

The atmospheric lifetime and GWP of selected GHGs are summarized in Table Q-1. As shown in the table, GWP ranges from 1 (carbon dioxide) to 23,900 (sulfur hexafluoride).

TABLE Q-1
GLOBAL WARMING POTENTIALS AND ATMOSPHERIC LIFETIMES

Greenhouse Gas	Atmospheric Lifetime (years)	Global Warming Potential (100 year time horizon)
Carbon Dioxide (CO_2)	50 – 200	1
Methane (CH_4)	12 ± 3	21
Nitrous Oxide (N_2O)	120	310
HFC-134a	48.3	1,300
PFC: Tetrafluoromethane (CF_4)	50000	6,500
PFC: Hexafluoroethane (C_2F_6)	10000	9,200
Sulfur Hexafluoride (SF_6)	3200	23,900

Source: USEPA 2007; CCAR 2008.

GENERAL ENVIRONMENTAL EFFECTS OF GLOBAL CLIMATE CHANGE

Executive Order S-3-05 discussed below under Regulatory Setting resulted in the preparation of a report on the impacts of climate change on California, including impacts to water supply, public health, agriculture, the coastline, and forestry. *Scenarios of Climate Change in California: An Overview* (Climate Scenarios report), was published in February 2006 (California Climate Change Center 2006).

The Climate Scenarios report uses a range of emissions scenarios developed by the Intergovernmental Panel on Climate Change (IPCC) to project a series of potential warming ranges (i.e., temperature increases) that may occur in California during the 21st century: lower warming range (3.0-5.5°F); medium warming range (5.5-8.0°F); and higher warming range (8.0-10.5°F). The Climate Scenarios report then presents analysis of future climate in California under each warming range.

Each emissions scenario would result in substantial temperature increases for California. According to the report, substantial temperature increases would result in a variety of impacts to the people, economy, and environment of California associated with a projected increase in extreme conditions, with the severity of the impacts depending upon actual future emissions of GHGs and associated warming. Under the emissions scenarios of the Climate Scenarios report (California Climate Change Center 2006), the impacts of global warming in California are anticipated to include, but are not limited to, the following:

- Public Health – Higher temperatures are expected to increase the frequency, duration, and intensity of conditions conducive to air pollution formation. For example, days with weather conducive to O_3 formation are projected to increase from 25 to 35 percent under the lower warming range to 75 to 85 per-

cent under the medium warming range. In addition, if global background O_3 levels increase as predicted in some scenarios, it may become impossible to meet local air quality standards. Air quality could be further compromised by increases in wildfires, which emit fine particulate matter that can travel long distances depending on wind conditions. The Climate Scenarios report indicates that large wildfires could become up to 55 percent more frequent if GHG emissions are not significantly reduced.

- In addition, under the higher warming scenario, there could be up to 100 more days per year with temperatures above 90°F in Los Angeles and 95°F in Sacramento by 2100. This is a large increase over historical patterns and approximately twice the increase projected if temperatures remain within or below the lower warming range. Rising temperatures will increase the risk of death from dehydration, heat stroke/exhaustion, heart attack, stroke, and respiratory distress caused by extreme heat.

- Water Resources – A vast network of man-made reservoirs and aqueducts captures and transports water throughout the state from northern California rivers and the Colorado River. The current distribution system relies on Sierra Nevada snowpack to supply water during the dry spring and summer months. Rising temperatures, potentially compounded by decreases in precipitation, could severely reduce spring snowpack, increasing the risk of summer water shortages.

- If GHG emissions continue unabated, more precipitation will fall as rain instead of snow, and the snow that does fall will melt earlier, reducing the Sierra Nevada spring snowpack by as much as 70 to 90 percent. Under the lower warming scenario, snowpack losses are expected to be only half as large as those expected if temperatures were to rise to the higher warming range. How much snowpack will be lost depends in part on future precipitation patterns, the projections for which remain uncertain. However, even under the wetter climate projections, the loss of snowpack would pose challenges to water managers, hamper hydropower generation, and nearly eliminate all skiing and other snow-related recreational activities.

- The state's water supplies are also at risk from rising sea levels. An influx of saltwater would degrade California's estuaries, wetlands, and groundwater aquifers. Saltwater intrusion caused by rising sea levels is a major threat to the quality and reliability of water within the southern edge of the Sacramento/San Joaquin River Delta–a major state fresh water supply.

- Global warming is also projected to seriously affect agricultural areas, with California farmers projected to lose as much as 25 percent of the water supply they need; decrease the potential for hydropower production within the state (although the effects on hydropower are uncertain); and seriously harm winter tourism. Under the lower warming range, the ski season at lower elevations could be reduced by as much as a month. If temperatures reach the higher

warming range and precipitation declines, there might be many years with insufficient snow for skiing and snowboarding.

- Agriculture – Increased GHG emissions are expected to cause widespread changes to the agriculture industry reducing the quantity and quality of agricultural products statewide. Although higher CO_2 levels can stimulate plant production and increase plant water-use efficiency, California's farmers will face greater water demand for crops and a less reliable water supply as temperatures rise. Crop growth and development will change, as will the intensity and frequency of pest and disease outbreaks. Rising temperatures will likely aggravate O_3 pollution, which makes plants more susceptible to disease and pests and interferes with plant growth.

- Plant growth tends to be slow at low temperatures, increasing with rising temperatures up to a threshold. However, faster growth can result in less-than-optimal development for many crops, so rising temperatures are likely to worsen the quantity and quality of yield for a number of California's agricultural products. Products likely to be most affected include wine grapes, fruits and nuts, and milk.

- In addition, continued global warming will likely shift the ranges of existing invasive plants and weeds and alter competition patterns with native plants. Range expansion is expected in many species while range contractions are less likely in rapidly evolving species with significant populations already established. Should range contractions occur, it is likely that new or different weed species will fill the emerging gaps. Continued global warming is also likely to alter the abundance and types of many pests, lengthen pests' breeding season, and increase pathogen growth rates.

- Forests and Landscapes – Global warming is expected to intensify this threat by increasing the risk of wildfire and altering the distribution and character of natural vegetation. If temperatures rise into the medium warming range, the risk of large wildfires in California could increase by as much as 55 percent, which is almost twice the increase expected if temperatures stay in the lower warming range. However, since wildfire risk is determined by a combination of factors, including precipitation, winds, temperature, and landscape and vegetation conditions, future risks will not be uniform throughout the state. For example, if precipitation increases as temperatures rise, wildfires in southern California are expected to increase by approximately 30 percent toward the end of the century. In contrast, precipitation decreases could increase wildfires in northern California by up to 90 percent.

- Moreover, continued global warming will alter natural ecosystems and biological diversity within the state. For example, alpine and subalpine ecosystems are expected to decline by as much as 60 to 80 percent by the end of the century as

a result of increasing temperatures. The productivity of the state's forests is also expected to decrease as a result of global warming.

CONTRIBUTIONS TO GREENHOUSE GAS EMISSIONS

GLOBAL

Anthropogenic GHG emissions worldwide as of 2005 (the latest year for which data are available for Annex 1 countries) totaled approximately 30,800 CO2 equivalent million metric tons (MMTCO2E).[4] It should be noted that global emissions inventory data are not all from the same year and may vary depending on the source of the emissions inventory data (UNFCCC 2005, 2008).[5] Six countries and the European Community accounted for approximately 70 percent of the total global emissions (refer to Table Q-2, Six Top GHG Producer Countries and the European Community). The GHG emissions in more recent years may be substantially different than those shown in Table Q-2.

TABLE Q-2
SIX TOP GHG PRODUCER COUNTRIES AND THE EUROPEAN COMMUNITY

Emitting Countries	GHG Emissions ($MMTCO_2E$)*
United States	7,241.5[1]
China	4,882.7[2]
European Community	4,192.6[1]
Russian Federation	2,132.5[1]
India	1,606.5[2]
Japan	1,359.9[1]
Germany[3]	1,001.5[1]
Total	21,415.7

Sources:
[1] UNFCC n.d.(a)
[2] GHG emissions for China and India (Calendar Year 2000) were obtained from the World Resources Institute's Climate Analysis Indicators Tool (CAIT) http://www.cait.wri.org/cait.php
[3] Germany's GHG emissions are included in the European Community.
* Excludes emissions/removals from land use, land-use change and forestry (LULUCF)

[4] The CO_2 equivalent emissions are commonly expressed as "million metric tons of carbon dioxide equivalent ($MMTCO_2E$)" The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP, such that $MMTCO_2E$ = (million metric tons of a GHG) x (GWP of the GHG). For example, the GWP for methane is 21. This means that emissions of one million metric tons of methane are equivalent to emissions of 21 million metric tons of CO_2.

[5] The global emissions are the sum of Annex I and non-Annex I countries without counting Land-Use, Land-Use Change and Forestry (LULUCF). For countries that 2004 data were unavailable, the UNFCCC data for the most recent year were used.

UNITED STATES

As noted in Table Q-2, the United States was the top producer of greenhouse gas emissions as of 2005. Based on GHG emissions in 2004, six of the states—Texas, California, Pennsylvania, Ohio, Illinois, and Florida, in ranked order—would each rank among the top 30 GHG emitters internationally (World Resources Institute 2006). The primary greenhouse gas emitted by human activities in the United States was CO_2, representing approximately 84 percent of total greenhouse gas emissions (US EPA 2008c). Carbon dioxide from fossil fuel combustion, the largest source of US greenhouse gas emissions, accounted for approximately 80 percent of US GHG emissions (US EPA 2008).

STATE OF CALIFORNIA

Based upon the 2004 GHG inventory data (the latest year available) compiled by CARB for the California 1990 greenhouse gas emissions inventory, California emitted emissions of 484 $MMTCO_2E$, including emissions resulting from out-of-state electrical generation (CARB 2007). Based on the CARB inventory and GHG inventories for countries contributing to the worldwide GHG emissions inventory compiled by the United Nations Framework Convention on Climate Change (UNFCCC) for 2005, California's GHG emissions rank second in the United States (Texas is number one) with emissions of 423 $MMTCO_2E$ (excluding emissions related to imported power) and internationally between Ukraine (418.9 $MMTCO_2E$) and Spain (440.6 $MMTCO_2E$) (UNFCCC 2008).

A California Energy Commission (CEC) emissions inventory report placed CO_2 produced by fossil fuel combustion in California as the largest source of GHG emissions in 2004, accounting for 81 percent of the total GHG emissions (CEC 2006a). CO_2 emissions from other sources contributed 2.8 percent of the total GHG emissions, methane emissions 5.7 percent, nitrous oxide emissions 6.8 percent, and the remaining 2.9 percent was composed of emissions of high-GWP gases (CEC 2006a). These high GWP gases are largely composed of refrigerants and a small contribution of sulfur hexafluoride (SF_6) used as insulating materials in electricity transmission and distribution.

The primary contributors to GHG emissions in California are transportation, electric power production from both in-state and out-of-state sources, industry, agriculture and forestry, and other sources, which include commercial and residential activities. These primary contributors to California's GHG emissions and their relative contributions are presented in Table Q-3, GHG Sources in California.

TABLE Q-3
GHG SOURCES IN CALIFORNIA

Source Category	Annual GHG Emissions ($MMTCO_2E$)[a]	Percent of Total	Annual GHG Emissions ($MMTCO_2E$)[b]	Percent of Total
Agriculture	27.9	5.8%	27.9	6.6%
Commercial Uses	12.8	2.6%	12.8	3.0%
Electricity Generation	119.8	24.7%	58.5	13.8%
Forestry (excluding sinks)	0.2	0.0%	0.2	0.0%
Industrial Uses	96.2	19.9%	96.2	22.7%
Residential Uses	29.1	6.0%	29.1	6.9%
Transportation	182.4	37.7%	182.4	43.1%
Other[c]	16.0	3.3%	16.0	3.8%
Totals	484.4	100.0%	423.1	100.0%

Sources:
[1] CARB 2007.
[a] Includes emissions associated with imported electricity, which account for 61.3 $MMTCO_2E$ annually.
[b] Excludes emissions associated with imported electricity.
[c] Unspecified combustion and use of ozone-depleting substances.

It should be noted that emissions from each of these economic sectors are not confined to emissions from a single process, since there is crossover with other sectors. For example, the GHG emissions from cement production places clinker manufacturing in its own category and the fuel used to heat the cement production process within the industrial fuel category. In the case of landfills, methane emissions and CO_2 emissions and sinks are reported in their respective portions of the inventory. Taken together, the CO_2 sinks approximately offset the landfill methane emissions. Additionally, fuel-related GHG emissions from transporting wastes to landfills are included in transportation fuels.

SAN FRANCISCO BAY REGION

The Bay Area Air Quality Management District has published the *Source Inventory of Bay Area Greenhouse Gas Emissions*, December 2008, inventorying direct and indirect GHG emissions due to human activities. The emissions are estimated for industrial, commercial, transportation, residential, forestry, and agriculture activities in the San Francisco Bay Area region of California. Both direct greenhouse gas emissions from locally generated electricity in the Bay Area and indirect emissions from out-of-region generated electricity for consumption in the region are reported. Emissions of CO2, Bio-CO2, CH4, N2O, HFCs, PFCs, and SF6 are estimated using the most current activity (e.g., cubic feet of natural gas burned or vehicle miles traveled) and emission factor data from various sources. Activity data used in preparing this GHG inventory is the same as is used in preparing the Air District's criteria and toxic inventories. Emission factor data

was obtained from the U.S. Department of Energy's (DOE's) Energy Information Administration (EIA), the California Energy Commission (CEC), and the California Air Resources Board (CARB).

In 2007, 102.6 million metric tons of CO_2-equivalent ($MMTCO_2E$) greenhouse gases were emitted by the San Francisco Bay Area (95.5 $MMTCO_2E$ were emitted within the Bay Area Air District and 7.1 $MMTCO_2E$ were indirect emissions from imported electricity). Fossil fuel consumption in the transportation sector was the single largest source of the SF Bay Area's greenhouse gas emissions in 2007, accounting for over 40.6 percent of all emissions – within this category, cars and light duty trucks contributed the most emissions (63.8%), with ships and boats accounting for the next highest quantity of transportation emissions (19.4%). The industrial and commercial sector, including oil refining, natural gas combustion, waste management, refrigerant usage and other sources, accounted for 34 percent of greenhouse gas emissions in the Bay Area. Energy production activities including electricity generation and co-generation were the third largest contributor with 14.8 percent; residential fuel combustion accounted for 6.6 percent of emissions, while off road equipment such as construction, industrial, commercial and lawn and garden equipment contributed 2.8 percent of emissions.

CITY OF BERKELEY

The International Council for Local Environmental Initiatives (ICLEI) conducted Berkeley's GHG emissions inventory for the year 2005. ICLEI provides the accepted community level inventory methodology for over 700 local governments throughout the world.Berkeley's community-wide greenhouse gas emissions totaled 634,798 tons of CO_2-equivalent (CO_2e) in 2005. ICLEI's inventory methodology assumes that local governments have little ability to influence the operational decisions of autonomous institutions in a community, such as universities and buildings owned and operated by other levels of government.

According to Berkeley's inventory numbers, community per capita emissions are approximately seven tons CO_2e. Gasoline and diesel consumption by automobiles driving within the Berkeley City limits accounts for about 47% of Berkeley's total greenhouse gas emissions, approximately 293,000 tons per year as of 2005. The emissions that result from gasoline consumption, mostly in private vehicles, are nearly double the emissions that result from the diesel consumed in trucks and other large vehicles. Gasoline consumption is the single largest source of GHG emissions in Berkeley.

Commercial and residential buildings account for the remaining 53% of emissions. Natural gas use is by far a larger source of emissions than electricity in both the commercial and residential sectors. Natural gas is predominately used for space and water heating. Municipal operations constitute about 1% of Berkeley's total emissions, or about 6,400 tons CO_2e. These emissions are included in the commercial and transportation sector data. The 2005 inventory reflects a significant decrease in greenhouse gas emissions in Berkeley: an almost 9% decrease between 2000 and 2005, one of the

largest reductions in GHG emissions documented by any U.S. city. A portion of these reductions can be attributed to increased energy efficiency in Berkeley homes and businesses. This period also included the 2000 California energy crisis. Surveys conducted by utilities and community groups at that time show that many consumers turned to energy efficiency in order to reduce energy costs.

LAWRENCE BERKELEY NATIONAL LABORATORY

LBNL is an immediate neighbor to the Berkeley campus, and part of the San Francisco Bay region. Growth at Lawrence Berkeley National Laboratory would contribute emissions of GHGs as a result of traffic increases and building heating, as well as indirectly through off site electricity generation. Like UC Berkeley, the Lab does not emit industrial or agricultural gases, and thus would generate little in the way of GHGs other than carbon dioxide. On-road transportation sources would represent the largest source of GHG emissions.

New development at LBNL built under auspices of The Regents is subject to the UC Policy on Sustainable Practices. An example of such development will be the planned Computational Research & Theory facility. New development at LBNL built under auspices of the Department of Energy (DOE) is subject to that agency's guidelines. As a national laboratory at the forefront of energy efficiency and sustainability research, the laboratory operationally supports green building standards. The Molecular Foundry building became the first building in the City of Berkeley to receive the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Gold certification. The Molecular Foundry's Gold rating — the second-highest ranking obtainable under the system — is based on the utilization of a myriad of features, including optimally designed electrical and HVAC systems, an energy-efficient chiller and boiler plant, and the innovative design of traditionally energy-intensive areas such as laboratories, a cleanroom, and a server room. Because of these and other measures, the Molecular Foundry consumes 28 percent less energy than the already-stringent California building efficiency standard, as mandated by Title 24. Furthermore, LBNL is now required by DOE to attain LEED Gold certification for all new construction and major building renovations in excess of $5 million, and comply with the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings for all buildings falling below this threshold.

EXISTING UC BERKELEY GHG EMISSION SOURCES

UC Berkeley's physical emission sources include all central campus buildings, all student housing on and off campus, and the Richmond Field Station. The GHG emitting operational activities for which UC Berkeley will take responsibility in meeting its 2014 goals include all activities represented in the CCAR/Registry inventory. The Registry only requires emission inventories from purchased electricity, steam generation, natural gas use, fugitive refrigerants and campus fleet. However, the campus also estimates emissions from additional sources such as automobile commute by students, staff and faculty, air travel emissions, solid waste disposal, and embodied energy consumption in water use for UC Berkeley's emissions inventory.

The 2020 LRDP EIR assumed that up to one million gross square feet of space could be under construction at any time in the course of 2020 LRDP implementation. These construction emissions are not reported in the campus CalCAP inventory, due to the fact that the campus does not directly control construction companies; emissions

TABLE Q-4
UC BERKELEY GHG EMISSION SOURCES

	2007 Emissions in $MTCO_2e$	Percent of Total
Imported Steam, District Heating, Cooling, Co-gen (also boilers and backup diesel engines)	85,436	41.5%
Purchased Electricity	61,443	29.8%
Air Travel	20,998	10.2%
Faculty & Staff Commute (Mobile Combus-tion)	17,433	8.5%
Natural Gas	10,470	5.1%
Student Commute (Mobile Combustion)	3,736	1.8%
Direct Fugitive - fugitive emissions of HCFCs from cooling units	1,791	.9%
Water Consumption	1,955	.9%
University Vehicle Fleet (Mobile Combustion)	1,751	.9%
Municipal Solid Waste: landfill emissions caused by University-generated waste	981	.5%

Note: The campus uses the 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 ($MTCO_2e$).
Source: 2009 Climate Action Plan, UC Berkeley

calculations for construction vehicles would be reported and regulated by construction businesses at their business address. Modeling shows that annual CO_2 of 1,264 metric tons results from construction activities of this scale (Source: Environmental Resources Management, Koehler, December 2008, with data translated to metric tons; see Attachment 1).

Q.5 STANDARDS OF SIGNIFICANCE

The significance of the potential impacts of the 2020 LRDP on global climate change was determined based on the following standards:

Standard: Would implementation of the 2020 LRDP impede or conflict with the emissions reduction targets and strategies prescribed in or developed to implement AB 32?

Consistency of the proposed action with the programs and regulations intended to achieve the statewide GHG emission reduction goals established under AB 32 cannot be fully determined at this time, because the rulemaking effort is not complete. In December 2008, CARB completed a significant milestone, adopting the scoping plan for California's effort to reduce the state's greenhouse gas emissions to 1990 levels by 2020, in accordance with AB 32. However, the analysis here can determine both compliance with the general direction of the CARB Scoping Plan strategies, and whether implementation of the 2020 LRDP would allow UC Berkeley to meet AB 32 targets.

AB 32 requires that CARB promulgate regulations to effectuate the GHG emission reduction targets, such that the State will reach 1990 emission levels by 2020. To the extent that CARB promulgates any such regulations that are applicable to UC Berkeley under the 2020 LRDP as amended or otherwise, UC Berkeley would comply with those regulations. Such regulations have not yet been promulgated but are required to be promulgated under AB 32 prior to 2013. Nonetheless, the analysis herein takes a conservative approach, in that it does not take into account, in determining significance, anticipated compliance with future regulations under AB 32 by UC Berkeley, by California utilities supplying energy and water to the campus, by vehicle or fuel manufacturers, or by others. It is currently unknown what regulations will be implemented by CARB under AB 32.

The contribution of implementation of the 2020 LRDP to cumulative global climate change is evaluated in this document by determining whether implementation would conflict with state-defined targets, or with strategies that the state is developing to comply with AB 32. Towards the latter end, Table Q-5, Consistency of 2020 LRDP Implementation with AB 32 Scoping Measures, lists initiatives for further rulemaking included in CARB's Scoping Plan for the state's compliance with AB 32, and presents ongoing 2020 LRDP EIR policies and continuing best practices that comply with the apparent intent of the scoping plan measures, and indicates that implementation of the 2020 LRDP is in substantial conformance with the direction of the CARB Scoping Plan measures.

As noted previously, the Bay Area Air Quality Management District is in the process of promulgating guidelines and standards for greenhouse gas emissions to be applied in the San Francisco Bay Area and has published an options paper. At a plan level, the options paper suggests that if a general plan demonstrates, through dividing the emissions inventory projects (MT CO2e) by the amount of growth that would be accommodated in 2020, that it could meet the GHG efficiency metrics proposed (either 6.4 MT CO2e per capita or 4.4 MT CO2e per service population), BAAQMD believes that the amount of GHG emissions associated with the general plan would be less than significant, regardless of its size and magnitude of emissions, because it would accommodate growth in a manner that would not hinder the state's ability to achieve AB 32 goals (BAAQMD Workshop Draft Options report, CEQA Thresholds of Significance, April 2009, page 38).

Although not clearly applicable to a campus environment, preliminary calculations indicate that campus per capita emissions given emissions reductions targets would be 3.3 MT CO2e in 2014, possibly rising to 3.4 MT CO2e in 2020 if no further reductions are taken. Campus emissions would be well below the proposed plan-level significance threshold.

Q.6 POLICIES AND PROCEDURES GUIDING FUTURE PROJECTS

This section describes existing policies and procedures that would help to minimize climate change impacts of development under the 2020 LRDP. It discusses both the policies in the 2020 LRDP itself and other University activities affecting climate change.

UNIVERSITY OF CALIFORNIA POLICY ON SUSTAINABLE PRACTICES

In March 2007, UC President Robert Dynes signed the American College and University Presidents Climate Commitment (ACUPCC), which calls for the University of California to reduce its greenhouse gas emissions, with the ultimate goal of making all ten UC campuses carbon-neutral. At that time, as an update to the green building policy adopted in 2004, the President Dynes issued a Presidential Policy on Sustainable Practices, which was accompanied by Policy Guidelines for Sustainable Practices. The policy documents the University's commitment to the stewardship of the environment and to reducing the University's dependence on non-renewable energy sources. Emission reduction strategies established under this policy include practices related to green building design, clean energy, climate protection, transportation, operations, recycling and waste management, and environmentally preferable procurement (EPP).

As with all University of California (UC) campuses, UC Berkeley is required to implement the UC Policy on Sustainable Practices and the associated Guidelines (UC Sustainability Policy) [6]. All future development under the 2020 LRDP is subject to the UC Sustainability Policy. A copy of the current Policy is provided at the end of this section (Attachment 2).

The UC Policy on Sustainable Practices requires that, by December 2008, all UC campuses, prepare a climate action plan establishing strategies to reduce GHG emissions from campus to 2000 levels by 2014 and to 1990 levels by 2020. The climate action plan incorporates information under the American College & University President's Climate Commitment (ACUPCC) Implementation Guidelines. The climate action plan required under the UC Policy on Sustainable Practices thus sets target GHG emission reductions for all UC campuses that are consistent with the statewide targets set under AB 32.

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6 To the extent that the Policy and Guidelines are updated from time to time, the then-current version can be viewed online at http://www.ucop.edu/ucophome/coordrev/policy/PP032207ltr.pdf or obtained through Universitywide Policy Office, Office of the President, 1111 Franklin Street, 12th Floor, Oakland, CA 94607.

Systemwide policy further requires the University as a system to develop an action plan for becoming climate neutral which will include a target date for achieving climate neutrality as soon as possible while maintaining the University's overall mission, and a needs assessment of the resources required to successfully achieve these goals. Climate neutrality 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.

As described below, however, UC Berkeley has set more aggressive targets. On April 27, 2007, at the 4th Annual Chancellor's Advisory Committee on Sustainability Summit, UC Berkeley Chancellor Robert Birgeneau officially committed the campus to reducing its greenhouse gas emissions to 1990 levels by year 2014. This goal is six years earlier than State of California and the UC Policy on Sustainable Practices requires. He also committed the campus to working towards climate neutrality.

UC BERKELEY CLIMATE ACTION PLAN (CALCAP)

In 2005 a grassroots student petition initiative calling upon the campus to be responsible for its greenhouse gas emissions garnered wide support. Vice Provost Catherine Koshland then convened the CalCAP Steering Committee in early 2006, bringing together a broad constituency from across the campus to provide recommendations to the Chancellor. In April, 2006, the Chancellor announced that the campus would strive to achieve Governor Schwarzenegger's state targets at a minimum, and he called for a feasibility study to identify mitigation opportunities and to determine how best to meet aggressive targets. The CalCAP final report, completed in 2007, meets the current near-term requirement of the University of California Policy on Sustainable Practices for submittal of a climate action plan. While this requirement has been met by UC Berkeley, the Office of Sustainability has produced a 2009 Climate Action Plan (Plan) to reflect the progress and lessons learned since the publication of the original plan.

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 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. Based on what the greenhouse gas inventory reveals 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. By January 2009, the campus had begun taking additional steps to achieve its GHG reduction goals and had effectively slowed the trend towards increasing GHG emissions.

UC BERKELEY INITIATIVES

UC Berkeley provides the nation with academic and research leadership on the topic of climate change. Berkeley Chancellor Robert Birgeneau testified before congress in April 2008, outlining the multi-faceted campus approach to climate change; the text of his testimony appears as Attachment 3. Although not discussed in this document, the academic and research environment provides a supportive context for campus administrative efforts to address climate change.

UC Berkeley initiatives to address campus GHG emissions particularly and sustainability generally are wide ranging and include the following:

The Green Initiative Fund (TGIF) is a grant-making fund for sustainability projects on UC Berkeley's campus. About $250,000 per year is available for grants; all students, faculty, and staff are eligible to submit project proposals. Projects will be selected for funding by an annually appointed grant making committee consisting of students, faculty, and staff, in which students have the majority vote. TGIF is funded by a $5 per semester student fee, beginning in fall 2007 and persisting for 10 years. The fee referendum was approved by the student body during the April 2007 ASUC elections. It received final approval by the Chancellor and Regents during summer 2007.

The Chancellor's Advisory Committee on Sustainability (CACS), a diverse committee of faculty, staff, students and alumni, was created in 2003 to promote environmental management and sustainable development on campus. An early initiative of CACS was the 2005 Campus Sustainability Assessment that established a baseline for measuring progress toward sustainability and provided guidance for future actions. The Committee is charged with advising the Chancellor on matters pertaining to the environment and sustainability as it directly relates to the University of California, Berkeley. The mission of the Committee includes three central goals: to engage the campus in an ongoing dialogue about reaching environmental sustainability; to integrate environmental sustainability with existing campus programs in education, research, operations, and public service; to instill a culture of sustainable long-range planning and forward-thinking design.

The Campus Sustainability Assessment, incorporated herein by reference, provides a comprehensive overview of campus sustainability activities in many resource areas. The information below is intended to supplement information in the 2008 update to the Campus Sustainability Assessment. In the areas of Water; Purchasing[7]; Food and Dining, the Sustainability Assessment information is current.

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[7] All standard configuration personal computers (desktop/laptop) purchased by UC Berkeley are required meet the standard of Electronic Product Environmental Assessment Tool (EPEAT) Bronze certification -- all but Gateway products are EPEAT Silver certified, in accordance with UCOP policy.

UC Berkeley purchases Energy-Star® rated personal computers, while other Energy-Star® products are purchased whenever possible for both energy and water efficiency.

Energy and Climate

Updates to Sustainability Assessment information as of February 09

The campus completed most of its 2006-2008 Higher Education Energy Efficiency PG&E Partnership projects, expected to reduce annual GHG emissions by about 4,000 metric tons. Projects under this effort address over-ventilation in buildings, lighting retrofits, retrofit fume hoods in laboratories to variable flow instead of 100% flow, and include building commissioning.

The campus joined the 2009-2011 UC Strategic Energy Partnership (SEP). The final report for UC Berkeley was completed in July 2008 (http://www.facilities.berkeley.edu/greenbuildings/Use_Savings/SEP/Report_final.pdf). The Strategic Energy Plan identifies potential energy efficiency retrofit projects at all campus buildings over 50,000 square feet. The projects include primarily lighting, HVAC and commissioning measures. A number of other measures are included that apply in all campus buildings, regardless of size. The Plan also addresses the potential for energy efficiency 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). The identified suite of SEP projects are expected to achieve one-third of the emission reductions needed to achieve the 2014 campus target. The planning process for projects will include a review of the project costs, and an assessment of the estimated energy savings. The campus will update the SEP including reevaluation of the project priority list, regularly.

The Berkeley Institute for the Environment (BIE) in partnership with the Office of Sustainability, established the Carbon Footprint Calculator (http://bie.berkeley.edu/files/ConsumerFootprintCalc.swf) to help the campus community estimate its carbon footprint from air travel and make a charitable contribution to the climate Action Fund (http://sustainability.berkeley.edu/calcap/ ClimateActionFund-Summary.html) to implement climate action projects on campus.

The Campus Building Energy Dashboard is partially in place. The Building Energy Dashboard can inform the campus community about the buildings they inhabit, educating users about energy efficiency on a personal and effective scale. (http://www.demandless.org/building/)

UCB is considering arrangements with power providers to install photovoltaic systems on campus property on campus roof tops, parking lots at the central campus and the Richmond campus. An academic unit, ERG's Renewable and Appropriate Energy Lab (RAEL), is working to develop a small wind turbine testing facility at UC Berkeley's Richmond Field Station.

UC Berkeley's environmentally preferable purchasing activities also support the green building program requirements for low VOC carpet, recycled-content carpet, low VOC adhesives, sealants, paints, and coatings, furniture purchases with foam components that do not contain CFCs or HFCs, and wood furniture certified by the Forest Stewardship Council (FSC).

The Office of Sustainability is working on a number of initiatives to address behaviors that contribute to energy usage. The Green Department Certification initiative would train campus units at the department level to consider energy efficiency in their practices.

Built Environment

Initiatives in this area are intended to foster environmental awareness and reduce the environmental consequences of UC development, including consumption of non-renewable energy.

Updates to Sustainability Assessment information as of February 09

UCB has been and will continue to use green building design standards for development. By promoting energy efficiency and helping to minimize water consumption, these programs also contribute to minimizing and reducing GHG emissions.
UCB completed construction of Haste Street Early Childhood Development Center, the University's first LEED NC "Silver" rated building, which opened in January 2007.

UCB currently has buildings under construction that have been designed to target a LEED NC "Silver" rating; buildings under construction targeted to meet a LEED CI Silver rating; buildings under construction designed to meet 'Gold, and; buildings in the design phase that are targeting Gold.

UCB has been developing plans to operate and maintain campus buildings to a minimum standard of UC-equivalent LEED® Existing Buildings Operation and Maintenance (EBOM) "certified" rating.

UCB has two buildings – Wurster Hall and University Hall – in preparation to achieve LEED-EB certification through the USGBC. Through implementation of these projects, and through execution of the campus Strategic Energy Plan projects, the campus will develop the campus' core prototype credits for LEED EBOM certification for existing campus buildings.

A number of individuals within UC Berkeley Facilities Services, both within the planning and project management groups, are LEED-accredited.

UC Berkeley would raise the minimum standard for LEED equivalency from "certification" to "Silver" with a goal of "Gold", for new construction.

Waste

Updates to Sustainability Assessment information as of February 09

Increasing waste diversion rates will reduce climate change emissions associated with energy intensive materials extraction and production as well as methane emissions from landfills (Cal/EPA, 2006).

An expansion to the campus composting program is under consideration. Composting organic waste that would otherwise be disposed in a landfill would reduce GHG emissions. Anaerobic decomposition of organic waste in a landfill produces CH4 (methane), a potent GHG, while campus composting via the vendor NorCal does not produce any CH4. Composting also has other climate- and environmentally-friendly co-benefits.

In response to Public Resources Code Section 40196.3 which states that the Regents of the University of California are encouraged to comply with code Chapter 18.5, the "State Agency Integrated Waste Management Plan" and in support of the California Integrated Waste Management Board's goal for a "zero waste California", the University voluntarily adopted the following waste diversion goals:

50% by June 30, 2008
75% by June 30, 2012
Ultimate goal of zero waste by 2020.

All recyclers of University electronic waste are required to sign the electronic recyclers pledge of true stewardship.

Transportation

Updates to Sustainability Assessment information as of February 09

The most recent survey of student travel behavior for fall of 2008 closed in February 2009 and results will be made available in the spring of 2009. Data from the survey, and data from the faculty staff travel behavior survey to be completed in the fall of 2009, will help to update the campus GHG emissions inventory.

Planning for campus properties on the blocks adjacent to the Campus Park embraces principles of transit-oriented development in a manner that contributes to the existing city environment. Blocks adjacent to campus are well served by public transit. The City of Berkeley and UC Berkeley have successfully completed two joint planning documents, the 2001 Transportation Demand Management Study and the 2003 Draft Southside Plan. UC Berkeley has participated in development of a new Downtown Area Plan, and in 2009 UC Berkeley expects to support the City of Berkeley's new Downtown Area Plan that would facilitate construction of 3100 new housing units near campus, and new office space that could reduce commutes for individuals affiliated with UC Berkeley and their families.

Land Use Impacts

Updates to Sustainability Assessment information as of February 09

Fire Fuel Management Program: In the past 100 years over 16 large wildfires, typically burning during extreme weather, have caused catastrophic loss to both forested and urbanized areas in the Oakland/Berkeley hills, representing a nearly completed release of sequestered carbon in the vegetation and buildings of both areas (HEF, 2005). The Hills Emergency Forum (HEF), created in the aftermath of the 1991 Tunnel Fire, endorses strategies to reduce or avoid large wildland-urban interface conflagrations. Consistent with this effort, the UC Berkeley 2020 LRDP includes policies and practices that reduce the likelihood of pulse emission of GHGs from catastrophic wildfires,

through a variety of forest management approaches. Most notably, the campus does not rely on a fire suppression-based approach, which is more likely to result in fewer, more catastrophic wildfires. Instead, the campus seeks to apply management strategies that foment the long-term and sustainable sequestration of carbon. UC practices embrace the emerging best practice promulgated by the CCAR by focusing long term efforts on the conversion of non-native forest ecosystems to native floral types, posing a lesser fire risk, enhancing habitat for native species, and representing a more stable long term bank for the sequestration of sustainable and historic levels of carbon on UC lands (UC Berkeley 2020 LRDP p. 55).

As noted by the HEF, eucalyptus stands in the east bay hills "are non-native and support a low diversity of species. Long term replacement by native hardwood forest or other less flammable vegetation is generally desirable, though the transition is recognized as disruptive"(HEF Management Recommendations). Monterey Pines were introduced to the study area in the 1900s and occur as mature groves, in dense plantations and mixed with Eucalyptus. Monterey Pine Forests in the study area are not essential habitat for any known species of special concern that would suggest special management requirements. These vegetation types have the highest ignition potential due to the presence of needles, hazardous understory and dead wood on the ground and lower portions of trees.

In the East Bay, pre-settlement conditions consisted of a significantly larger coverage of grasslands and chaparral, which have been largely supplanted by housing and exotic tree species. While much of UC's Hill Campus is stocked with a growing native forest, other portions are carrying high levels of non-native trees. UC's eucalyptus and pine dominated forests would not be considered native and are at risk of catastrophic wildfire and associated carbon releases. As of 2008, over 150 acres of the 800 acre Hill Campus have begun the conversion process toward native forests (UC Berkeley, 2007).

The removal of exotic tree species, prone to extreme pulse emissions of GHG's during wildfires is clearly desirable from a global warming perspective. Whether the best replacement flora, from a global warming perspective is arboreal or grassland is currently a point of scientific study (see, for example, Proceedings of the National Academy of Sciences, April 2007 http://www.pnas.org/content/104/16/6550.abstract). UC Berkeley stewardship efforts will likely seek a balance, mixing native hardwood forests with grassland/chaparral communities, balancing the needs for GHG control with competing environmental imperatives, such as habitat protection.

At this time and in keeping with standard inventory practice, UC Berkeley does not include GHG emissions or sequestration from land use changes in its inventory.

Joint City/University Plans: UC Berkeley and the City of Berkeley have two initiatives underway for joint land use planning, the Southside Plan and the Downtown Area Plan. As described under Transportation above, the Downtown plan seeks to capitalize on downtown Berkeley's superior transit access by intensifying development in the downtown area. The Downtown plan would promote a sustainable downtown that serves as a model of urban stewardship and the wise use of resources.

2020 LRDP

The 2020 LRDP would influence climate change by guiding the location, scale, form and design of new University projects. The 2020 LRDP further establishes the campus capacity for growth through 2020. The following 2020 LRDP Objectives are particularly relevant:

Build a campus that fosters intellectual synergy and collaborative endeavors both within and across disciplines.

Provide the housing, access, and services we require to support a vital intellectual community and promote full engagement in campus life.

Plan every new project to represent the optimal investment of land and capital in the future of the campus.

Plan every new project as a model of resource conservation and environmental stewardship.

Maintain the hill campus as a natural resource for research, education and recreation, with focused development on suitable sites.

The 2020 LRDP includes a number of policies and procedures for individual project review to support these Objectives, as described below.

In order to foster intellectual synergy, 2020 LRDP policies suggest increasingly intensive use of the University owned land on and adjacent to campus. More than ninety percent of future growth under the LRDP is planned to be accommodated on or adjacent to the Campus Park.

With respect to access, the 2020 LRDP anticipates increasing the supply of undergraduate beds to equal 100% of incoming freshmen, plus 50% of sophomores and transfers, by 2020; and providing up to three years of University rental housing for new untenured ladder faculty who desire it by 2020. Although an increase in parking spaces is proposed to meet demand, the LRDP also anticipates reducing demand for parking through incentives for alternate travel modes, and collaborating with local cities and transit providers to improve service to the campus. The housing program is designed to support these policies by ensuring all new student housing is located within a one mile radius or within a block of a transit line providing trips to Doe Library in under 20 minutes, thus reducing the need to drive.

The 2020 LRDP strategies to optimize land and capital include looking at a full range of alternatives in capital investment decisions; basing decisions on life cycle costs, including the cost of known future expenditures; and considering joint public private ventures that leverage University resources.

Policies under the fourth objective include incorporating sustainable design principles into capital investment decisions; designing new campus buildings to a standard equivalent to LEED 2.1; and designing new campus laboratory buildings to a standard equivalent to LEED 2.1 and LABS 21 environmental performance criteria.

In order to maintain the Hill Campus as a natural resource, the 2020 LRDP policies assert that the campus will maintain the visual primacy of the natural landscape in the Hill Campus, and manage the Hill Campus landscape to reduce fire and flood risk and restore native vegetation and hydrology patterns.

2020 LRDP EIR

As part of the 2020 LRDP EIR certified by The Regents in 2005, the University established and implements a campus-wide mitigation monitoring program for both mitigation measures and continuing best practices included in the 2020 LRDP EIR. Below are listed existing measures and best practices, subject to on-going monitoring as part of the 2020 LRDP EIR Mitigation Monitoring and Reporting program, with potential to reduce campus climate-related impacts over the lifetime of the 2020 LRDP. The additional Climate measures appearing in bold below would be incorporated into the existing mitigation monitoring program upon approval of the proposed LRDP amendment action. The other existing measures listed are not specifically targeted at climate impacts but can help reduce campus climate emissions as an ancillary benefit.

Continuing Best Practice AES-1-d: To the extent feasible, future fuel management practices would include the selective replacement of high-hazard introduced plant species with native species: for example, the restoration of native grassland and oak-bay woodland though the eradication of invasive exotics, and replacement of aged pines and second-growth eucalyptus. Such conversions would be planned with care, however, to avoid significant disruption of faunal habitats.

Continuing Best Practice AIR-1: UC Berkeley shall continue to implement the same or equivalent alternative transit programs, striving to improve the campus mode split and reduce the use of single occupant vehicles among students, staff, faculty and visitors to campus.

Continuing Best Practice AIR-4-b: UC Berkeley shall continue to implement the following control measure to reduce emissions of diesel particulate matter and ozone precursors from construction equipment exhaust: Minimize idling time when construction equipment is not in use.

LRDP Mitigation Measure AIR-4-b: UC Berkeley shall implement the following control measures to reduce emissions of diesel particulate matter and ozone precursors from construction equipment exhaust:
•To the extent that equipment is available and cost effective, UC Berkeley shall require contractors to use alternatives to diesel fuel, retrofit existing engines in construction equipment and employ diesel particulate matter exhaust filtration devices.
•To the extent practicable, manage operation of heavy-duty equipment to reduce emissions, including the use of particulate traps.

Continuing Best Practice AIR-5: UC Berkeley will continue to implement transportation control measures such as supporting voluntary trip-reduction programs, ridesharing, and implementing improvements to bicycle facilities.

LRDP Mitigation Measure AIR-5: UC Berkeley will work with the City of Berkeley, ABAG and BAAQMD to ensure that emissions directly and indirectly associated with the campus are adequately accounted for and mitigated in applicable air quality planning efforts.

Continuing Best Practice BIO-1-a: UC Berkeley will continue to implement the Campus Specimen Tree Program to reduce adverse effects to specimen trees and flora. Replacement landscaping will be provided where specimen resources are adversely affected, either through salvage and relocation of existing trees and shrubs or through new plantings in kind or from species previously recorded on campus, at a ratio of 3:1, as directed by the Campus Landscape Architect. New plantings are selected as horticulturally appropriate at largest possible nursery size. (amended 2008)

Continuing Best Practice BIO-1-c: Because trees and other vegetation require routine maintenance, as trees age and become senescent, UC Berkeley would continue to undertake trimming, thinning, or removal, particularly if trees become a safety hazard. Vegetation in the Hill Campus requires continuing management for fire safety, habitat enhancement, and other objectives. This may include removal of mature trees such as native live oaks and non-native plantings of eucalyptus and pine.

Continuing Best Practice CLI-1 (new): UC Berkeley would continue to implement provisions of the UC Policy on Sustainable Practices including, but not limited to: Green Building Design; Clean Energy Standards; Climate Protection Practices; Sustainable Transportation Practices; Sustainable Operations; Recycling and Waste Management; and Environmentally Preferable Purchasing Practices.

Continuing Best Practice CLI-2 (new): UC Berkeley would continue to implement energy conservation measures (such as energy-efficient lighting and microprocessor-controlled HVAC equipment) to reduce the demand for electricity and natural gas. The energy conservation measures may be subject to modification as new technologies are developed or if current technologies become obsolete through replacement.

Continuing Best Practice CLI-3 (new): UC Berkeley would continue to annually monitor and report upon its progress toward its greenhouse gas emission targets. UC Berkeley would continue to report actions undertaken in the past year, and update its climate action plan annually to specify actions that UC Berkeley is planning to undertake in the current year and future years to achieve emission targets.

Continuing Best Practice HYD-2-a: UC Berkeley will continue to review each development project, to determine whether project runoff would increase

pollutant loading. If it is determined that pollutant loading could lead to a violation of the Basin Plan, UC Berkeley would design and implement the necessary improvements to treat storm water. Such improvements could include grassy swales, detention ponds, continuous centrifugal system units, catch basin oil filters, disconnected downspouts and storm water planter boxes.

Continuing Best Practice HYD-2-c: Landscaped areas of development sites shall be designed to absorb runoff from rooftops and walkways. The Campus Landscape Architect shall ensure that open or porous paving systems be included in project designs wherever feasible, to minimize impervious surfaces and absorb runoff.

Continuing Best Practice HYD-3: UC Berkeley will continue to review each development project, to determine whether rainwater infiltration to groundwater is affected. If it is determined that existing infiltration rates would be adversely affected, UC Berkeley would design and implement the necessary improvements to retain and infiltrate storm water. Such improvements could include retention basins to collect and retain runoff, grassy swales, infiltration galleries, planter boxes, permeable pavement, or other retention methods. The goal of the improvement should be to ensure that there is no net decrease in the amount of water recharged to groundwater that serves as freshwater replenishment to Strawberry Creek. The improvement should maintain the volume of flows and times of concentration from any given site at pre-development conditions.

Continuing Best Practice PUB-2.1-b: UC Berkeley would continue on-going implementation of the Hill Area Fire Fuel Management program.

Continuing Best Practice PUB-2.1-c: UC Berkeley would continue to plan and implement programs to reduce risk of wildland fires, including plan review and construction inspection programs that ensure that campus projects incorporate fire prevention measures.

Continuing Best Practice PUB-2.1-d: UC Berkeley would continue to plan and collaborate with other agencies through participation in the Hills Emergency Forum.

Continuing Best Practice TRA-1-a: UC Berkeley will continue in partnership with the City of Berkeley to develop a City program to: (a) maintain the Southside area between College, Dana, Dwight and Bancroft in a clean and safe condition; and (b) provide needed public improvements to the area (e.g. traffic improvements, lighting, bicycle facilities, pedestrian amenities and landscaping).

Continuing Best Practice TRA-1-b, Part 1: UC Berkeley will continue to do strategic bicycle access planning. Issues addressed include bicycle access, circulation and amenities with the goal of increasing bicycle commuting and safety. Planning considers issues such as bicycle access to the campus from adjacent streets and public transit; bicycle, vehicle, and pedestrian interaction;

bicycle parking; bicycle safety; incentive programs; education and enforcement; campus bicycle routes; and amenities such as showers. The scoping and budgeting of individual projects will include consideration of improvements to bicycle access.

Continuing Best Practice TRA-2: The following housing and transportation policies will be continued:
•Except for disabled students, students living in UC Berkeley housing would only be eligible for a daytime student fee lot permit or residence hall parking based upon demonstrated need, which could include medical, employment, academic and other criteria.
•An educational and informational program for students on commute alternatives would be expanded to include all new housing sites.

Continuing Best Practice TRA-3-a: Early in construction period planning UC Berkeley shall meet with the contractor for each construction project to describe and establish best practices for reducing construction period impacts on circulation and parking in the vicinity of the project site.

Continuing Best Practice TRA-3-b: For each construction project, UC Berkeley will require the prime contractor to prepare a Construction Traffic Management Plan which will include the following elements:
•Proposed truck routes to be used, consistent with the City truck route map.
•Construction hours, including limits on the number of truck trips during the a.m. and p.m. peak traffic periods (7:00 – 9:00 a.m. and 4:00 – 6:00 p.m.), if conditions demonstrate the need.
•Proposed employee parking plan (number of spaces and planned locations).
•Proposed construction equipment and materials staging areas, demonstrating minimal conflicts with circulation patterns.
•Expected traffic detours needed, planned duration of each, and traffic control plans for each phase of construction

Continuing Best Practice TRA-5: The University shall continue to work to coordinate local transit services as new academic buildings, parking facilities, and campus housing are completed, in order to accommodate changing demand locations or added demand.

LRDP Mitigation Measure TRA-11: The University will implement the following measures to limit the shift to driving by existing and potential future non-auto commuters:
•Review the number of sold parking permits in relation to the number of campus parking spaces and demographic trends on a yearly basis, and establish limits on the total number of parking permits sold proportionate to the number of spaces, with the objective of reducing the ratio of permits to spaces over time as the number of spaces grows, thus ensuring that new supply improves the existing space-to-permit ratio without encouraging mode change to single occupant vehicles.
•As new parking becomes operational, assign a portion of the new or existing parking supply to short-term or visitor parking, thus targeting parkers who

choose on-street parking now, and also effectively reserving part of the added supply for non-commuters.
•Expand the quantity of parking that is available only after 10:00 a.m., to avoid affecting the travel mode use patterns of the peak hour commuting population, as new parking inventory is added to the system.
•Review and consider reductions in attended parking as new parking inventory is added to the system and other impacts do not reduce parking supply.

LRDP Mitigation Measure TRA-12: The University shall prepare a strategic pedestrian improvement plan that outlines the expected locations and types of pedestrian improvements that may be desirable to accommodate 2020 LRDP growth. The plan shall be flexible to respond to changing conditions as the LRDP builds out, and shall contain optional strategies and improvements that can be applied to specific problems that arise as the LRDP builds out. The University shall develop the Plan in consultation with the City of Berkeley, and work with the City to implement plan elements as needed during the life of the 2020 LRDP on a fair share basis.

Continuing Best Practice USS-2.1-a: UC Berkeley will promote and expand the central energy management system (EMS) to tie building water meters into the system for flow monitoring.

Continuing Best Practice USS-2.1-c: UC Berkeley will continue to incorporate specific water conservation measures into project design to reduce water consumption and wastewater generation. This could include the use of special air-flow aerators, water-saving shower heads, flush cycle reducers, low-volume toilets, weather based or evapotranspiration irrigation controllers, drip irrigation systems, the use of drought resistant plantings in landscaped areas, and collaboration with EBMUD to explore suitable uses of recycled water.

Continuing Best Practice USS-2.1-d: UC Berkeley will continue to incorporate specific water conservation measures into project design to reduce water consumption and wastewater generation. This could include the use of special air-flow aerators, water-saving shower heads, flush cycle reducers, low-volume toilets, weather based or evapotranspiration irrigation controllers, drip irrigation systems, the use of drought resistant plantings in landscaped areas, and collaboration with EBMUD to explore suitable uses of recycled water.

Continuing Best Practice USS-5.1: UC Berkeley would continue to implement a solid waste reduction and recycling program designed to limit the total quantity of campus solid waste that is disposed of in landfills during implementation of the 2020 LRDP plan.

Continuing Best Practice USS-5.2: In accordance with the Regents-adopted green building policy and the policies of the 2020 LRDP, the University would develop a method to quantify solid waste diversion. Contractors working for the University would be required under their contracts to report their solid waste

diversion according to the University's waste management reporting requirements.

Q.7 2020 LRDP IMPACTS

This section describes the potential climate change impacts of the 2020 LRDP based on the Standard of Significance, whether impacts are significant or less than significant, and whether any significant impacts can be mitigated to less than significant levels.

LESS THAN SIGNIFICANT IMPACTS

LRDP Impact CLI-1: Implementation of the 2020 LRDP would not impede or conflict with the emissions reductions targets and strategies prescribed in or developed to implement AB 32, given the provisions of the 2020 LRDP and campus best practices.

Prior to completion of the CalCAP work described above, campus activities, including implementation of the 2020 LRDP, had the potential to increase GHG emissions. Implementation of the 2020 LRDP could increase commute, air travel, fleet, electricity, steam, gas, waste, water supply and refrigerant-related GHG emissions due to an increase in campus square footage and population. See insert, Figure 1.

Implementation of the 2020 LRDP based on estimated emissions rates without the implementation of many UC Berkeley GHG reduction policies and programs could increase annual GHG emissions to approximately 237,269 MTCO2 per year in 2020, 44% above 1990 levels (source: 2009 Climate Action Plan). This estimated increase represents a "worst case" projection since reductions due to campus sustainability and GHG initiatives are not quantified for this projection. For example, all new development implementing the 2020 LRDP would not follow past trends for energy use, but instead would be subject to the UC Policy on Sustainable Practices green building requirement to outperform California Title 24 energy efficiency standards by a minimum of 20 percent

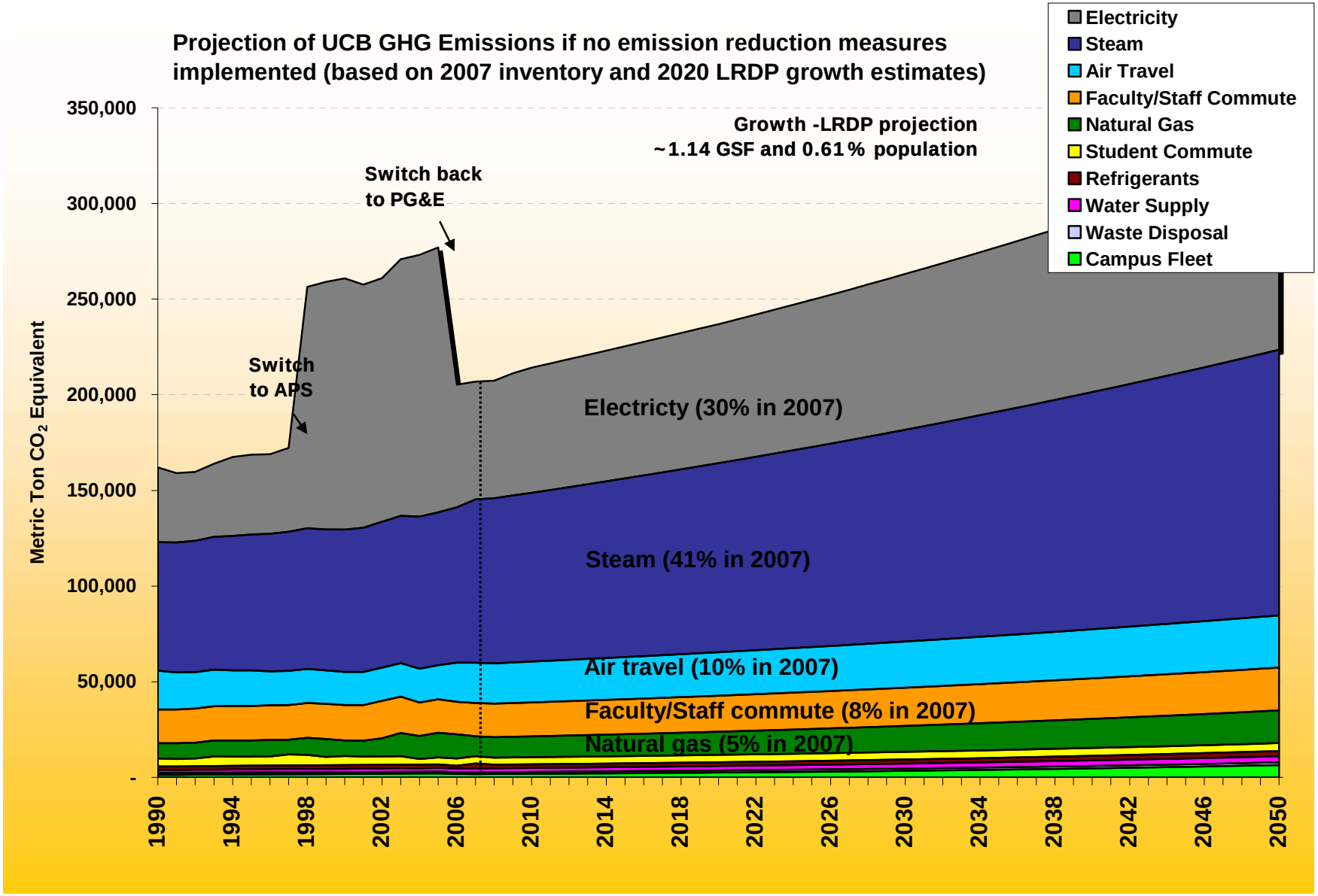
As described in Section Q.6, Policies and Procedures Guiding Future Projects, above, additional policies and programs to reduce GHG emissions are already in place and have resulted in reductions in energy use, water consumption, vehicle trips, etc. and the corresponding GHG emissions. Continuation of these policies and programs and implementation of new programs would result in lower GHG emission increases. Moreover, the campus Climate Action Plan establishes programs and policies to bring future reasonably foreseeable campus growth within AB 32 GHG reduction targets.

Construction

Construction emissions would be associated with vehicle engine exhaust from construction equipment, vendor trips, and employee compute trips. Construction projects would generate an estimated average of 1,283 metric tons of CO2 per year, as described in Section Q.4, Existing Setting, above.

Construction emissions for major improvement projects are not long-term recurring emissions, nor are they under the direct control of UC Berkeley. In accordance with the

FIGURE 1



Source: Office of Sustainability 2009

ACUPCC Implementation Guide, UC Berkeley does not report major project construction emissions as part of the annual GHG reporting. GHG emissions from minor construction and maintenance performed by UC Berkeley employees are included in the annual reporting as part of campus fleet and fuel use categories.

2020 LRDP EIR IMPACT SUMMARY AND ADDITIONAL ANALYSIS

Aesthetics

The 2020 LRDP FEIR concluded that projects implemented as part of the 2020 LRDP at UC Berkeley would not result in new significant aesthetic impacts or increase the severity of impacts previously found to be significant (2020 LRDP FEIR Vol. 1, 4.1-15 to 4.1-19); nor would the 2020 LRDP make a cumulatively considerable contribution to adverse aesthetic impacts (2020 LRDP FEIR Vol. 1, 4.1-22 to 4.1-24)

Since certification of the 2020 LRDP FEIR, there have been no substantial changes to the 2020 LRDP or to the circumstances surrounding the 2020 LRDP with respect to aesthetic issues that were not adequately analyzed and, as necessary, mitigated, and no new information is available. The amendments proposed to the Sustainable Campus chapter of the 2020 LRDP memorialize existing campus policy with regard to climate change, and would not impact conclusions of the 2020 LRDP EIR with regard to aesthetics.

Air Quality

The 2020 LRDP FEIR concluded that projects implemented as part of the 2020 LRDP, guided by compliance with local regulations, campus policies and programs to reduce emissions and risk of toxic air contaminant releases, would, with one exception, not result in new significant air quality impacts (2020 LRDP FEIR Vol. 1 p. 4.2-20 to 4.2-26). As the one exception, the 2020 LRDP FEIR conservatively estimated that the Bay Area Air Quality Management District's (BAAQMD) Clean Air Plan did not include an increment for growth at UC Berkeley, and found that campus growth overall may not comply with the Clean Air Plan, and may result in a cumulatively considerable increase in non-attainment pollutants that conflicts with the Clean Air Plan (2020 LRDP FEIR Vol. 1 p. 4.2-26, and p. 4.2-31).

The amendments proposed herein to the Sustainable Campus chapter of the 2020 LRDP memorialize existing campus policy with regard to climate change, and would not result in new air quality impacts not previously considered; would not contribute to significant environmental impacts previously identified in the 2020 LRDP FEIR, and will not result in those impacts being more severe than as described in the 2020 LRDP FEIR. No additional mitigation measures have been identified that would further lessen the previously identified impact, and no additional analysis is required.

Implementation of the 2020 LRDP would not impede or conflict with the emissions reductions targets and strategies prescribed in or developed to implement AB 32, given the provisions of the 2020 LRDP and campus best practices. Since certification of the 2020 LRDP FEIR, there have been no substantial changes to the 2020 LRDP or to the circumstances surrounding 2020 LRDP development with respect to air quality that

were not adequately analyzed and, as necessary, mitigated, and no new information is available.

Biological Resources

The 2020 LRDP FEIR concluded that projects implemented as part of the 2020 LRDP, incorporating existing best practices and 2020 LRDP FEIR mitigation measures, would not result in new significant impacts upon biological resources (2020 LRDP FEIR Vol. 1, 4.3-22 to 4.3-30). The amendments proposed herein to the Sustainable Campus chapter of the 2020 LRDP memorialize existing campus policy with regard to climate change, and would not result in new or more severe impacts than analyzed in the 2020 LRDP FEIR, nor contribute to cumulatively significant adverse effects upon biological resources.

Since certification of the 2020 LRDP FEIR, there have been no substantial changes to the 2020 LRDP or to the circumstances surrounding 2020 LRDP development with respect to biological resources that were not adequately analyzed and, as necessary, mitigated, and no new information is available.

Cultural Resources

The 2020 LRDP FEIR noted that under certain circumstances, projects developed under the 2020 LRDP could cause substantial adverse changes in the significance of historical resources, which would remain a significant and unavoidable impact despite recordation of the resource (2020 LRDP FEIR Vol. 1, 4.4-55). The amendments proposed herein to the Sustainable Campus chapter of the 2020 LRDP memorialize existing campus policy with regard to climate change, and would not result in new or more severe impacts than analyzed in the 2020 LRDP FEIR, nor contribute to cumulatively significant adverse effects upon cultural resources.

Since certification of the 2020 LRDP FEIR, there have been no substantial changes to the 2020 LRDP or to the circumstances surrounding 2020 LRDP development with respect to cultural resources that were not adequately analyzed and, as necessary, mitigated, and no new information is available. No additional mitigation measures have been identified that would further lessen the previously identified impact, and no additional analysis is required.

Geology, Seismicity and Soils

The 2020 LRDP FEIR concluded that projects implemented as part of the 2020 LRDP, incorporating existing best practices and 2020 LRDP FEIR mitigation measures, would not result in new significant impacts in the area of geology, seismicity, or soils (2020 LRDP FEIR Vol. 1 p. 4.5-17 to 4.5-24). The proposed amendments to the Sustainable Campus chapter of the 2020 LRDP reflect current campus policy with regard to greenhouse gas emission reduction targets and would not alter 2020 LRDP FEIR conclusions with respect to geology, seismicity and soils. Since certification of the 2020 LRDP FEIR, there have been no substantial changes to the 2020 LRDP or to the circumstances surrounding 2020 LRDP development with respect to geology, seismicity and soils that were not adequately analyzed and, as necessary, mitigated, and no new information is available.

Hazardous Materials

The 2020 LRDP FEIR concluded that projects implemented as part of the 2020 LRDP, incorporating existing best practices and 2020 LRDP FEIR mitigation measures, would not result in new significant hazardous materials-related impacts (2020 LRDP FEIR Vol. 1 p. 4.6-20 to 4.6-35). The proposed amendments to the Sustainable Campus chapter of the 2020 LRDP would not create a new significant hazard not analyzed in the 2020 LRDP FEIR, and would not result in new or more severe impacts than analyzed in the 2020 LRDP FEIR, nor contribute to cumulatively significant adverse effects related to hazardous materials. Since certification of the 2020 LRDP FEIR, there have been no substantial changes to the 2020 LRDP or to the circumstances surrounding 2020 LRDP development with respect to hazardous materials that were not adequately analyzed and, as necessary, mitigated, and no new information is available. No additional mitigation measures have been identified that would further lessen any previously identified impact, and no additional analysis is required.

Hydrology and Water Quality

The 2020 LRDP FEIR concluded that projects implemented as part of the 2020 LRDP, incorporating existing best practices and 2020 LRDP FEIR mitigation measures, would not result in new significant impacts upon hydrology and water quality (2020 LRDP FEIR Vol. 1, 4.7-24 to 4.7-35) Since certification of the 2020 LRDP FEIR, there have been no substantial changes to the 2020 LRDP or to the circumstances surrounding 2020 LRDP development with respect to hydrology and water quality that were not adequately analyzed and, as necessary, mitigated, and no new information is available. The proposed amendments to the Sustainable Campus chapter of the 2020 LRDP reflect current campus policy with regard to greenhouse gas emission reduction targets and would not alter 2020 LRDP FEIR conclusions with respect to hydrology and water quality. No additional mitigation measures have been identified that would further lessen the previously identified impact, and no additional analysis is required.

Land Use

The 2020 LRDP FEIR concluded that projects implemented as part of the 2020 LRDP, incorporating existing best practices and 2020 LRDP FEIR mitigation measures, would not result in new significant land use impacts (2020 LRDP FEIR Vol. 1, 4.8-15 to 4.8-21). The proposed amendments to the Sustainable Campus chapter of the 2020 LRDP would not result in new or more severe impacts upon land use than analyzed in the 2020 LRDP FEIR, nor contribute to cumulatively significant adverse land use effects.

Since certification of the 2020 LRDP FEIR, there have been no substantial changes to the 2020 LRDP or to the circumstances surrounding 2020 LRDP development with respect to land use that were not adequately analyzed and, as necessary, mitigated, and no new information is available. No additional mitigation measures have been identified that would further lessen the previously identified impact, and no additional analysis is required.

Noise

The 2020 LRDP FEIR concluded that projects implemented as part of the 2020 LRDP, even with incorporation of existing best practices and 2020 LRDP FEIR mitigation measures, could result in significant noise impacts resulting from demolition and construction activities (2020 LRDP FEIR Vol. 1, 4.9-16 to 4.9-25). The proposed amendments to the Sustainable Campus chapter of the 2020 LRDP to reflect current campus climate change policy would not alter findings of the 2020 LRDP FEIR with respect to noise. Since certification of the 2020 LRDP FEIR, there have been no substantial changes to the 2020 LRDP or to the circumstances surrounding 2020 LRDP development with respect to noise that were not adequately analyzed and, as necessary, mitigated, and no new information is available. No additional mitigation measures have been identified that would further lessen the previously identified impact, and no additional analysis is required.

Population and Housing

The 2020 LRDP FEIR concluded that projects implemented as part of the 2020 LRDP, incorporating existing best practices and 2020 LRDP FEIR mitigation measures, would not result in new significant impacts related to population and housing (2020 LRDP FEIR Vol. 1 p. 4.10-10 to 4.10-19). The proposed amendments to the Sustainable Campus chapter of the 2020 LRDP would not result in new or more severe impacts than analyzed in the 2020 LRDP FEIR, nor contribute to cumulatively significant adverse population effects.

Since certification of the 2020 LRDP FEIR, there have been no substantial changes to the 2020 LRDP or to the circumstances surrounding 2020 LRDP development with respect to population and housing that were not adequately analyzed and, as necessary, mitigated, and no new information is available. No additional mitigation measures have been identified that would further lessen the previously identified impact, and no additional analysis is required.

Public Services

The 2020 LRDP FEIR concluded that projects implemented as part of the 2020 LRDP, incorporating existing best practices and 2020 LRDP FEIR mitigation measures, would not result in new significant impacts upon public services (2020 LRDP FEIR Vol. 1, 4.11-11 to 4.11-15; 4.11-10; 4.11-26 to 4.11-28; 4.11-32 to 4.11-33). The proposed amendments to the Sustainable Campus chapter of the 2020 LRDP does not alter assumptions of the 2020 LRDP with regard to recreational facilities, emergency access and emergency services demand, or schools. The amendments would not result in new or more severe impacts than analyzed in the 2020 LRDP FEIR, nor contribute to cumulatively significant adverse public services effects.

Since certification of the 2020 LRDP FEIR, there have been no substantial changes to the 2020 LRDP or to the circumstances surrounding 2020 LRDP development with respect to public services that were not adequately analyzed and, as necessary, mitigated, and no new information is available. No additional mitigation measures have been identified that would further lessen the previously identified impact, and no additional analysis is required.

Traffic and Transportation

The 2020 LRDP FEIR concluded that projects implemented as part of the 2020 LRDP, incorporating existing best practices and 2020 LRDP FEIR mitigation measures, would as a whole result in some significant impacts upon traffic and transportation, specifically upon indicated intersections and roadways (2020 LRDP FEIR Vol. 1, 4.12-48 to 4.12-54). The proposed amendments to the 2020 LRDP do not include a component adding parking, nor would it alter parking supplies in the vicinity. No additional mitigation measures have been identified that would further lessen the previously identified impact, and no additional analysis is required.

Since certification of the 2020 LRDP FEIR, there have been no substantial changes to the 2020 LRDP or to the circumstances surrounding 2020 LRDP development with respect to transportation that were not adequately analyzed and, as necessary, mitigated, and no new information is available. No additional mitigation measures have been identified that would further lessen the previously identified impact, and no additional analysis is required.

Utilities and Service Systems

The 2020 LRDP FEIR concluded that projects implemented as part of the 2020 LRDP, incorporating existing best practices and 2020 LRDP FEIR mitigation measures, would not result in new significant utilities and service systems impacts (2020 LRDP FEIR Vol. 1, 4.13-5, 4.13-10 to 4.13-12, 4.13-15 to 4.13-16, 4.13-18, 4.13-21 to 4.13-22, 4.13-25 to 4.13-28) . The proposed amendments to the Sustainable Campus chapter of the 2020 LRDP to reflect current campus policy with regard to climate change is not anticipated to result in the need for new or altered steam and/or chilled water facilities, energy production and/or transmission facilities, wastewater or solid waste capacity concerns. Further, the amendments are not expected to significantly increase the amount of built or paved surface or otherwise result in stormwater capacity concerns.

Since certification of the 2020 LRDP FEIR, there have been no substantial changes to the 2020 LRDP or to the circumstances surrounding 2020 LRDP development with respect to utilities and service systems that were not adequately analyzed and, as necessary, mitigated, and no new information is available. No additional mitigation measures have been identified that would further lessen the previously identified impact, and no additional analysis is required.

Based on the foregoing, the proposed amendments to the Sustainable Campus chapter of the 2020 LRDP would not result in new significant impacts not previously addressed in the 2020 LRDP EIR; as outlined in the introductory discussion, none of the circumstances that would require preparation of a subsequent or supplemental EIR under CEQA exists.

Q.8 CUMULATIVE IMPACTS

The contribution to the cumulative global climate change impact as a result of implementation of the 2020 LRDP is evaluated in this document by determining whether the LRDP implementation would conflict with programs and measures that the state is developing to comply with AB 32. Towards this end, Table Q-5, Consistency of Campus Programs with AB 32 Draft Scoping Measures, lists all pertinent measures included in CARB's Draft Scoping Plan for the state's compliance with AB 32, and presents ongoing 2020 LRDP EIR policies, programs, and project design features that comply with the draft scoping plan measures, and indicates that the implementation of the UC Berkeley 2020 LRDP is in substantial conformance with the Scoping Plan measures. Consistency is further evaluated based on conformity with UC Berkeley's Climate Action Plan and the previously-adopted UC Sustainability Policy.

TABLE Q-5
CONSISTENCY OF 2020 LRDP AS AMENDED WITH AB 32 SCOPING PLAN MEASURES

(source for AB 32 scoping plan measures: http://www.arb.ca.gov/cc/scopingplan/document/psp.pdf)

Scoping Plan Measure	UC Berkeley 2020 LRDP Implementation
SPM-1: California Cap-and-Trade Program linked to Western Climate Initiative	**Not applicable.**
SPM-2: California Light-Duty Vehicle GHG Standards: *Implement adopted Pavley standards and planned second phase of the program. Align zero-emission vehicle, alternative and renewable fuel and vehicle technology programs with long-term climate change goals.*	**Not applicable.**
SPM-3: Energy Efficiency *Maximize energy efficiency building and appliance standards, and pursue additional efficiency efforts including new technologies, and new policy and implementation mechanisms. Pursue comparable investment in energy efficiency from all retail providers of electricity in California (including both investor-owned and publicly-owned utilities).*	**CBP CLI-1 (new):** UC Berkeley would continue to implement provisions of the UC Policy on Sustainable Practices including, but not limited to: Green Building Design; Clean Energy Standards; Climate Protection Practices; Sustainable Transportation Practices; Sustainable Operations; Recycling and Waste Management; and Environmentally Preferable Purchasing Practices. **CBP CLI-2 (new):** UC Berkeley would continue to implement energy conservation measures (such as energy-efficient lighting and microprocessor-controlled HVAC equipment) to reduce the demand for electricity and natural gas. The energy conservation measures may be subject to modification as new technologies are developed or if current technologies become obsolete through replacement. **CBP CLI-3 (new):** UC Berkeley would continue to annually monitor and report upon its progress toward its greenhouse gas emission targets. UC Berkeley would continue to report

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	actions undertaken in the past year, and update its climate action plan annually to specify actions that UC Berkeley is planning to undertake in the current year and future years to achieve emission targets.
SPM-4: Renewables Portfolio Standard *Achieve 33 percent renewable energy mix statewide.*	*This standard would likely be most relevant to utility providers.* **CBP CLI-1 (new):** UC Berkeley would continue to implement provisions of the UC Policy on Sustainable Practices including, but not limited to: Green Building Design; Clean Energy Standards; Climate Protection Practices; Sustainable Transportation Practices; Sustainable Operations; Recycling and Waste Management; and Environmentally Preferable Purchasing Practices.
SPM-5: Low Carbon Fuel Standard *Develop and adopt the Low Carbon Fuel Standard.*	**Not directly applicable to UC Berkeley.**
SPM-6: Regional Transportation-Related GHG Targets *Develop regional greenhouse gas emissions reduction targets for passenger vehicles. "The Regional Transportation-Related Greenhouse Gas Targets provide incentives for channeling investment into integrated development patterns and transportation infrastructure, through improved planning. Improved planning and the resulting development are essential for meeting the 2050 emissions target." (p. 19, Scoping Plan)*	Existing 2020 LRDP policies state that UC Berkeley will use municipal plans and policies to inform the design of future capital projects in the City Environs; that all new University housing will be within a mile or within 20 minutes of campus by transit; further UC Berkeley is engaged in joint planning initiatives with the City of Berkeley to support transit oriented development in support of this standard.
SPM-7: Vehicle Efficiency Measures *Implement light-duty vehicle efficiency measures.*	**CBP CLI-1 (new):** UC Berkeley would continue to implement provisions of the UC Policy on Sustainable Practices including, but not limited to: Green Building Design; Clean Energy Standards; Climate Protection Practices; Sustainable Transportation Practices; Sustainable Operations; Recycling and Waste Management; and Environmentally Preferable Purchasing Practices.
SPM-8: Goods Movement *Implement adopted regulations for the use of shore power for ships at berth. Improve efficiency in goods movement activities.*	**Not directly applicable to UC Berkeley.**
SPM-9: Million Solar Roofs *Program The Million Solar Roofs Initiative is a ratepayer-financed incentive program aimed at transforming the market for rooftop solar systems by driving down costs over time. Install 3,000 MW of solar-electric capacity under California's existing solar*	**CBP CLI-1 (new):** UC Berkeley would continue to implement provisions of the UC Policy on Sustainable Practices including, but not limited to: Green Building Design; Clean Energy Standards; Climate Protection Practices; Sustainable Transportation Practices; Sustainable Operations; Recycling and Waste Management; and Environmentally Preferable

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programs.	Purchasing Practices. **CBP CLI-3 (new):** UC Berkeley would continue to annually monitor and report upon its progress toward its greenhouse gas emission targets. UC Berkeley would continue to report actions undertaken in the past year, and update its climate action plan annually to specify actions that UC Berkeley is planning to undertake in the current year and future years to achieve emission targets.
SPM-10: Heavy/Medium-Duty Vehicles *Adopt medium and heavy duty vehicle efficiency measures. Requiring retrofits to improve the fuel efficiency of heavy-duty trucks could include a requirement for devices that reduce aerodynamic drag and rolling resistance. In addition, hybridization of medium- and heavy-duty vehicles would also reduce greenhouse gas emissions through increased fuel efficiency.*	**Not directly applicable to UC Berkeley; could eventually impact fleet purchasing.** **CBP CLI-1 (new):** UC Berkeley would continue to implement provisions of the UC Policy on Sustainable Practices including, but not limited to: Green Building Design; Clean Energy Standards; Climate Protection Practices; Sustainable Transportation Practices; Sustainable Operations; Recycling and Waste Management; and Environmentally Preferable Purchasing Practices.
SPM-11: Industrial Emissions *Require assessment of large industrial sources to determine whether individual sources within a facility can cost-effectively reduce greenhouse gas emissions and provide other pollution reduction co-benefits. Reduce greenhouse gas emissions from fugitive emissions from oil and gas extraction and gas transmission. Adopt and implement regulations to control fugitive methane emissions and reduce flaring at refineries.*	**UC Berkeley is not a large industrial source. Not directly applicable to UC Berkeley.**
SPM-12: High Speed Rail *Support implementation of a high speed rail system.*	**Not directly applicable to UC Berkeley.**
SPM-13: Green Building Strategy *Expand the use of green building practices to reduce the carbon footprint of California's new and existing inventory of buildings.*	**CBP CLI-1 (new):** UC Berkeley would continue to implement provisions of the UC Policy on Sustainable Practices including, but not limited to: Green Building Design; Clean Energy Standards; Climate Protection Practices; Sustainable Transportation Practices; Sustainable Operations; Recycling and Waste Management; and Environmentally Preferable Purchasing Practices. **CBP CLI-3 (new):** UC Berkeley would continue to annually monitor and report upon its progress toward its greenhouse gas emission targets. UC Berkeley would continue to report actions undertaken in the past year, and update its climate action plan annually to specify actions that UC Berkeley is planning to undertake in the current year and future years to

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	achieve emission targets.
SPM-14: High GWP Gases *Adopt measures to reduce high global warming potential gases. High GWP chemicals are very common and are used in many different applications such as refrigeration, air conditioning systems, fire suppression systems, and the production of insulating foam. ARB has identified additional potential reduction opportunities based on specifications for future commercial and industrial refrigeration, changing the refrigerants used in auto air conditioning systems, and ensuring that existing car air conditioning systems as well as stationary refrigeration equipment do not leak. Recovery and destruction of high GWP materials… could also provide significant reductions.*	**CBP CLI-1 (new):** UC Berkeley would continue to implement provisions of the UC Policy on Sustainable Practices including, but not limited to: Green Building Design; Clean Energy Standards; Climate Protection Practices; Sustainable Transportation Practices; Sustainable Operations; Recycling and Waste Management; and Environmentally Preferable Purchasing Practices. **CBP CLI-3 (new):** UC Berkeley would continue to annually monitor and report upon its progress toward its greenhouse gas emission targets. UC Berkeley would continue to report actions undertaken in the past year, and update its climate action plan annually to specify actions that UC Berkeley is planning to undertake in the current year and future years to achieve emission targets.
SPM-15: Recycling and Waste *Reduce methane emissions at landfills. Increase waste diversion, composting, and commercial recycling. Move toward zero-waste.*	**CBP CLI-1 (new):** UC Berkeley would continue to implement provisions of the UC Policy on Sustainable Practices including, but not limited to: Green Building Design; Clean Energy Standards; Climate Protection Practices; Sustainable Transportation Practices; Sustainable Operations; Recycling and Waste Management; and Environmentally Preferable Purchasing Practices. **CBP USS-5.1 (existing):** UC Berkeley would continue to implement a solid waste reduction and recycling program designed to limit the total quantity of campus solid waste that is disposed of in landfills during implementation of the 2020 LRDP plan.
SPM-16: Sustainable Forests *Preserve forest sequestration and encourage the use of forest biomass for sustainable energy generation. The 2020 Proposed Scoping Plan target for California's forest sector is to maintain the current 5 MMTCO2E of sequestration through sustainable management practices, including reducing the risk of catastrophic wildfire, and the avoidance or mitigation of land-use changes that reduce carbon storage.*	**CBP PUB-2.1-b:** UC Berkeley would continue on-going implementation of the Hill Area Fire Fuel Management program. **CBP PUB-2.1-c:** UC Berkeley would continue to plan and implement programs to reduce risk of wildland fires, including plan review and construction inspection programs that ensure that campus projects incorporate fire prevention measures. **CBP PUB-2.1-d:** UC Berkeley would continue to plan and collaborate with other agencies through participation in the Hills Emergency Forum.
SPM-17: Water *Continue efficiency*	**CBP USS-2.1-a:** UC Berkeley will promote and expand the

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programs and use cleaner energy sources to move and treat water.	central energy management system (EMS) to tie building water meters into the system for flow monitoring. **CBP USS-2.1-c:** UC Berkeley will continue to incorporate specific water conservation measures into project design to reduce water consumption and wastewater generation. This could include the use of special air-flow aerators, water-saving shower heads, flush cycle reducers, low-volume toilets, weather based or evapotranspiration irrigation controllers, drip irrigation systems, the use of drought resistant plantings in landscaped areas, and collaboration with EBMUD to explore suitable uses of recycled water.
SPM-18: Agriculture	**Not directly applicable to UC Berkeley**

As discussed in more detail above in Q.6, Policies and Procedures Guiding Future Projects, the UC Policy on Sustainable Practices and the Cal Climate Action Plan incorporate and expand upon AB 32 GHG reduction targets at a campus-specific level. To achieve these targets, UC Berkeley's Climate Action Plan accounts for reasonably foreseeable growth under the 2020 LRDP. Consistent with this assumption, the Climate Action Plan specifically incorporates into its year 2020 projections a growth adjustment of up to 2.2 million additional gsf– an amount that would allow for full development of allocated square footage under the 2020 LRDP. Accordingly, the implementation of the 2020 LRDP is expected to be consistent with UC Berkeley's Climate Action Plan, and would be subject to programs and policies established under the plan to exceed AB 32 target GHG emission levels.

Conclusion

The information provided in Table Q-5 taken together with UC Berkeley's ongoing GHG emission reduction programs discussed in Q-6, demonstrate that implementation of the 2020 LRDP is consistent with applicable strategies of the AB 32 Scoping Plan, implements the UC Berkeley Climate Action Plan, and would not impede or conflict with the emissions reduction targets and strategies prescribed in or developed to implement AB 32. The cumulative impact of implementation of the 2020 LRDP upon climate change would be less than significant.

Additional Analysis

The impact of implementation of the 2020 LRDP, with incorporation of all best practices and implementation of UC Berkeley's Climate Action Plan, on cumulative climate change would be less than significant. Therefore, no mitigation measures are required.

Notwithstanding the above analysis under the significance threshold described above, in this period of development of CEQA analysis of program and project impacts to global climate change, for informational purposes only this document further discusses features of UC Berkeley activities and initiatives that also are in substantial conformity

with most GHG reduction measures recommended as GHG emission reduction or "mitigation measures" by the State Attorney General and OPR. Therefore, the following tables: Table Q-6, Attorney General's Recommended Project Level Mitigation Measures, Table Q-7, Attorney General's Recommended General Plan Mitigation Measures, and Table Q-8, Office of Planning and Research Suggested Mitigation Measures, present mitigation measures recommended by the Attorney General's office and OPR for lead agencies to consider in the development and approval of projects and/or plans. Most of the applicable measures are already covered by the policies and practices contained in the 2020 LRDP specifically, or in initiatives under the Sustainability Assessment, or in initiatives under the Cal Climate Action Plan, or by sustainability elements of the 2020 LRDP as amended. An "X" indicates that the measure is already addressed or under consideration. A blank generally indicates that the measure is not currently under consideration by UC Berkeley.

TABLE Q-6
ATTORNEY GENERAL'S RECOMMENDED "PROJECT-LEVEL" MITIGATION MEASURES

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
Energy Efficiency	
Design buildings to be energy efficient. Site buildings to take advantage of shade, prevailing winds, landscaping and sun screens to reduce energy use.	X
Install efficient lighting and lighting control systems. Use daylight as an integral part of lighting systems in buildings.	X
Install light colored "cool" roofs, cool pavements, and strategically placed shade trees	
Provide information on energy management services for large energy users.	
Install energy efficient heating and cooling systems, appliances and equipment, and control systems.	X
Install light emitting diodes (LEDs) for traffic, street and other outdoor lighting.	
Limit the hours of operation of outdoor lighting.	X
Use solar heating, automatic covers, and efficient pumps and motors for pools and spas.	
Provide education on energy efficiency.	X
Renewable Energy	
Install solar and wind power systems, solar and tankless hot water heaters, and energy-efficient heating ventilation and air conditioning. Educate consumers about existing incentives.	X
Install solar panels on carports and over parking areas.	X
Use combined heat and power in appropriate applications.	

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
Water Conservation and Efficiency	
Create water-efficient landscapes.	X
Install water-efficient irrigation systems and devices, such as soil moisture-based irrigation controls.	X
Use reclaimed water for landscape irrigation in new developments and on public property. Install the infrastructure to deliver and use reclaimed water.	
Design buildings to be water-efficient. Install water-efficient fixtures and appliances.	X
Use graywater. (Graywater is untreated household waste water from bathtubs, showers, bathroom wash basins, and water from clothes washing machines.) For example, install dual plumbing in all new development allowing graywater to be used for landscape irrigation.	
Restrict watering methods (e.g., prohibit systems that apply water to non-vegetated surfaces) and control runoff.	X
Restrict the use of water for cleaning outdoor surfaces and vehicles.	
Implement low-impact development practices that maintain the existing hydrologic character of the site to manage storm water and protect the environment. (Retaining storm water runoff on-site can drastically reduce the need for energy-intensive imported water at the site.)	X
Devise a comprehensive water conservation strategy appropriate for the project and location. The strategy may include many of the specific items listed above, plus other innovative measures that are appropriate to the specific project.	X
Provide education about water conservation and available programs and incentives.	X
Solid Waste Measures	

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
Reuse and recycle construction and demolition waste (including, but not limited to, soil, vegetation, concrete, lumber, metal, and cardboard).	X
Provide interior and exterior storage areas for recyclables and green waste and adequate recycling containers located in public areas.	X
Recover by-product methane to generate electricity.	
Provide education and publicity about reducing waste and available recycling services.	X
Land Use Measures	
Include mixed-use, infill, and higher density in development projects to support the reduction of vehicle trips, promote alternatives to individual vehicle travel, and promote efficient delivery of services and goods.	X
Educate the public about the benefits of well-designed, higher density development.	X
Incorporate public transit into project design.	X
Preserve and create open space and parks. Preserve existing trees, and plant replacement trees at a set ratio.	X
Develop "brownfields" and other underused or defunct properties near existing public transportation and jobs.	X
Include pedestrian and bicycle-only streets and plazas within developments. Create travel routes that ensure that destinations may be reached conveniently by public transportation, bicycling or walking.	X
Transportation and Motor Vehicles	
Limit idling time for commercial vehicles, including delivery and construction vehicles.	X
Use low or zero-emission vehicles, including construction vehicles.	X

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
Promote ride sharing programs e.g., by designating a certain percentage of parking spaces for ride sharing vehicles, designating adequate passenger loading and unloading and waiting areas for ride sharing vehicles, and providing a web site or message board for coordinating rides.	X
Create car sharing programs. Accommodations for such programs include providing parking spaces for the car share vehicles at convenient locations accessible by public transportation.	X
Create local "light vehicle" networks, such as neighborhood electric vehicle (NEV) systems.	
Provide the necessary facilities and infrastructure to encourage the use of low or zero-emission vehicles (e.g., electric vehicle charging facilities and conveniently located alternative fueling stations.	
Increase the cost of driving and parking private vehicles by, e.g., imposing tolls and parking fees.	X
Build or fund a transportation center where various public transportation modes intersect.	
Provide shuttle service to public transit.	X
Provide public transit incentives such as free or low-cost monthly transit passes.	X
Promote "least polluting" ways to connect people and goods to their destinations.	X
Incorporate bicycle lanes and routes into street systems, new subdivisions, and large developments.	X
Incorporate bicycle-friendly intersections into street design.	

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
For commercial projects, provide adequate bicycle parking near building entrances to promote cyclist safety, security, and convenience. For large employers, provide facilities that encourage bicycle commuting, including, e.g., locked bicycle storage or covered or indoor bicycle parking.	X
Create bicycle lanes and walking paths directed to the location of schools, parks and other destination points.	X
Work with the school district to restore or expand school bus services.	
Institute a telecommute work program. Provide information, training, and incentives to encourage participation. Provide incentives for equipment purchases to allow high-quality teleconferences.	
Provide information on all options for individuals and businesses to reduce transportation-related emissions. Provide education and information about public transportation.	X
Source: Department of Justice, The California Environmental Quality Act – Addressing Global Warming Impacts at the Local Agency Level, *http://ag.ca.gov/globalwarming/pdf/GW_mitigation_measures.pdf., 2008*.	

TABLE Q-7
ATTORNEY GENERAL'S RECOMMENDED GENERAL PLAN MITIGATION MEASURES

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
Climate Action Plan or Policy: Include a comprehensive climate change action plan that requires a baseline inventory of greenhouse gas emissions from all sources by a date certain; greenhouse gas emissions reduction targets and deadlines; and enforceable greenhouse gas emissions reduction measures.	X
Climate Action Plan Implementation Program: Include mechanisms to ensure regular review of progress toward the emission reduction targets established by the Climate Action Plan, report progress to the public and responsible officials, and revise the plan as appropriate, using principles of adaptive management. Allocate funding to implement the plan. Fund staff to oversee implementation of the plan.	X
Strengthen local building codes for new construction and renovation to require a higher level of energy efficiency.	X
Require that all new government buildings, and all major renovations and additions, meet identified green building standards.	X
Adopt a "Green Building Program" to require or encourage green building practices and materials. The program could be implemented through, e.g., a set of green building ordinances.	X
Require orientation of buildings to maximize passive solar heating during cool seasons, avoid solar heat gain during hot periods, enhance natural ventilation, and promote effective use of daylight. Orientation should optimize opportunities for on-site solar generation.	
Provide permitting-related and other incentives for energy efficient building projects, e.g., by giving green projects priority in plan review, processing and field inspection services.	
Conduct energy efficiency audits of existing buildings by checking, repairing, and readjusting heating, ventilation, air conditioning, lighting, water heating equipment, insulation, and weatherization. Offer financial incentives for adoption of identified efficiency measures.	X
Partner with community services agencies to fund energy efficiency project, including heating, ventilation, air conditioning, lighting, water heating equipment, insulation, and weatherization, for low income residents.	

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
Target local funds, including redevelopment and Community Development Block Grant resources, to assist affordable housing developers in incorporating energy efficient designs and features.	
Provide innovative, low-interest financing for energy efficiency and alternative energy projects. For example, allow property owners to pay for energy efficiency improvements and solar system installation through long-term assessments on individual property tax bills	
Fund incentives to encourage the use of energy efficient vehicles, equipment and lighting. Provide financial incentives for adoption of identified efficiency measures	X
Require environmentally responsible government purchasing. Require or give preference to products that reduce or eliminate indirect greenhouse gas emissions, e.g., by giving preference to recycled products over those made from virgin materials.	X
Require that government contractors take action to minimize greenhouse gas emissions, e.g., by using low or zero-emission vehicles and equipment.	
Adopt a "heat island" mitigation plan that requires cool roofs, cool pavements, and strategically placed shade trees. (Darker colored roofs, pavement, and lack of trees may cause temperatures in urban environments to increase by as much as 6-8 degrees Fahrenheit as compared to surrounding areas.40) Adopt a program of building permit enforcement for re-roofing to ensure compliance with existing state building requirements for cool roofs on non-residential buildings.	
Adopt a comprehensive water conservation strategy. The strategy may include, but not be limited to, imposing restrictions on the time of watering, requiring water-efficient irrigation equipment, and requiring new construction to offset demand so that there is no net increase in water use.	X
Adopt water conservation pricing, e.g., tiered rate structures, to encourage efficient water use.	
Adopt water-efficient landscape ordinances	
Strengthen local building codes for new construction and implement a program to renovate existing buildings to require a higher level of water efficiency.	X
Adopt energy and water efficiency retrofit ordinances that require upgrades as a condition of issuing permits for renovations or additions, and on the sale of residences and buildings.	
Provide individualized water audits to identify conservation opportunities Provide financial incentives for adopting identified efficiency measures.	

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
Provide water audits for large landscape accounts. Provide financial incentives for efficient irrigation controls and other efficiency measures.	
Require water efficiency training and certification for irrigation designers and installers, and property managers	
Implement or expand city or county-wide recycling and composting programs for residents and businesses. Require commercial and industrial recycling.	X
Extend the types of recycling services offered (e.g., to include food and green waste recycling).	X
Establish methane recovery in local landfills and wastewater treatment plants to generate electricity.	
Implement Community Choice Aggregation (CCA) for renewable electricity generation. (CCA allows cities and counties, or groups of them, to aggregate the electric loads of customers within their jurisdictions for purposes of procuring electrical services. CCA allows the community to choose what resources will serve their loads and can significantly increase renewable energy.)	
Preserve existing conservation areas (e.g., forested areas, agricultural lands, wildlife habitat and corridors, wetlands, watersheds, and groundwater recharge areas) that provide carbon sequestration benefits	X
Establish a mitigation program for development of conservation areas. Impose mitigation fees on development of such lands and use funds generated to protect existing, or create replacement, conservation areas.	
Provide public education and information about options for reducing greenhouse gas emissions through responsible purchasing, conservation, and recycling.	X
Adopt land use designations to carry out policies designed to reduce greenhouse gas emissions, *e.g.*, policies to minimize or reduce vehicle miles traveled, encourage development near existing public transportation corridors, encourage alternative modes of transportation, and promote infill, mixed use, and higher density development.	X
Identify and facilitate the development of land uses not already present in local districts – such as supermarkets, parks and recreation fields, and schools in neighborhoods; or residential uses in business districts – to reduce vehicle miles traveled and allow bicycling and walking to these destinations.	X
Create neighborhood commercial districts.	
Require bike lanes and bicycle/pedestrian paths	X

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
Prohibit projects that impede bicycle and walking access, *e.g.*, large parking areas that cannot be crossed by non-motorized vehicles, and new residential communities that block through access on existing or potential bicycle and pedestrian routes	X
Site schools to increase the potential for students to walk and bike to school.	
Enact policies to limit or discourage low density development that segregates employment, services, and residential areas	X
Where there are growth boundaries, adopt policies providing certainty for infill development.	X
Require best management practices in agriculture and animal operations to reduce emissions, conserve energy and water, and utilize alternative energy sources, including biogas, wind and solar.	
In conjunction with measures that encourage public transit, ride sharing, bicycling and walking, implement circulation improvements that reduce vehicle idling. For example, coordinate controlled intersections so that traffic passes more efficiently through congested areas	X
Create an interconnected transportation system that allows a shift in travel from private passenger vehicles to alternative modes, including public transit, ride sharing, car sharing, bicycling and walking. Before funding transportation improvements that increase vehicle miles traveled, consider alternatives such as increasing public transit or improving bicycle or pedestrian travel routes.	X
Give funding preference to investment in public transit over investment in infra-structure for private automobile traffic	
Include safe and convenient bicycle and pedestrian access in all transportation improvement projects. Ensure that non-motorized transportation systems are connected and not interrupted by impassable barriers, such as freeways and include amenities such as secure bicycle parking.	X
Provide adequate and affordable public transportation choices including expanded bus routes and service and other transit choices such as shuttles, light rail, and rail where feasible.	X
Assess transportation impact fees on new development in order to maintain and increase public transit service.	
Provide public transit incentives, including free and reduced fare areas	X

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
Adopt a comprehensive parking policy that discourages private vehicle use and encourages the use of alternative transportation. For example, reduce parking for private vehicles while increasing options for alternative transportation; eliminate minimum parking requirements for new buildings; "unbundle" parking (require that parking is paid for separately and is not included in rent for residential or commercial space); and set appropriate pricing for parking.	X
Develop school transit plans to substantially reduce automobile trips to, and congestion surrounding, schools. (According to some estimates, parents driving their children to school account for 20-25% of the morning commute.) Plans may address, *e.g.*, necessary infrastructure improvements and potential funding sources; replacing older diesel buses with low or zero-emission vehicles; mitigation fees to expand school bus service; and Safe Routes to School programs[59] and other formal efforts to increase walking and biking by students.	X
Create financing programs for the purchase or lease of vehicles used in employer ride sharing programs.	
Enter into partnerships to create and expand polluting vehicle buy-back programs to include vehicles with high greenhouse gas emissions.	
Provide public education and information about options for reducing motor vehicle-related greenhouse gas emissions. Include information on trip reduction; trip linking; public transit; biking and walking; vehicle performance and efficiency (*e.g.*, keeping tires inflated); low or zero-emission vehicles; and car and ride sharing.	X
Improve the jobs-housing balance and promote a range of affordable housing choices near jobs, services and transit	X
Concentrate mixed use, and medium to higher density residential development in areas near jobs, transit routes, schools, shopping areas and recreation.	X
Increase density in single family residential areas located near transit routes or commercial areas. For example, promote duplexes in residential areas and increased height limits of multi-unit buildings on main arterial streets, under specified conditions.	X
Encourage transit-oriented developments.	X
Impose minimum residential densities in areas designated for transit-oriented, mixed use development to ensure higher density in these areas.	
Designate mixed use areas where housing is one of the required uses.	

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
In areas designated for mixed use, adopt incentives for the concurrent development of different land uses (*e.g.*, retail with residential).	
Promote infill, mixed use, and higher density development by, for example, reducing developer fees;[62] providing fast-track permit processing; reducing processing fees; funding infrastructure loans; and giving preference for infrastructure improvements in these areas.	
Preserve forested areas, agricultural lands, wildlife habitat and corridors, wetlands, watersheds, groundwater recharge areas and other open space that provide carbon sequestration benefits.	X
Establish a mitigation program for development of those types of open space that provide carbon sequestration benefits. Require like-kind replacement for, or impose mitigation fees on development of such lands. Use funds generated to protect existing, or create replacement, open space.	
Allow alternative energy projects in areas zoned for open space where consistent with other uses and values.	
Protect existing trees and encourage the planting of new trees. Adopt a tree protection and replacement ordinance, *e.g.*, requiring that trees larger than a specified diameter that are removed to accommodate development must be replaced at a set ratio.	X
Connect parks and publicly accessible open space through shared pedestrian/bike paths and trails to encourage walking and bicycling.	X
Address expected effects of climate change that may impact public safety, including increased risk of wildfires, flooding and sea level rise, salt water intrusion; and health effects of increased heat and ozone, through appropriate policies and programs.	X
Adopt programs for the purchase, transfer or extinguishment of development rights in high risk areas.	
Monitor the impacts of climate change. Use adaptive management to develop new strategies, and modify existing strategies, to respond to the impacts of climate change.	
Source: *Department of Justice,* The California Environmental Quality Act – Addressing Global Warming Impacts at the Local Agency Level, *http://ag.ca.gov/globalwarming/pdf/ GW_mitigation_measures.pdf., 2008*.	

TABLE Q-8
OFFICE OF PLANNING AND RESEARCH SUGGESTED MITIGATION MEASURES

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
Land Use and Transportation	
Implement land use strategies to encourage jobs/housing proximity, promote transit-oriented development, and encourage high density development along transit corridors. Encourage compact, mixed-use projects, forming urban villages designed to maximize affordable housing and encourage walking, bicycling and the use of public transit systems.	X
Encourage infill, redevelopment, and higher density development, whether in incorporated or unincorporated settings	X
Encourage new developments to integrate housing, civic and retail amenities (jobs, schools, parks, shopping opportunities) to help reduce VMT resulting from discretionary automobile trips.	X
Apply advanced technology systems and management strategies to improve operational efficiency of transportation systems and movement of people, goods and services.	X
Incorporate features into project design that would accommodate the supply of frequent, reliable and convenient public transit	X
Implement street improvements that are designed to relieve pressure on a region's most congested roadways and intersections.	
Limit idling time for commercial vehicles, including delivery and construction vehicles.	X
Urban Forestry	
Plant trees and vegetation near structures to shade buildings and reduce energy requirements for heating/cooling.	X
Preserve or replace onsite trees (that are removed due to development) as a means of providing carbon storage.	X
Green Buildings	
Encourage public and private construction of LEED (Leadership in Energy and Environmental Design) certified (or equivalent) buildings.	X
Energy Conservation Policies and Actions	

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
Recognize and promote energy saving measures beyond Title 24 requirements for residential and commercial projects	X
Where feasible, include in new buildings facilities to support the use of low/zero carbon fueled vehicles, such as the charging of electric vehicles from green electricity sources.	X
Educate the public, schools, other jurisdictions, professional associations, business and industry about reducing GHG emissions.	X
Replace traffic lights, street lights, and other electrical uses to energy efficient bulbs and appliances.	X
Purchase Energy Star equipment and appliances for public agency use.	X
Incorporate on-site renewable energy production, including installation of photovoltaic cells or other solar options.	X
Execute an Energy Savings Performance Contract with a private entity to retrofit public buildings. This type of contract allows the private entity to fund all energy improvements in exchange for a share of the energy savings over a period of time.	
Design, build, and operate schools that meet the Collaborative for High Performance Schools (CHPS) best practices.	
Retrofit municipal water and wastewater systems with energy efficient motors, pumps and other equipment, and recover wastewater treatment methane for energy production.	
Convert landfill gas into energy sources for use in fueling vehicles, operating equipment, and heating buildings.	
Purchase government vehicles and buses that use alternatives fuels or technology, such as electric hybrids, biodiesel, and ethanol. Where feasible, require fleet vehicles to be low emission vehicles. Promote the use of these vehicles in the general community.	X
Offer government incentives to private businesses for developing buildings with energy and water efficient features and recycled materials. The incentives can include expedited plan checks and reduced permit fees.	
Offer rebates and low-interest loans to residents that make energy-saving improvements on their homes.	
Create bicycle lanes and walking paths directed to the location of schools, parks and other destination points.	X
Programs to Reduce Vehicle Miles Traveled	

Suggested Mitigation Measures	Addressed or under consideration by UC Berkeley (see Q-6, Policies and Procedures Guiding Future Projects, above)
Offer government employees financial incentives to carpool, use public transportation, or use other modes of travel for daily commutes.	X
Encourage large businesses to develop commute trip reduction plans that encourage employees who commute alone to consider alternative transportation modes.	X
Develop shuttle systems around business district parking garages to reduce congestion and create shorter commutes.	X
Create an online ridesharing program that matches potential carpoolers immediately through email.	X
Develop a Safe Routes to School program that allows and promotes bicycling and walking to school.	
Programs to Reduce Solid Waste	
Create incentives to increase recycling and reduce generation of solid waste by residential users.	X
Implement a Construction and Demolition Waste Recycling Ordinance to reduce the solid waste created by new development.	X
Add residential/commercial food waste collection to existing greenwaste collection programs.	X

Source: *Office of Planning and Research,* CEQA and Climate Change: Addressing Climate Change Through California Environmental Quality Act (CEQA) Review, *http://opr.ca.gov/download.php?dl=ceqa/pdfs/june08-ceqa.pdf. 2008.*

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Memorandum

Environmental Resources Management

1777 Botelho Drive
Suite 260
Walnut Creek, CA 94596
(925) 946-0455
(925) 946-9968 (fax)

To:	Greg Haet UC Berkeley Office of Environment, Health & Safety
From:	John Koehler, Sc.D. Vicki Hoffman
Date:	December 2, 2008
Subject:	**Carbon Dioxide (CO_2) Emission Estimates from Construction of 2020 LRDP Projects** **ERM Project 0070607.01.01**

INTRODUCTION

The University of California, Berkeley (UC Berkeley) requested ERM-West, Inc. (ERM), to estimate potential emissions of carbon dioxide (CO_2) from construction activities associated with the 2020 Long Range Development Plan (LRDP). The estimates described in this memorandum were based on the same general construction assumptions used in the 2020 LRDP Environmental Impact Report (EIR).

Potential construction impacts estimated in the 2020 LRDP EIR used URBEMIS2002, the latest version of the URBEMIS model available when these analyses were completed in April 2004. URBEMIS calculates air emissions associated with construction activities and various area sources. URBEMIS2002 did not include the capability to calculate CO2 emissions. The purpose of the 2020 LRDP EIR construction emissions assessment was to characterize "worst day" emissions, assuming a maximum daily disturbed area of 11.5 acres. Thus, in the 2020 LRDP EIR, only maximum daily construction emissions were calculated.

METHODOLOGY

In 2007, URBEMIS2007 replaced URBEMIS2002. URBEMIS2007 added the capability to calculate CO_2 emissions. The attached output from the new URBEMIS2007 (Version 9.2.4) runs assumes a construction cycle of 12 months. The total area assumed to be disturbed over the course of any given 12-month period is 45.9 acres. This level of activity was assumed in the April 2004 Draft EIR to be representative of a maximum construction year under the 2020 LRDP. As in the URBEMIS2002 analysis performed in 2004, emissions from "grading" and "building" periods during the 12-month construction scenario were estimated by URBEMIS2007. The construction activities were modeled assuming a construction period of June 1, 2005

through May 31, 2006, to match the assumed start of construction used in the 2020 LDRP EIR analysis. The specific equipment assumptions used in the URBEMIS2007 runs assumed the model's default factors.

SUMMARY OF FINDINGS

The attached output presents CO_2 emission results from the URBEMIS2007 runs. For daily emissions, the model output shows potential maximum emissions as the sum of the highest values obtained from each subphase (i.e., grading, building, paving, worker trips, etc.), reflecting that at any moment in time, more than one LRDP project could be under construction, and each project could be at different points in the construction process. Of greater interest for the assessment of potential greenhouse gas emissions are annual CO_2 emission estimates. These are also provided in the attached output for the total annual disturbed area of 45.9 acres assumed in the 2020 LRDP EIR.

The table below summarizes the results for 2020 LDRP construction. Further details on these emission estimates, including breakdowns by various construction subphases, can be found in the attached URBEMIS2007 outputs. When reviewing the attached outputs, please note that the analysis period chosen of June 2005 through May 2006 results in reporting emissions for each of these calendar years. For maximum daily emissions, the highest pound per day result reported for either 2005 or 2006 is reported below as the maximum daily emissions. For annual emissions, the results from 2005 and 2006 need to be added together to obtain the 12-month estimate reported below. The highest daily emissions multiplied by 365 days will result in a higher value than the 12-month estimate because not all days will have "highest day" emissions.

Estimated CO_2 Emissions from Construction of 2020 LRDP Projects

Maximum Daily CO_2 Emissions	13,190 pounds per day[1]
Annual CO_2 Emissions	1,283 tons per year

[1] Occurs in the 2006 analysis year.

If you have any questions, please contact Vicki Hoffman at (925) 279-3236, or John Koehler at (925) 279-3211.

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: E:\Projects\UC Berkeley\UCBerkeley_Scen1.urb924

Project Name: UC Berkeley LRDP Construction Emissions

Project Location: Bay Area Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

	CO2
Time Slice 6/1/2005-7/8/2005 Active Days: 28	2,949.40
Mass Grading 06/01/2005-07/10/2005	2,949.40
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	2,822.00
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	127.40
Time Slice 7/11/2005-12/30/2005 Active Days: 125	10,008.56
Building 07/11/2005-05/31/2006	10,008.56
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.24
Building Worker Trips	6,522.86

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Time Slice 1/2/2006-3/31/2006 Active Days: 65	10,003.72
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83
Time Slice 4/3/2006-5/3/2006 Active Days: 23	11,064.56
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83
Coating 04/01/2006-05/03/2006	1,060.84
Architectural Coating	0.00
Coating Worker Trips	1,060.84
Time Slice 5/4/2006-5/19/2006 Active Days: 12	**13,189.67**
Asphalt 05/04/2006-05/20/2006	3,185.95
Paving Off-Gas	0.00
Paving Off Road Diesel	1,914.87
Paving On Road Diesel	1,143.78
Paving Worker Trips	127.30
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83

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Time Slice 5/22/2006-5/31/2006 Active Days: 8	10,003.72
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83

Phase Assumptions

Phase: Mass Grading 6/1/2005 - 7/10/2005 - Grading 1.3 months beginning June 1

Total Acres Disturbed: 45.9

Maximum Daily Acreage Disturbed: 11.5

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Rubber Tired Dozers (352 hp) operating at a 0.59 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (79 hp) operating at a 0.465 load factor for 8 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 5/4/2006 - 5/20/2006 - Asphalt 0.5 months beginning in May 2006

Acres to be Paved: 11.5

Off-Road Equipment:

1 Pavers (190 hp) operating at a 0.62 load factor for 8 hours per day

2 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day

2 Rollers (95 hp) operating at a 0.56 load factor for 8 hours per day

Phase: Building Construction 7/11/2005 - 5/31/2006 - Construction 10.7 months beginning July

Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 8 hours per day

2 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day

1 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

3 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day

Phase: Architectural Coating 4/1/2006 - 5/3/2006 - Coating 1.1 month beginning April 2006

Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Winter Pounds Per Day, Mitigated

	CO2
Time Slice 6/1/2005-7/8/2005 Active Days: 28	2,949.40
Mass Grading 06/01/2005-07/10/2005	2,949.40
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	2,822.00
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	127.40

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Time Slice 7/11/2005-12/30/2005 Active Days: 125	10,008.56
Building 07/11/2005-05/31/2006	10,008.56
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.24
Building Worker Trips	6,522.86
Time Slice 1/2/2006-3/31/2006 Active Days: 65	10,003.72
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83
Time Slice 4/3/2006-5/3/2006 Active Days: 23	11,064.56
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83
Coating 04/01/2006-05/03/2006	1,060.84
Architectural Coating	0.00
Coating Worker Trips	1,060.84

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Time Slice 5/4/2006-5/19/2006 Active Days: 12	13,189.67
Asphalt 05/04/2006-05/20/2006	3,185.95
Paving Off-Gas	0.00
Paving Off Road Diesel	1,914.87
Paving On Road Diesel	1,143.78
Paving Worker Trips	127.30
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83
Time Slice 5/22/2006-5/31/2006 Active Days: 8	10,003.72
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Mass Grading 6/1/2005 - 7/10/2005 - Grading 1.3 months beginning June 1

For Soil Stablizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:

PM10: 84% PM25: 84%

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Soil Stablizing Measures, the Equipment loading/unloading mitigation reduces emissions by:

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PM10: 69% PM25: 69%

The following mitigation measures apply to Phase: Paving 5/4/2006 - 5/20/2006 - Asphalt 0.5 months beginning in May 2006

For Pavers, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Pavers, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Pavers, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Paving Equipment, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Paving Equipment, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Paving Equipment, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Rollers, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Rollers, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Rollers, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

The following mitigation measures apply to Phase: Building Construction 7/11/2005 - 5/31/2006 - Construction 10.7 months beginning July

For Cranes, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Cranes, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Cranes, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Forklifts, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Forklifts, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Forklifts, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Generator Sets, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Generator Sets, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Generator Sets, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Tractors/Loaders/Backhoes, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Tractors/Loaders/Backhoes, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Tractors/Loaders/Backhoes, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Welders, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Welders, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Welders, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

The following mitigation measures apply to Phase: Architectural Coating 4/1/2006 - 5/3/2006 - Coating 1.1 month beginning April 2006

For Residential Architectural Coating Measures, the Residential Exterior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Residential Architectural Coating Measures, the Residential Interior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Nonresidential Architectural Coating Measures, the Nonresidential Exterior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Nonresidential Architectural Coating Measures, the Nonresidential Interior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

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Combined Summer Emissions Reports (Pounds/Day)

File Name: E:\Projects\UC Berkeley\UCBerkeley_Scen1.urb924

Project Name: UC Berkeley LRDP Construction Emissions

Project Location: Bay Area Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

	CO2
Time Slice 6/1/2005-7/8/2005 Active Days: 28	2,949.40
Mass Grading 06/01/2005-07/10/2005	2,949.40
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	2,822.00
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	127.40
Time Slice 7/11/2005-12/30/2005 Active Days: 125	10,008.56
Building 07/11/2005-05/31/2006	10,008.56
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.24
Building Worker Trips	6,522.86

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Time Slice 1/2/2006-3/31/2006 Active Days: 65	10,003.72
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83
Time Slice 4/3/2006-5/3/2006 Active Days: 23	11,064.56
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83
Coating 04/01/2006-05/03/2006	1,060.84
Architectural Coating	0.00
Coating Worker Trips	1,060.84
Time Slice 5/4/2006-5/19/2006 Active Days: 12	**13,189.67**
Asphalt 05/04/2006-05/20/2006	3,185.95
Paving Off-Gas	0.00
Paving Off Road Diesel	1,914.87
Paving On Road Diesel	1,143.78
Paving Worker Trips	127.30
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83

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Time Slice 5/22/2006-5/31/2006 Active Days: 8	10,003.72
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83

Phase Assumptions

Phase: Mass Grading 6/1/2005 - 7/10/2005 - Grading 1.3 months beginning June 1

Total Acres Disturbed: 45.9

Maximum Daily Acreage Disturbed: 11.5

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Rubber Tired Dozers (352 hp) operating at a 0.59 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (79 hp) operating at a 0.465 load factor for 8 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 5/4/2006 - 5/20/2006 - Asphalt 0.5 months beginning in May 2006

Acres to be Paved: 11.5

Off-Road Equipment:

1 Pavers (190 hp) operating at a 0.62 load factor for 8 hours per day

2 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day

2 Rollers (95 hp) operating at a 0.56 load factor for 8 hours per day

Phase: Building Construction 7/11/2005 - 5/31/2006 - Construction 10.7 months beginning July

Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 8 hours per day

2 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day

1 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

3 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day

Phase: Architectural Coating 4/1/2006 - 5/3/2006 - Coating 1.1 month beginning April 2006

Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Summer Pounds Per Day, Mitigated

	CO2
Time Slice 6/1/2005-7/8/2005 Active Days: 28	2,949.40
Mass Grading 06/01/2005-07/10/2005	2,949.40
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	2,822.00
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	127.40

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Time Slice 7/11/2005-12/30/2005 Active Days: 125	10,008.56
Building 07/11/2005-05/31/2006	10,008.56
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.24
Building Worker Trips	6,522.86
Time Slice 1/2/2006-3/31/2006 Active Days: 65	10,003.72
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
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Building Worker Trips	6,517.83
Time Slice 4/3/2006-5/3/2006 Active Days: 23	11,064.56
Building 07/11/2005-05/31/2006	10,003.72
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Coating 04/01/2006-05/03/2006	1,060.84
Architectural Coating	0.00
Coating Worker Trips	1,060.84

Time Slice 5/4/2006-5/19/2006 Active Days: 12	**13,189.67**
Asphalt 05/04/2006-05/20/2006	3,185.95
Paving Off-Gas	0.00
Paving Off Road Diesel	1,914.87
Paving On Road Diesel	1,143.78
Paving Worker Trips	127.30
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83
Time Slice 5/22/2006-5/31/2006 Active Days: 8	10,003.72
Building 07/11/2005-05/31/2006	10,003.72
Building Off Road Diesel	1,871.46
Building Vendor Trips	1,614.43
Building Worker Trips	6,517.83

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Mass Grading 6/1/2005 - 7/10/2005 - Grading 1.3 months beginning June 1

For Soil Stablizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:

PM10: 84% PM25: 84%

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Soil Stablizing Measures, the Equipment loading/unloading mitigation reduces emissions by:

PM10: 69% PM25: 69%

The following mitigation measures apply to Phase: Paving 5/4/2006 - 5/20/2006 - Asphalt 0.5 months beginning in May 2006

For Pavers, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Pavers, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Pavers, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Paving Equipment, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Paving Equipment, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Paving Equipment, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Rollers, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Rollers, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Rollers, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

The following mitigation measures apply to Phase: Building Construction 7/11/2005 - 5/31/2006 - Construction 10.7 months beginning July

For Cranes, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Cranes, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Cranes, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Forklifts, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Forklifts, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Forklifts, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Generator Sets, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Generator Sets, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Generator Sets, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Tractors/Loaders/Backhoes, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Tractors/Loaders/Backhoes, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Tractors/Loaders/Backhoes, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Welders, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Welders, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Welders, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

The following mitigation measures apply to Phase: Architectural Coating 4/1/2006 - 5/3/2006 - Coating 1.1 month beginning April 2006

For Residential Architectural Coating Measures, the Residential Exterior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Residential Architectural Coating Measures, the Residential Interior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Nonresidential Architectural Coating Measures, the Nonresidential Exterior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Nonresidential Architectural Coating Measures, the Nonresidential Interior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

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Urbemis 2007 Version 9.2.4

Summary Report for Summer Emissions (Pounds/Day)

File Name: E:\Projects\UC Berkeley\UCBerkeley_Scen1.urb924

Project Name: UC Berkeley LRDP Construction Emissions

Project Location: Bay Area Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES

	CO2
2005 TOTALS (lbs/day unmitigated)	10,008.56
2005 TOTALS (lbs/day mitigated)	10,008.56
2006 TOTALS (lbs/day unmitigated)	13,189.67
2006 TOTALS (lbs/day mitigated)	13,189.67

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: E:\Projects\UC Berkeley\UCBerkeley_Scen1.urb924

Project Name: UC Berkeley LRDP Construction Emissions

Project Location: Bay Area Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	CO2
2005 TOTALS (tons/year unmitigated)	666.83
2005 TOTALS (tons/year mitigated)	666.83
Percent Reduction	0.00
2006 TOTALS (tons/year unmitigated)	571.52
2006 TOTALS (tons/year mitigated)	571.52
Percent Reduction	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

CO2

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2005	666.83
Mass Grading 06/01/2005-07/10/2005	41.29
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	39.51
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	1.78
Building 07/11/2005-05/31/2006	625.53
Building Off Road Diesel	116.97
Building Vendor Trips	100.89
Building Worker Trips	407.68
2006	571.52
Building 07/11/2005-05/31/2006	540.20
Building Off Road Diesel	101.06
Building Vendor Trips	87.18
Building Worker Trips	351.96
Coating 04/01/2006-05/03/2006	12.20
Architectural Coating	0.00
Coating Worker Trips	12.20
Asphalt 05/04/2006-05/20/2006	19.12
Paving Off-Gas	0.00
Paving Off Road Diesel	11.49
Paving On Road Diesel	6.86
Paving Worker Trips	0.76

Phase Assumptions

Phase: Mass Grading 6/1/2005 - 7/10/2005 - Grading 1.3 months beginning June 1

Total Acres Disturbed: 45.9

Maximum Daily Acreage Disturbed: 11.5

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Rubber Tired Dozers (352 hp) operating at a 0.59 load factor for 8 hours per day

2 Tractors/Loaders/Backhoes (79 hp) operating at a 0.465 load factor for 8 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 5/4/2006 - 5/20/2006 - Asphalt 0.5 months beginning in May 2006

Acres to be Paved: 11.5

Off-Road Equipment:

1 Pavers (190 hp) operating at a 0.62 load factor for 8 hours per day

2 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day

2 Rollers (95 hp) operating at a 0.56 load factor for 8 hours per day

Phase: Building Construction 7/11/2005 - 5/31/2006 - Construction 10.7 months beginning July

Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 8 hours per day

2 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day

1 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

3 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day

Phase: Architectural Coating 4/1/2006 - 5/3/2006 - Coating 1.1 month beginning April 2006

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Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	CO2
2005	666.83
Mass Grading 06/01/2005-07/10/2005	41.29
Mass Grading Dust	0.00
Mass Grading Off Road Diesel	39.51
Mass Grading On Road Diesel	0.00
Mass Grading Worker Trips	1.78
Building 07/11/2005-05/31/2006	625.53
Building Off Road Diesel	116.97
Building Vendor Trips	100.89
Building Worker Trips	407.68

2006	571.52
Building 07/11/2005-05/31/2006	540.20
Building Off Road Diesel	101.06
Building Vendor Trips	87.18
Building Worker Trips	351.96
Coating 04/01/2006-05/03/2006	12.20
Architectural Coating	0.00
Coating Worker Trips	12.20
Asphalt 05/04/2006-05/20/2006	19.12
Paving Off-Gas	0.00
Paving Off Road Diesel	11.49
Paving On Road Diesel	6.86
Paving Worker Trips	0.76

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Mass Grading 6/1/2005 - 7/10/2005 - Grading 1.3 months beginning June 1

For Soil Stablizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:

PM10: 84% PM25: 84%

For Soil Stablizing Measures, the Replace ground cover in disturbed areas quickly mitigation reduces emissions by:

PM10: 5% PM25: 5%

For Soil Stablizing Measures, the Water exposed surfaces 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

For Soil Stablizing Measures, the Equipment loading/unloading mitigation reduces emissions by:

PM10: 69% PM25: 69%

The following mitigation measures apply to Phase: Paving 5/4/2006 - 5/20/2006 - Asphalt 0.5 months beginning in May 2006

For Pavers, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Pavers, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Pavers, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Paving Equipment, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Paving Equipment, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Paving Equipment, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Rollers, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Rollers, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Rollers, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

The following mitigation measures apply to Phase: Building Construction 7/11/2005 - 5/31/2006 - Construction 10.7 months beginning July

For Cranes, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Cranes, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Cranes, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Forklifts, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Forklifts, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Forklifts, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

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For Generator Sets, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Generator Sets, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Generator Sets, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Tractors/Loaders/Backhoes, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Tractors/Loaders/Backhoes, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Tractors/Loaders/Backhoes, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

For Welders, the Use Aqueous Diesel Fuel mitigation reduces emissions by:

NOX: 15% PM10: 50% PM25: 50%

For Welders, the Diesel Particulate Filter (DPF) 1st Tier mitigation reduces emissions by:

PM10: 85% PM25: 85%

For Welders, the Diesel Oxidation Catalyst 15% mitigation reduces emissions by:

NOX: 15%

The following mitigation measures apply to Phase: Architectural Coating 4/1/2006 - 5/3/2006 - Coating 1.1 month beginning April 2006

For Residential Architectural Coating Measures, the Residential Exterior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Residential Architectural Coating Measures, the Residential Interior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Nonresidential Architectural Coating Measures, the Nonresidential Exterior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

For Nonresidential Architectural Coating Measures, the Nonresidential Interior: Use Low VOC Coatings mitigation reduces emissions by:

ROG: 10%

UNIVERSITY OF CALIFORNIA

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March 22, 2007

CHANCELLORS

Policy on Sustainable Practices

The University of California is committed to minimizing the University's impact on the environment and reducing the University's dependence on non-renewable energy. In October 2006, in response to the requirement that the guidelines for the *Policy on Green Building Design, Clean Energy Standards, and Sustainable Transportation Practices* be re-examined every three years, sections of the policy were clarified and new sections were added. This review and the development of the revised guidelines were conducted by the Sustainability Steering Committee, consisting of administrators from all campuses and the Office of the President, and faculty members with expertise in these disciplines.

The new sections that expand on more general guidelines in the original policy are in the areas of:

- Building Renovations;
- Climate Protection Practices;
- Sustainable Operations;
- Recycling and Waste Management; and
- Environmentally Preferable Procurement.

The expansion of goals in these areas strengthens implementation of evolving best practices on sustainability. To reflect these changes, the *Policy on Green Building Design, Clean Energy Standards, and Sustainable Transportation Practices* has been renamed the *Policy on Sustainable Practices*.

Enclosed are the revised and renamed *Policy on Sustainable Practices* and the Guidelines for implementation of this policy. Supplementary to and embedded within the Guidelines are Implementation Procedures that are intended to provide specific courses of action, standardized methods, and/or consistent series of steps to implement the policy.

Robert C. Dynes

Enclosures

cc: Members, President's Cabinet
Principal Officers of The Regents
Assistant Vice President Bocchicchio
Universitywide Policy Coordinator Capell

March 22, 2007

UNIVERSITY OF CALIFORNIA
POLICY ON SUSTAINABLE PRACTICES

Resource sustainability is critically important to the University of California, the State of California, and the nation. Efficient energy use is central to this objective, and renewable energy and energy-conservation efforts provide a means to save money, foster environmental awareness, reduce the environmental consequences of University activities, and provide educational leadership for the 21st century.

The University is committed to stewardship of the environment and to reducing the University's dependence on non-renewable energy sources. With this commitment in mind, we will regularly review initiatives and best practices and share successes by augmenting the existing University guidelines. These guidelines currently recommend that University operations:

- Incorporate the principles of energy efficiency and sustainability in all capital projects, renovation projects, operations and maintenance within budgetary constraints and programmatic requirements.

- Minimize the use of non-renewable energy sources on behalf of the University's built environment by creating a portfolio approach to energy use, including the use of local renewable energy and purchase of green power from the grid as well as conservation measures that reduce energy consumption.

- Incorporate alternative means of transportation to/from and within the campus to improve the quality of life on campus and in the surrounding community. The campuses will continue their strong commitment to provide affordable on-campus housing, in order to reduce the volume of commutes to and from campus. These housing goals are detailed in the campuses' Long Range Development Plans.

- Track, report and minimize greenhouse gas emissions on behalf of University operations

- Minimize the amount of University generated waste sent to landfill.

- Utilize the University's purchasing power to meet its sustainability objectives.

The Office of the President will annually report to The Regents on the Policy's impact on capital and operating costs, and overall campus sustainable practices.

March 22, 2007

UNIVERSITY OF CALIFORNIA
POLICY GUIDELINES FOR SUSTAINABLE PRACTICES

SCOPE/AUTHORITY

The Regents have delegated authority to the President for promulgating policy promoting sustainable new capital projects, existing University facilities, and campus transportation resources. The President has delegated authority to the Senior Vice President, Business and Finance for further definition of measures to implement University policy regarding sustainability. Chancellors are responsible for implementation in the context of individual building projects, facilities operations, and transportation projects and programs.

These Policy Guidelines are intended to provide specific scope, direction, and expectations underlying from the Presidential Policy on Sustainable Practices. They also identify best practices to facilitate compliance and provide additional background relevant to this policy.

Supplementary to, and embedded within, these Policy Guidelines are Implementation Procedures that are intended to provide specific course of action, standardized methods, and/or consistent series of steps to implement the Presidential Policy on Sustainable Practices and these Policy Guidelines. The Implementation Procedures are denoted, follow applicable Policy Guidelines, and are formatted in *italics*.

BACKGROUND

Resource sustainability is critically important to the University of California, the State of California, and the nation. Efficient energy use is central to this objective, and renewable energy and energy-conservation projects provide a means to stabilize campus budgets, increase environmental awareness, reduce the environmental consequences of University activities, and provide educational leadership for the 21st century.

On July 17, 2003, The Regents of the University expressed their support for a Presidential policy to promote "…the principles of energy efficiency and sustainability in the planning, financing, design, construction, renewal, maintenance, operation, space management, facilities utilization, and decommissioning of facilities and infrastructure to the fullest extent possible, consistent with budgetary constraints and regulatory and programmatic requirements." At their September 2005 meeting, The Regents authorized the President to incorporate sustainable transportation practices into this Policy. Transportation to, from and within a campus grounds has a significant impact on air quality and affects both the campus landscape and relations with surrounding communities. It is desirable, therefore, to effectively manage transportation demand, provide transportation options and encourage the use of low-impact vehicles, non-fossil fuels, and creative modes of transport, while ensuring maximum campus access and preserving lifestyle features. This

approach to transportation services is a necessary component of the University's sustainability efforts.

In October 2006, in response to the requirement that this policy guideline document be re-examined every three years, sections of the policy were clarified and new sections were added specifically in the areas of: renovation policy, climate change practices, green building operations and maintenance, recycling and waste management, and environmentally preferable procurement.

The University of California is committed to improving the University's effect on the environment and reducing the University's dependence on non-renewable energy. Guidelines for implementing practices in support of Green Building Design, Clean Energy Standards, and Sustainable Transportation Practices are explained in detail in the following plan for achieving these goals.

POLICY GUIDELINES

I. Green Building Design

New Buildings

a. Given the importance of energy efficiency to Green Building design, the University has set a goal for all new building projects, other than acute-care facilities, to outperform the required provisions of the California Energy Code (Title 24) energy-efficiency standards by at least 20 percent. Standards for energy efficiency for acute care facilities will be developed in consultation with campuses and medical centers.

b. The University of California will design and build all new buildings, except for laboratory and acute care facilities, to a minimum standard equivalent to a *LEED*™ 2.1 "Certified" rating.

c. Campuses will strive to achieve a standard equivalent to a *LEED*™ "Silver" rating or higher, whenever possible within the constraints of program needs and standard budget parameters.

d. Given the importance of specifically addressing sustainability in laboratory facilities, the University of California will design and build all new laboratory buildings to a minimum standard equivalent to a *LEED*™ *2.1* "Certified" rating and the *Laboratories for the 21st Century (Labs21) Environmental Performance Criteria* (EPC), as appropriate. The design process will include attention to energy efficiency for systems not addressed by the California Energy Code (Title 24).

e. In consultation with the campuses, the Office of the President will develop an internal evaluation and certification standard based on the *LEED*™ and *Labs21* measures.

f. The measures required by this Policy Guideline will be incorporated into all new building projects, other than acute care facilities, submitted for first formal scope and budget approval as of July 1, 2004.

g. Further study will be conducted before a similar sustainable design policy for new acute-care facilities is adopted.

Building Renovations

a. Any significant renovation projects involving existing buildings will also apply sustainability principles to the systems, components and portions of the building being renovated. At Budget Approval, all renovation projects should include a listing of sustainable measures under consideration. Design and specification of renovation components such as mechanical, electrical and plumbing components, lighting, finishes, materials, etc. must meet or exceed associated Campus Baseline Green Building points.

b. Renovation of buildings that require 100% replacement of mechanical, electrical and plumbing systems and replacement of over 50% of all non-shell areas (interior walls, doors, floor coverings and ceiling systems) should at a minimum comply with a UC equivalent to a LEED-NC 2.1 or most current version of the LEED NC program certified rating. Subject to life cycle cost analysis, such projects should outperform Title 24, Part 6, that is currently in effect, by 20% and register with the Savings by Design program.

c. Renovation projects with a project cost of $5 million or greater (CCCI 5000) that do not fall [under item b. above] should at a minimum comply with a UC equivalent to a LEED Commercial Interiors certified rating and register with the Savings by Design program, if eligible.

d. The green building requirements in b. and c. above will apply to the listed categories of renovations, receiving budget approval after July 1, 2007.

General/Miscellaneous

a. Policy guidelines for sustainable operations of existing buildings previously addressed by this section are now found in Section V of this document.

b. Policy guidelines which previously indicated that the University will use its purchasing power to promote the availability of products that are resource-efficient, energy-efficient, water-efficient, and of recycled and rapidly renewable content for building materials, subsystems, components, equipment, and supplies are now found in Section VII, Environmentally Preferable Procurement, of this document.

c. The University will work with regulatory agencies and other entities to speed the development, approval, and implementation of products and technologies that improve energy efficiency and support sustainable design, construction, and operating practices.

d. The University will develop a program for sharing of best practices.

e. The University will incorporate the Green Building Design policy into existing facilities-related training programs, with the aim of promoting and maintaining the goals of the policy.

Implementation Procedures for Green Building Design – General/Miscellaneous:

- *Any proposed exception from standards listed in the Policy Guideline may be requested administratively during preparation of the Project Planning Guide (PPG). Any exception proposed after approval of the PPG will be treated as a scope change and processed in accordance with standard University procedures.*

- *Campuses may choose to pursue external certification through the LEED™ process, augmented with Labs21 criteria as appropriate for laboratory systems, in lieu of the internal process for a given project.*

- *The University planning and design process will include explicit consideration of lifecycle cost along with other factors in the project planning and design process, recognizing the importance of long-term operations and maintenance in the performance of University facilities.*

- *The University will work closely with the U.S. Green Building Council, Labs21, the Department of Energy, the U.S. Environmental Protection Agency, State government, and other organizations to facilitate the improvement of evaluation methodologies to better address University requirements. Additionally, the University will work with the U.S. Green Building Council to develop a self-certification tool for University use.*

II. Clean Energy Standard

a. The University will implement a systemwide portfolio approach to reduce consumption of non-renewable energy. The portfolio will include a combination of energy efficiency projects, the incorporation of local renewable power measures for existing and new facilities, green power purchases from the electrical grid, and other energy measures with equivalent demonstrable effect on the environment and reduction in fossil fuel usage. The appropriate mix of measures to be adopted within the portfolio will be determined by each campus. Since each campus's capacity to adopt these measures is driven by technological and economic factors, the campus will need to reevaluate their energy measures mix on a regular basis. The portfolio approach will provide valuable analytical information for improving energy efficiency, resulting in an overall improvement in the University's impact on the environment and reduced reliance on fossil fuels during the next decade of capital program growth.

b. The University will strive to achieve a level of grid-provided electricity purchases from renewable sources that will be similar to the State's Renewable Portfolio Standard, which sets a goal of procuring 20 percent of its electricity needs from renewable sources by 2010.

c. With a goal of providing up to 10 megawatts of local renewable power by 2014, the University will develop a strategic plan for siting renewable power projects in existing and new facilities. The plan will include demonstration projects for photovoltaic systems and other renewable energy systems, such as landfill gas fueled electricity generation or thermal energy production. The strategic plan will include criteria for evaluating the feasibility of a variety of projects, such as incorporating photovoltaic systems in replacement roofing projects and in new buildings, as well as forecasting the accommodations necessary for eventual installation of photovoltaic systems. The University will assess the progress of renewable energy technology improvements, both in terms of cost and technical efficiency. To achieve the renewable power goal, the University will maximize the use of available subsidies and negotiate pricing reductions in the marketplace, and will develop funding sources for financing the costs of renewable energy measures.

d. With a goal of reducing systemwide non-renewable energy consumption, the University will develop a strategic plan for implementing energy efficiency projects for existing buildings and infrastructure to include operational changes and the integration of best practices. The University will monitor industry progress in energy retrofits and implement technical improvements as they become available. As with renewable energy projects, the University will develop funding sources and establish a program for financing retrofit projects. The initial goal for energy efficiency retrofit projects will be to reduce systemwide growth-adjusted energy consumption by 10 percent or more by 2014 from the year 2000 base consumption level. The University will strive to achieve even greater savings as additional potential is identified and funding becomes available.

e. The University will continuously evaluate the feasibility of other energy-saving measures with equivalent demonstrable effect on the environment and reduction in fossil fuel usage. In particular, campuses will strive to implement the Sustainable Transportation Practices described in Section III, below.

f. The University will develop a variety of funding sources and financing alternatives for energy efficiency, renewable energy, and clean energy projects that will enable campuses to be flexible in addressing their energy needs.

g. The University will pursue marketing of emissions credits as a means to bridge the cost-feasibility gap for green power projects.

Implementation Procedures for Clean Energy Standard:

- *The University will initiate progress towards a level of grid-provided electricity purchases in 2004 by purchasing 10 percent of grid-supplied electricity from renewable sources, subject to funding availability, and will track progress annually toward achievement of the year 2010 goal.*

- *Campuses will provide strategic plans for implementing energy efficiency projects by identifying opportunities to incorporate energy retrofit projects into major building*

renovations as funding is available, and to initiate standalone retrofit projects as justified by future energy savings.

III. Climate Protection Practices

a. With an overall goal of reducing greenhouse gas (GHG) emissions while maintaining enrollment accessibility for every eligible student, enhancing research, promoting community service and operating campus facilities more efficiently, the University will develop a long term strategy for voluntarily meeting the State of California's goal, pursuant to the "California Global Warming Solutions Act of 2006" that is: by 2020, to reduce GHG emissions to 1990 levels. In addition, consistent with the Clean Energy Standard sections a., b. and c. of this document, the University will pursue the goal of reducing GHG emissions to 2000 levels by 2014 and provide an action plan for becoming climate neutral as specified in the Implementation Procedures below.

Implementation Procedures for Climate Protection Practices:

- *By December 2008, the University will develop an action plan for becoming climate neutral which will include: a feasibility study for meeting the 2014 and 2020 goals stated in the Policy Guidelines, a target date for achieving climate neutrality as soon as possible while maintaining the University's overall mission, and a needs assessment of the resources required to successfully achieve these goals. Climate neutrality 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.*

- *Each UC campus will pursue individual membership with the California Climate Action Registry. The Senior Vice President, Business and Finance, in coordination with campus administration, faculty, students and other stakeholders will form a Climate Change Working Group that will develop a protocol to allow for growth adjustment and normalization of data and accurate reporting procedures. The Climate Change Working Group will monitor progress toward reaching the stated goals for GHG reduction, and will evaluate suggestions for programs to reach these goals.*

IV. Sustainable Transportation Practices

Metrics and Benchmarking

a. In implementing a most efficient and effective economic and environmental strategy for campus fleets, campuses shall implement practicable and cost-effective measures, including, but not necessarily limited to, the purchase of the cleanest and most efficient vehicles and replacement tires, the use of alternative fuels, and other conservation measures.

b. Campuses will be encouraged to collect data on Average Vehicle Ridership (AVR) of commuters.

c. The Senior Vice President, Business & Finance has made a written request to major automobile manufacturers expressing both the University's commitment to work with industry to provide vehicle and fuel choice, and the expectation that industry will provide these choices to the fullest extent possible.

d. Using the time period 2004-2005 as a baseline, campuses will strive to increase the percentage of low (PZEV) or zero-emission vehicles (ZEV) by 50% by the year 2009-2010, or to increase the number of PZEV and ZEV vehicles by 20% by the year 2009-2010, whichever is more feasible, and/or to convert campus vehicles to 50% non-carbon based fuel by year 2009-2010.

e. The University will work with regulatory agencies and other entities (e.g., regional transit agencies, air quality management districts) to speed the development, approval, and implementation of programs and technologies that support the goals of sustainable transportation as related to the increased use of biodiesel or other alternative fuel sources.

Implementation Procedures for Sustainable Transportation Practices:

- *With the goal of measuring all campus fleet vehicles fuel consumption reduction, campuses will collect and report fuel consumption annually to the Office of the President beginning in 2005-06.*

- *AVR is defined as the number of trips to campus divided by the number of automobiles used for those trips (AVR = trips/# automobiles). Campuses may use this data to set goals for reduction of fuel consumption. AVR data may also be used in conjunction with transportation mode split data to develop maps of distance "zones" surrounding the campus, and to model each zone's proportionate share of various commuting modes (e.g., percentage of bicycle or single-occupancy vehicle trips within 0-2 miles from the central campus core).*

- *The Sustainable Transportation Working Group will continue to work with State agencies to facilitate the purchase and use of LEV, ZEV, and alternative fuel vehicles by the campuses, and to find solutions for increasing the availability of an affordable supply.*

Transportation Programs

a. The University will continue to facilitate the sharing of best practices within the University and among other educational institutions.

b. The University will develop a mechanism for ongoing involvement of undergraduate and graduate students in efforts toward achieving sustainable campus transportation. The means may include but are not limited to undergraduate and graduate internships and/or scholarships for relevant conference attendance.

c. By January 2009, each campus will implement a pre-tax transit pass program to facilitate the purchase of transit passes by University employees, or will establish a universal access transit pass program for employees.

d. The University will pursue the introduction of ride-share programs at each campus for all eligible program participants, where available. In conjunction with this effort, campuses will engage in advocacy efforts with local transit districts to improve routes in order to better serve student and staff ridership.

e. To the extent practicable, campuses will develop a business-case analysis for any proposed parking structure projects.

Implementation Procedures for Transportation Programs:

- *The University will continue to participate in Transportation Sessions at the annual UC/CSU/CCC Campus Sustainability Conference.*

- *The Office of the President will begin funding an internship for one to two students in Academic Year 2005-06 and continuing until Academic Year 2009-10 or longer. At that time, the program's results will be reviewed and the Senior Vice President, Business and Finance, or other delegated administrator, will determine whether or not to extend the program.*

V. Sustainable Operations

a. For existing buildings, the University will explore the development of a standard methodology for sustainable practices and standards for facilities management, by assessing the LEED for Existing Building (LEED-EB) evaluation tool as described in b. through g. below.

b. For existing buildings, the University of California will develop a plan to operate and maintain all scope eligible campus buildings at a minimum standard equivalent to a LEED for Existing Buildings (LEED-EB) "Certified" rating. The implementation for certification will be carried out in a comprehensive campus approach vs. an individual building basis, except for exceptions noted below.

c. The University will incorporate these Sustainable Operations Policy Guidelines into existing facilities-related training programs, with the aim of promoting and maintaining the goals of the Policy.

d. The University will work closely with the U.S. Green Building Council (USGBC) to address the needs and concerns of campuses in the further development of the LEED-EB rating system and the USGBC's "Portfolio Program." As information and requirements are

determined from the USGBC's "Portfolio Program"; the University will update this policy as appropriate.

e. Campuses will explore ways to connect the buildings it certifies through LEED-EB with the University's educational and research mission, using the buildings as living, learning laboratories.

f. Eligible scope buildings for the purpose of this policy will be all buildings on-site at the ten campuses; except the following buildings or building types: acute care and patient care facilities; buildings scheduled for demolition, replacement, or major renovation; any building not located on the main campus; and any building less than 50,000 maintained gross sq. ft.

g. A timetable for full campus implementation will be further evaluated after completion of the interim milestones listed in Implementation Procedures below.

Implementation Procedures for Sustainable Operations:

- *Each campus will submit for certification one pilot building at a LEED-EB "Certified" level or higher by July 1, 2008*

- *To facilitate the implementation steps for the policy, campuses will develop an inventory of buildings that meet the scope eligibility requirements above, and then group these eligible buildings into categories of buildings with similar operational and maintenance needs.*

- *Campuses will submit proposed core credits for one of the building type groupings identified above and any campuswide core credits to the U.S. Green Building Council by July 1, 2009. A core credit is a credit that will be sought for either all scope eligible buildings on a campus, or for all buildings within a building type group.*

- *By July 1, 2009, the University will evaluate efforts to date and develop an implementation plan and funding strategy toward a goal of achieving campus wide LEED-EB certification.*

VI. Recycling and Waste Management

a. In response to Public Resources Code Section 40196.3 which states that the Regents of the University of California are encouraged to comply with code Chapter 18.5, the "State Agency Integrated Waste Management Plan" and in support of the California Integrated Waste Management Board's goal for a "zero waste California", the University voluntarily adopts the following waste diversion goals:

  - 50% by June 30, 2008
  - 75% by June 30, 2012
  - Ultimate goal of zero waste by 2020

b. All campuses will develop an Integrated Waste Management Plan (IWMP) and funding mechanism by June 30, 2007.

c. Waste reduction and recycling elements shall be integrated in Green Building Design and Sustainable Operation implementation goals and into campus operations as they are developed.

d. The University will seek to develop funding sources for financing waste reduction projects.

Implementation Procedures for Recycling and Waste Management:

- *The IWMP will include current and future programs, dates of implementation, funding, and exact diversion numbers intended to meet goals*

- *For purposes of reporting, the medical centers (and other traditionally exempted entities) (Satellite locations) at various campuses will be required to report solid waste and recycling tonnage to the campus entity collecting data for the report. Medical Centers and other exempted facilities are also required to meet diversion requirements. Exceptions will be considered for those entities which represent less than 1% of the overall campus solid waste tonnage.*

VII. Environmentally Preferable Purchasing Practices

Sustainable Economy

a. The University will utilize its purchasing power and academic and research excellence to advance the development of sustainable technologies by pressing markets to continually improve resource productivity.

b. For products and services that do not currently offer environmentally preferable alternatives, the University will work with its existing and potential suppliers to develop options.

c. "Cradle to cradle" is the preferred purchasing standard and is defined as accountable, responsible, and environmentally preferable supply chain management from material extraction, production, marketing, sale, use, disposal, collection, re-use and the web of closed loop cycles and processes.

d. The University will continue to transition all locations toward electronic and paperless processes and utilize web-based catalogs and programs.

e. The University will incorporate the credit requirements set forth by LEED (Leadership in Energy an Environmental Design) into product and service sourcing and procurement.

f. The University evaluates total cost of ownership including purchase price, operating cost, maintenance, collection and disposal, and recycling costs when selecting suppliers.

Energy and Water

a. For product categories that have ENERGY STAR© rated products available, the University will focus its procurement efforts only on products with an ENERGY STAR© rating, consistent with the needs of UC researchers.

b. For all electronic equipment, the supplier will deliver the items to the University with energy efficiency and conservation features enabled.

c. The University will utilize its strategic purchasing program to negotiate better pricing for rated commodities.

d. The University of California shall establish an ongoing partnership with the ENERGY STAR© Program administered by the EPA, and continually press the market for greater energy efficiency for the products and services regularly purchased by the University.

e. For products and services requiring the use of water, the University will give preference to technologies that ensure the efficient use of water resources.

Implementation Procedures for Energy and Water:

- *For those goods already in use across the system, available energy conservation features shall be ENERGY STAR© enabled by a designated party (e.g. IT, department MSO).*

Recycled Content

a. The University will phase out the use of virgin paper and adopt a minimum standard of 30% Post Consumer Waste (PCW) recycled content paper for all office supplies.

b. For uncut paper uses, including but not limited to janitorial supplies, the University will adopt a standard of 100% PCW recycled content paper.

c. The University will utilize its strategic purchasing program to negotiate better pricing for commodities with recycled content as compared to commodities without recycled content.

d. The University will continually work towards increasing the procurement of products with high recycled content.

e. Outside suppliers and consultants shall be encouraged to print proposals and reports on both sides, using recycled content paper. Furthermore, the documents shall be clearly marked to indicate that they are printed on recycled content paper.

Green Seal Certified Products

a. The University will work to phase in Green Seal certified products, as specified in the Implementation Procedures.

Implementation Procedures for Green Seal Certified Products:

- *The University will work to phase in Green Seal certified products through its Strategic Sourcing and local campus procurement programs in coordination with EH&S, Facilities Management, and Housing and Residential Services.*

Reduction of Hazardous Electronic Waste

a. All desktop computers, laptops, and computer monitors purchased by the University are required to have achieved Bronze registration or higher under the Electronic Products Environmental Assessment Tool (EPEAT).

b. Additional consideration will be provided for electronics products that have achieved EPEAT Silver or EPEAT Gold registration. The registration criteria and a list of all registered equipment are provided at http://www.epeat.net.

c. The University will recycle all electronic waste in a responsible manner, as specified in the Implementation Procedures.

Implementation Procedures for Reduction of Hazardous Electronic Waste:

- *The University will require all recyclers of the University's electronic equipment to have signed the Electronics Recyclers Pledge of True Stewardship, agreeing to a rigorous set of environmental criteria. The Pledge, and a list of recyclers who have signed, is available at http://www.ban.org/pledge1.html. In cases where the University has established recycling "take-back" programs, the University will ensure that the manufacturer adheres to similarly high standards of responsible recycling.*

Environmentally Responsible Packaging

a. Packaging for electronics products should be designed, produced, and managed in an environmentally sustainable manner, as specified in the Implementation Procedures.

b. The University will specify that all packing materials abide by at least one of, and preferably all of, the criteria listed in the Implementation Procedures:

c. The University will work with its suppliers to ensure effective waste management and recycling programs are in place for all business operations.

Implementation Procedures for Environmentally Responsible Packaging:

- *The University requires that a take-back program be offered for packaging of electronics products and will give preference to take-back programs that are provided free of charge. The University will also give preference to packaging that is reusable, contains a minimum of hazardous and non-recyclable materials, and meets or exceeds the recycled material content levels in the US EPA Comprehensive Procurement Guidelines for Paperboard and Packaging.*

- *Specify that all packing materials abide by at least one of and preferably all of the criteria listed below:*

  - *Made from 100% post-consumer recycled materials and be recyclable, reusable, or*
  - *Be non-toxic,*
  - *Be biodegradable,*
  - *Be produced with the minimum of resources and sized as small as possible, while still maintaining product protection during shipping. Where feasible, packaging materials should be eliminated, if unnecessary.*

- *The University will work with its suppliers to ensure effective waste management and recycling programs are in place for all business operations.*

Effective Recycling and Manufacturer Take-Backs

a. The University will work to incorporate effective end-of-life recycling programs into each commodity as applicable.

b. The University will work with its suppliers to establish, re-use or recycling "take-backs" at no extra cost to the University, and in compliance with environmental standards that abide by Federal, State, and local legislation regarding waste disposal.

Supply Chain Environmental Responsibility

a. The University will encourage suppliers to demonstrate environmental stewardship through their Environmental Management Programs.

Evaluating Environmental Claims

a. Suppliers citing environmentally preferred product claims shall follow requirements specified in the Implementation Procedures below.

Implementation Procedures for Evaluating Environmental Claims:

- *Suppliers citing environmentally preferred product claims shall provide proper certification or detailed information on environmental benefits, durability, and recyclable properties.*

Training and Annual Plan and Report

a. The University will incorporate the Environmentally Preferable Purchasing Policy into existing strategic sourcing and other training programs, with the aim of promoting and maintaining the goals of the policy. The University shall provide training seminars, supplier fairs, and workshops on purchasing environmentally preferred products and establish educational programs and materials for faculty, staff, and students.

b. An annual plan and report shall be completed by each campus to define their environmental purchasing plan and report their efforts.

Implementation Procedures for Training and Annual Plan and Report:

- *UC campus Sustainability Committees will be responsible for reporting to the Sustainability Steering Committee on an annual basis. The Sustainability Steering Committee and the Sustainable Purchasing Working Group will maintain responsibility for determining the format and data to be submitted in the annual report, and the form for the annual plan.*

VIII. Authority and Report Schedule

On an annual basis, the President will provide a report to The Regents detailing the impact of the University's sustainability efforts on the overall capital program, University operating costs, energy use, greenhouse gas emissions, solid waste diversion, campus environmentally preferable purchasing and campus transportation practices. The University's sustainability guidelines will be subject to continuous review. The Policy Guidelines for Sustainable Practices and Implementation Procedures will be reviewed at a minimum every three years, with the intent of developing and strengthening implementation provisions and assessing the influence of the guidelines on existing facilities, new capital projects, plant operating costs, fleet and transportation services, and campus accessibility, mobility, and livability. The University will provide means for the ongoing active participation of students, faculty, administrators, and external representatives in further development and implementation of the Policy on Sustainable Practices.

Examining strategies to reduce greenhouse gas emissions at U.S. colleges and universities

Testimony of Robert J. Birgeneau
Chancellor, University of California, Berkeley

Committee on Environment and Public Works, United States Senate

April 3, 2008

Senator Boxer and members of the committee — thank you for giving me the opportunity to speak to you today on one of the most urgent issues facing our state, our nation and our globe. Climate change caused by our use of carbon fuels is one of the most significant and pressing challenges of our time. At UC Berkeley, the nation's leading public teaching and research university, we are aggressively addressing climate change through our teaching and research, as well as through policy and collective and individual action on our campus.

California has demonstrated national and international leadership in committing to reduce its green house gas emissions. It has legislated that the state's global warming emissions be reduced to 1990 levels by 2020 (a 25% greenhouse gas cut) and 80% below 1990 levels by 2050.

Berkeley is at the forefront of energy research, and specifically energy research and implementation to make these goals viable. This is fundamental to our public mission as a university. Our flagship effort is the creation of the Energy Biosciences Institute (EBI), a collaboration with the Lawrence Berkeley National Laboratory (LBNL) and the University of Illinois at Urbana-Champaign, funded by a $500 million, 10-year grant from BP awarded in 2007, to explore and develop biofuels. We have simultaneously created the Joint Bioenergy Institute (JBEI), through a $125 million grant from the Department of Energy. Additionally, scientists from UC Berkeley and the LBNL have been developing a bold research agenda called Helios exploring solar energy devices from photovoltaics to microorganisms, including nanotechnologies to produce cheaper solar cells and improve their efficiency. Today Berkeley has emerged as a leading world center on energy research and education, with an annual budget of $100 million through unprecedented public-private partnership.

We have also been aggressive with measures to reduce greenhouse gas emissions on campus. Under the Cal Climate Action Partnership (a coalition of students, faculty and staff with the administration), we have undertaken a feasibility study, and based on sound analysis and actionable policy, have committed to a target of reducing greenhouse gas emissions on campus to 1990 levels by 2014. This is six years ahead of the state's mandated reduction. Our strategies for achieving this ambitious target include increasing the efficiency of our energy usage, greening our electricity supply, and promoting sustainable transportation.

Buildings account for over 70% of campus emissions. Projects to reduce emissions include large scale lighting retrofits, building re-commissioning, making our heating, ventilation, and air conditioning systems more efficient, and deploying additional on-site renewable energy production. Our plan also contains efforts that are indirectly related to energy usage and also have enormous impacts on resource conservation, such as water conservation, minimizing waste, and purchasing greener

products. These actions are supported by a formal campus policy "statement of commitment to the environment" and the appointment of a Director of Sustainability.

Many of these efforts to mitigate UC Berkeley's climate footprint have been led by our students who are a new generation passionately committed to solving the world's energy needs in both a clean and socially responsible way. Berkeley students recently voted a $5 student fee increase to fund sustainability projects on campus. The Berkeley Energy and Resources Collaborative is a unique student community that brings together hundreds of students, professors and industry and government leaders on issues of energy and resources at Berkeley. Our students are acutely aware that over one billion people live on 50 cents per day or less and that these populations will be disadvantaged even further if global climate change continues to progress at its current rate. They understand that how we deal with these challenges will transform humankind's relationship with the environment and change the way that we drive the global economy. Universities must lead this transformation.

Thank you for this opportunity to describe very briefly UC Berkeley's strategies for reducing greenhouse gases both on its campus and even more importantly, its strategies for contributing to greenhouse gas emission reduction world-wide.

Finally, if you would allow me to comment on national policy, I feel strongly that while there is so much that universities and other local entities can do to reduce their carbon footprints, global warming really must be addressed at the national level if we as a nation are going to have the kind of impact we must have to prevent further destruction of our atmosphere. To that end, passage of the S.2191 or similar legislation to impose strict limits on greenhouse gas emissions, is absolutely critical.

I have submitted a much fuller written submission describing in detail our many initiatives. I would be pleased to answer any questions that you may have.

Campus Activities to Reduce Emissions

The University of California at Berkeley is committed to reducing the greenhouse gas emissions associated with our campus activities. We have inventoried our emissions, set an ambitious target, and begun implementation. Our Cal Climate Action Partnership (CalCAP) program is an interdisciplinary research and implementation program and is the torchbearer of climate action on campus. In April 2007, based on recommendations from the CalCAP study, I committed the campus to reduce its greenhouse gas emissions to 1990 levels by the year 2014, which is equivalent to meeting California's AB-32 (Global Warming Solutions Act) six years early (see Figure 1).

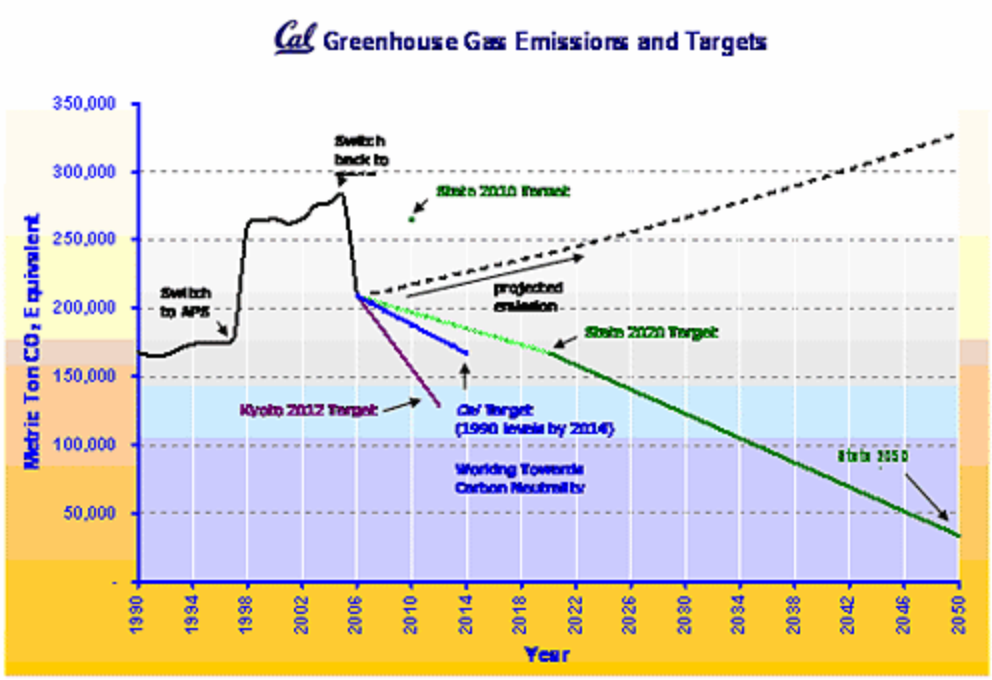

Figure 1: Projected Emissions and Potential Targets

Emissions Sources and Reduction Feasibility

CalCAP started in the fall of 2006 by creating a climate action feasibility study. This study led to the development of a ten source greenhouse gas emissions inventory and the emissions reduction target, which included 14 possible projects as a starting point for implementation. Our target and inventory are based on both our direct emissions — like energy usage in buildings and our fleet vehicles — and optional categories like air travel, staff and student commute to campus, water consumption, and solid waste.

In order to achieve this ambitious emission reduction target, we will:

- Use aggregate emissions targets as a metric in campus communication and planning
- First implement infrastructure-related emissions reduction projects, starting with the most cost-effective (i.e., highest $/MTCO2e) projects, and then use the savings from those projects to invest in additional projects or to purchase Renewable Energy Credits (RECs)
- Focus on identifying additional cost-effective GHG mitigation opportunities on campus, such as energy efficiency.

The campus joined the California Climate Action Registry and has certified its emissions inventory for 2005 and 2006 (see Figure 2). Of the 14 projects that have been initially associated with the CalCAP target, four projects are active and seven projects are in a small pilot phase. Investments of almost $2 million have already yielded an estimated one million KWH energy savings.

While our 2007 inventory calculations are not certified yet, we expect that our overall emissions will be lower (approximately 207,000 metric tons) than what we had originally projected. The relative percentage contribution by various emissions sources has not shifted by a significant portion.

Emissions Sources (required & optional reporting)	CO_2 equivalent (metric tons)	Percentage Contribution
Steam (co-generation)	82,000	38.8%
Purchased Electricity	65,000	30.6%
Air Travel	24,000	11.3%
Faculty and Staff Auto Commute	19,000	8.6%
Natural Gas	13,000	6.1%
Student Commute	4,000	1.8%
Fugitive Emissions- Refrigeration	2,000	1.0%
Water Consumption	2,000	0.9%
Solid Waste	1,000	0.4%
Campus Fleet	1,000	0.4%
Total Emissions	209,000	100.0%
Required reporting emissions sources	160,000	76.5%
Optional Reporting emissions sources	50,000	23.5%

Figure 2: UC Berkeley GHG Emissions by Source in Calendar Year 2006

The reasons for this year's reduction can be attributed to implementation of various energy efficiency projects on campus. Examples of these efficiency measures include lighting retrofits, building re-commissioning, and upgrades to heating and air conditioning systems. An additional factor is the increased use of cleaner electricity, as the campus has purchased more of its power from Pacific Gas and Electric. Other initiatives are discussed below.

Specific Initiatives

1. **Infrastructure projects** — The following types of projects enhance the energy efficiency of campus energy systems. They can have a significant upfront cost, but can also have a quick payback and generate savings that can be further invested.
    a. Co-generation plant steam trap survey and repair (saving up over 1,000 tons of carbon a year)
    b. Monitoring-based commissioning (all buildings over 50,000 square feet will be re-commissioned; energy savings of up to 15% are expected)
    c. Automated lighting controls (for example, use of wireless lighting controls in a pilot study has yielded energy reductions of 65%)
    d. Fluorescent lighting retrofits (for example, installation of more than 700 electronic ballasts and photoelectric control in five parking structures)
    e. Fleet vehicle replacement plan (questionnaire and plan to convert the single-occupant fleet on campus to electric by 2014)

In addition, the campus is completing a Strategic Energy Plan (SEP) in partnership with PG&E. Consultants have started surveying almost 70 campus building to identify commissioning, retrofit, HVAC upgrade and other energy efficiency projects. Work is expected to begin in 2009. The campus also plans to purchase up to 1MW of solar power Solar through a power purchase agreement.

2. **Educational and Behavioral Projects** — These campus initiatives will encourage individuals to conserve more energy and educate the campus population to incorporate conservation into their daily activities. They require some capital investment and a significant dedication to coordination and planning. They have a quick payback and also

contribute to establishing a culture of environmentally sustainable practices. Not all of these projects are currently funded.

a. Introduce fleet biking
b. Expand electric vehicle fleet
c. Implement high priority bicycle plan projects & programs
d. Reward department level energy reduction
e. Increase utilization of videoconference room(s)
f. Increasing occupant awareness and electricity curtailment
g. Introduce Campus Composting program

3. **New Buildings —** We are using the Leadership in Energy Efficient Design guidelines for new buildings, supplemented by additional energy efficiency requirement: all new building projects on campus will be designed to exceed the required provisions of the California Energy Code (Title 24) energy-efficiency standards by at least 20 percent. Our first LEED certified building, the Haste Street Early Childcare Development Center, has been awarded Silver. The certification process was funded through a grant from Stopwaste.Org, procured by Capital Projects. Additional projects presently undergoing USGBC LEED certification include University Village Step 2 (housing); Clark Kerr Renovation (housing); Li Ka Shing Biomedical Building (laboratory); and Durant Hall Renovation (historic/office).

   In addition, LEED Equivalence submittal for the Underhill Parking Structure has been received and planning checklists for all major capital projects have been prepared. All projects are tracking at 20% or greater in outperforming the California Energy Code. We have modified its project approvals to assure that all renovation projects include sustainability measures, as required by policy. The Li Ka Shing Biomedical Building, a Labs 21 partner, has been identified as a Best Practice for Energy Efficient Laboratory Design from the PG&E Savings by Design program. The building will outperform energy code requirements by 33%, and is projected to receive almost $500,000 in energy efficiency incentive funding.

   The Berkeley campus has incorporated expectations for internal LEED equivalent certification into all design professional agreements and contracting documents for major capital projects. Results thus far indicate that performance objectives are being met.

Started as a grassroots effort by students, CalCAP has since matured into a results-oriented sustainability program. Today, it is a partnership of various research and administrative departments, and it continues to add stakeholders. The culture of collaboration is rooted in its interdisciplinary steering committee with more than 25 active members from faculty, staff, administration, and students. The CalCAP model is now the University of California standard on climate action, and the program was showcased at the University of California-California State University- Community College annual summit in 2007.

Student Leadership and Ingenuity

Our students have pioneered many of our broader sustainability efforts. In addition to being the

driving force behind our climate reduction target and the backbone of our implementation of many projects, they are "walking the walk." Last year, students passed a referendum known as The Green Initiative Fund (TGIF) to increase their fees by $5 per student per semester. This fee has raised about $170,000 so far and will be used to fund sustainability projects around campus. These grants are student controlled and have already generated around $1 million in grant proposals.

One successful student program is the Green Campus Interns. The projects implemented by the Green Campus Interns, in partnership with the Alliance to Save Energy, have saved over 1,500 MWh of energy, which equals $150,000 in avoided energy costs or 70,000 pounds of CO2. Their projects have included dorm energy competitions ("Blackout Battles") and a fume hood campaign ("Shut the Sash").

Another is the Green Living Project, the first project in the nation to demonstrate that a room in a student resident hall can be environmentally friendly without costing huge sums or sacrificing a comfortable lifestyle. The project, organized by Campus Recycling and Refuse Services in close cooperation with Residential and Student Service Programs and Green Campus, is showing the campus community that it is not only possible but also easy to "go green."

There are unique student initiatives related green building. All our major building projects work to engage students during the process, through an eco-charette or having them assist on tracking LEED and green building performance measures. We employed students to assist with documenting LEED performance on the following projects: University Village Housing Step 2, Units 1 and 2 Infill Housing and Durant Hall Renovations, Hearst Memorial Mining Building. With the College of Civil and Environmental Engineering, we had students work on Life Cycle Cost Analysis tools for the design phase, using our CITRIS building as an example. In addition, there are Green Classroom Programs, where students work with the Registrar's Office and the Classroom Renovation Program to develop recycling in classrooms, energy efficiency lighting, and user satisfaction research tools.

Students have played a key role in integrating climate action into curricula to further elevate the campus's climate commitment. In the fall of 2007, the first student-led climate action course trained 14 undergraduate and graduate students on campus decision processes and emissions reduction options — an engagement that has inspired hundreds of students to integrate climate action into their research and activities. This student-led course — with guest lectures from staff, faculty and students — developed recommendations for holistic campus planning. They concluded that the CalCAP reduction target could potentially be achieved just by focusing on energy efficiency alone. Students are also running two additional courses that are producing an educational campaign and multiple building energy audits.

The CalCAP program also supported student projects that produced actionable recommendations on department and building level energy reduction, greening procurement, emissions inventory data gathering, project financing options and a design for sustainability programs on campus.

Broader Context

These actions to reduce our greenhouse gas emissions are grounded in a broader policy on sustainability. I have an Advisory Committee on Sustainability designed to promote environmental

management and sustainable development at UC Berkeley. This committee is charged with advising me on matters pertaining to the environment and sustainability and draws strength from its diverse composition of faculty, staff, students and alumni. Earlier this year, I approved a formal "Statement of Commitment to the Environment," that commits our campus to being "responsible stewards of the physical environment and to using educational and research activities to promote environmental awareness, global thinking, and local action." As part of this commitment, I recently formed an Office of Sustainability, which has been charged to identify and prioritize ways to improve environmental sustainability on campus and generate creative solutions.

We are also reaching out beyond the edges of campus. In a wholly new and innovative collaboration, the mayors of Berkeley, Oakland, Richmond and Emeryville have joined forces with me and LBNL director Steve Chu to form the East Bay Green Corridor Partnership — aimed at "establishing our region as one of the world's leading centers" of environmental innovation, alternative-energy research, and green business, green job development and industry. After several months of negotiations, a formal Statement of Principles was developed that outlines the cooperative agreement between the East Bay cities, UC Berkeley and LBNL. This unique partnership brings the expertise of all the entities together to contribute to emerging green and sustainable industries, alternative energy research and green workforce development throughout the region. This new alliance is intended to position the East Bay to become one of the nation's green economic engines that also looks to keep California competitive and the nation energy independent.

The CalCAP program offers many benefits to the local community, including local emissions reductions information, informed participation in the process of climate change mitigation, and a forum for discussion of ideas, strategies, and best practices. The City of Berkeley and community action groups are involved participants in the group's steering committee to jointly work on community based carbon reduction opportunities. In January 2008, our campus observed Focus the Nation — Global Warming Solutions for America, that brought together over 500 students, staff and local community members to jointly discuss solutions for climate change at a regional scale.

Additional information is available at our websites: sustainability.berkeley.edu and climateaction.berkeley.edu.

Research on Global Climate Change at UC Berkeley

California and its academic institutions have a unique history in addressing climate change, which includes path-breaking scientific and technological research, as well as the development of new economic techniques and assessments of social impacts of changing environmental conditions. Researchers at UC Berkeley have been at the forefront of national and international research efforts that have found there can be significant local benefits to confronting climate change, including energy savings from "greening" buildings and industries, creating job growth, and building export opportunities in some of the fastest growing economic sectors.

UC Berkeley has a long and rich history of pioneering knowledge and action on the most urgent issues facing our state, our nation, and our globe, and climate change is no exception. A hallmark of our campus is a tradition of not only training the next generation of research and political leaders, but also in engaging in real world mission-oriented projects to meet the needs of the state, nation, and the

world. We recognize that as a society, we must discover how and how fast the climate is changing, what degree of climate protection we can implement through low-carbon energy systems, and how can adapt to the climate change we can not prevent. Across the campus, we are deeply engaged in research that focuses not only on the science of climate change, but also on developing new practices to lower energy demand, and the emerging economic and legal frameworks that can help manage our energy demand and impacts that change will have on the planet.

At UC Berkeley more than 300 faculty are already working on issues related to energy, the environment and global warming. We are particularly fortunate in our close association with the Department of Energy funded Lawrence Berkeley National Laboratory. Berkeley Lab is a multidisciplinary scientific research lab that is home to some of the world's best scientific tools and research expertise. Approximately 300 of Berkeley Lab's scientists are also UC professors, and close to 1,000 UC Berkeley students do scientific work and training at Berkeley Lab. It is a remarkable alliance.

Berkeley Lab Director Steve Chu and I have brought together the great resources of our institutions to address the energy and environmental challenges head on. UC Berkeley and Berkeley Lab are pooling our vast experience in energy technology, policy and transportation to help achieve an affordable, sustainable, and clean supply of global energy. From the BP-funded, campus-led Energy Biosciences Institute, to the Berkeley Lab-led, DOE-funded Joint BioEnergy Institute, Berkeley is becoming a world center of sustainable energy research.

These are some of the major research initiatives already underway on our campus:

Energy Biosciences Institute

The Energy Biosciences Institute (EBI) is a new research and development organization that brings advanced knowledge in biology, physical sciences, engineering, and environmental and social sciences to bear on problems related to global energy production, particularly the development of next-generation, carbon-neutral transportation fuels.

EBI represents a collaboration between the University of California, Berkeley, Lawrence Berkeley National Laboratory, the University of Illinois at Urbana-Champaign, and BP, which will support the Institute with a 10-year $500 million grant. EBI's multidisciplinary teams will collectively explore total-system approaches to problems that include the sustainable production of cellulosic biofuels, enhanced biological carbon sequestration, bioprocessing of fossil fuels and biologically-enhanced petroleum recovery. A hallmark of EBI will be the attention to the social and environmental impacts of fuel pathways, and the 'life-cycle' impacts of a bio-energy infrastructure.

Joint Bioenergy Institute

The Joint Bioenergy Institute (JBEI) uses a $125 million, five-year grant from the US Department of Energy to Lawrence Berkeley National Laboratory (LBNL), the University of California, Berkeley, and four other partners to develop better biofuels.

Research at JBEI centers on improvements to current technology for producing ethanol, in particular

cellulosic technology for producing ethanol from biomass, and new technologies for producing other biofuels. Research will find out how plant cell walls — the hard lignocelluose that makes plants sturdy — are put together, so that scientists can find a way to take them apart and access the simple sugars they're made from. These sugars could then be fermented along with the simple starches in the plant to produce much more energy than currently possible.

JBEI scientists will also develop the tools and infrastructure to accelerate future biofuel research and production efforts, and help transition new technologies into the commercial sector.

Helios

The Helios project is a clean energy initiative at LBNL designed to address the challenges of climate change by developing new, clean energy alternatives with low carbon emissions. Its goal is to harness the sun's energy for a secure, sustainable, and prosperous future.

Helios research will concentrate on developing transportation fuel from biomass and from solar energy driven electrochemistry. It will also target solar technologies, including a new generation of solar photovoltaic cells, and the conversion of electricity into chemical storage to meet future energy demands.

Energy and Resources Group

The Energy and Resources Group (ERG) is an interdisciplinary academic unit of the University of California, Berkeley whose mission is to develop, transmit and apply critical knowledge to enable a future in which human material needs and a healthy environment are mutually and sustainably satisfied. ERB pursues its mission through education, research, and service. Established in 1973, ERG offers programs of study in Energy and Resources for graduate students leading to MA, MS, and PhD degrees.

University of California Energy Institute

The University of California Energy Institute (UCEI), located on the Berkeley campus, is a multi-campus research unit of the University of California system. Since its inception in 1980, UCEI's mission has been to foster research and educate students and policy makers on energy issues that are crucial to the future of California, the nation, and the world.

Renewable and Appropriate Energy Laboratory

The Renewable and Appropriate Energy Laboratory (RAEL) is a unique research, development, project implementation, and community outreach facility based at UCB. RAEL focuses on designing, testing, and disseminating renewable and appropriate energy systems. The laboratory's mission is to help these technologies realize their full potential to contribute to environmentally sustainable development in both industrialized and developing nations while also addressing the cultural context and range of potential social impacts of any new technology or resource management system. RAEL

groups in Nicaragua, Kenya, South Africa, Tanzania, China, and elsewhere, to put these projects into operation.

Berkeley Water Center

The nation's water resources are certain to be affected by global climate change. Effective water management is not purely a scientific problem, a political problem, a technological problem, a computer science problem nor a socioeconomic problem; it is a complex, 21st century problem that demands collaborative coordination between all of these disciplines. The Berkeley Water Center has been developed to integrate expertise across disciplines in support of a new research mode for water investigations.

Center for Fire Research and Outreach

The impact of global warming on our climate is already being felt in our nation's wooded areas. Given the importance of fire in many ecosystems, along with our dependence on and development into inherently fire-prone landscapes, we need to reach a sustainable coexistence with wildfire. The mission of the Center for Fire Research and Outreach is to develop and disseminate science-based solutions to wildfire-related challenges.

Center for Forestry

The mission of the Center for Forestry is to sustain forested ecosystems through scientific inquiry. Our approach is comprehensive. We seek to create and disseminate knowledge concerning ecosystem processes, human interactions and value systems, and restoration and operational management practices.

Center for Sustainable Resource Development

The Center for Sustainable Resource Development brings together UC Berkeley's leading environmental and social scientists with other experts and stakeholders from industry, government, and environmental organizations to address complex resource-use issues such as global climate change, sustainable agriculture, water reliability, and population, poverty and the environment.

Center for the Assessment and Monitoring of Forest and Environmental Resources

CAMFER is dedicated to providing innovative, state-of-the-art monitoring of environment using geospatial technologies. CAMFER research and outreach staff conduct studies in wetland monitoring and modeling, atmospheric emissions, forest biometrics, and watershed modeling.

Center for Information Technology Research in the Interest of Society

CITRIS creates information technology solutions for many of our most pressing social, environmental and healthcare problems, including global climate change.

Merced and Santa Cruz) with industrial researchers from over 60 corporations. Together they are thinking about IT in ways that have not been thought of before. They see solutions to many of the concerns that face all of us today, including the environment and finding viable sustainable energy alternatives.

Energy and the Environment

As climate change continues and the world population expands at a rapid rate, we must find energy solutions that improve the quality of life while not adversely affecting the environment. CITRIS researchers are engaged in a variety of projects in renewable energy; nuclear energy; and carbon capture and storage, to name a few.

- Modeling Electric Usage in Residential Areas: Because electricity cannot be practically or economically stored in large quantities, the electricity generation and distribution system must match supply and demand on a minute-by-minute basis. Delivery of electricity for residential use has traditionally been done by matching the supply to the demand, with little or no control over the demand. This causes severe distortions in the system operation and economics when the demand hits unusually high peak values.
- Energy Efficiency and Reliability in Dense Sensor Networks: This research addresses some important components in the theoretical and algorithmic signal processing machinery needed to make low-power, ubiquitous sensor networks a reality. The physical and hardware attributes as well as the computing and communication capabilities of these low-power, low-cost sensors, particularly those based on high-density low-cost MEMS devices, have the potential to revolutionize next-generation information technology.
- Window Performance for Human Thermal Comfort: Anyone who has ever sat near a cold window on a winter day or in direct sunlight on a hot day recognizes that windows can cause thermal discomfort. In spite of this broad recognition there is no straightforward method to quantify the extent of such discomfort. HVAC designers specify dedicated perimeter heating and cooling systems to mitigate window-related comfort problems, yet they use simplified assumptions that may not solve the comfort problems or that might lead to designs that are energy-inefficient.
- Solar Reflecting Film: The Center for the Built Environment (CBE) at UC Berkeley has developed a sophisticated thermal comfort capable of modeling non-uniform, transient conditions. This model has been used to study occupant comfort in buildings and automobiles. SRF has unique properties that reduce transmitted solar heat gain and lower the glass surface temperature.

Center for the Built Environment

Research is being conducted at the Center for the Built Environment (CBE) to improve the design, operation, and environmental quality of buildings by providing timely, unbiased information on building technologies and design techniques.

CBE projects fall into two broad program areas: First, developing ways to "take the pulse" of occupied buildings - looking at how people use space, asking them what they like and don't like about their indoor environment, and linking these responses to physical measurements of indoor

environmental quality. This feedback is highly valuable those who manage, operate, and design buildings.

Secondly, studying technologies that hold promise for making buildings more environmentally friendly, more productive to work in, and more economical to operate. This helps manufacturers target their product offerings, and facility management and design partners to apply these new technologies effectively. Some current research projects include:

- Indoor Environmental Quality (IEQ): CBE has developed methods to measure the performance of occupied buildings in terms of occupant comfort, workplace efficiency, and building operations.
- Building HVAC Systems: Advanced HVAC systems provide opportunities for energy savings and benefits to occupants.
- Building Envelope Systems: CBE is developing tools and criteria for evaluating facade performance in terms of occupant comfort and energy efficiency.
- Controls and Information Technology: New information technologies provide ways to optimize the performance of building systems.

Berkeley Institute of the Environment

The Berkeley Institute of the Environment (BIE) is a nexus for research on environmental issues that brings together campus teams in a number of thematic areas, that currently include: low-energy buildings; sustainable fuels; environmental history; and life-cycle analyses of materials.

One of the many areas of research related to global warming being conducted at BIE is the Zero Energy Commercial Buildings Initiative. ZECBI will transform the energy use of commercial buildings in the United States to routinely achieve carbon-neutral building performance within a generation. The building sector remains responsible for about 40% of energy use and carbon emissions, and over 70% of electricity use. Research at ZECBI will transform the energy use of commercial buildings in the US to routinely achieve carbon-neutral building performance within a generation by addressing industry institutional inertia, fostering technological innovation in equipment, materials, and controls, developing innovative tools and predictive models to support innovative design, enhancing the education of design and engineering professionals, fostering technology transfer from labs to industry, developing innovative processes for delivering and operating high performance buildings, identifying deployment policies that will ensure widespread adoption of high performance buildings, and developing metrics and a framework to track long term progress toward goals.

Environmental Energy Technologies Division (EETD) at Lawrence Berkeley National Lab

UC Berkeley partners closely with the Lawrence Berkeley National Lab on a wide range of research, including research done at the Environmental Energy Technologies Division. Together, the LBNL and UC Berkeley researchers work to find better energy technologies and market mechanisms that reduce adverse energy-related environmental impacts. EETD's work increases the efficiency of energy

the support of the U.S. Department of Energy other federal entities, state governments, and the private sector. Our staff of 300 represents a diverse cross-section of fields and skills, ranging from architecture, physics, and mechanical engineering to economics and public policy. Many areas of research are directly related to global warming:

Energy efficiency in buildings

- Energy-efficient windows and daylighting systems
- Energy-efficient lighting concepts and systems
- Simulation tools for energy use in buildings
- Information technology for energy efficiency in commercial buildings
- Application of advanced concepts to testbed buildings

Advanced energy technologies

- Electrochemical research on batteries
- Combustion and emissions
- Laser and other spectroscopic tools: development and application

International energy issues

- Energy efficiency in developing countries (special emphasis:China and India)
- Energy efficiency and global climate change

US energy issues

- Appliance and equipment energy-efficiency standards
- Energy efficiency programs to promote market transformation
- Energy utility deregulation
- End-use energy demand forecasting and policy analysis

Indoor environment

- Advanced ventilation, infiltration, and thermal distribution systems
- Sources, emissions, and transport of indoor pollutants
- Air pollutant exposures and health risks
- Control strategies for indoor air quality

Other areas of research and development

- air pollution: from science to public policy
- electricity reliability: distributed energy systems, real-time control, and markets
- industrial energy efficiency: U.S. and international perspectives

Building Technologies

Division researchers work closely with industry to develop efficient technologies for buildings that reduce energy bills while improving the comfort, health, and safety of building occupants. Technology efforts focus on windows, daylighting, lighting systems, building simulation research, and commercial building systems.

Windows and daylighting

Every year, heat worth billions of dollars flows through windows in American homes and businesses. In hot climates, the heat radiates into homes, requiring expensive air conditioning. In cold climates, it leaks out, requiring more energy to keep the occupants warm. Thermally efficient windows save consumers and businesses energy and money. The division's researchers develop advanced optical coatings and materials for future windows; study the energy performance of windows and window systems (windows, glazings, and their frames, blinds, louvers, etc.); and create computer tools to improve window energy performance and aid product rating and labeling. In the 1980s, EETD researchers worked with window manufacturers to develop special "low emissivity" window coatings to reduce heat loss through windows. These windows, which reduce energy loss by 20% to 50% depending on the design, now account for 35% of the market and have saved more than $1 billion in energy costs. Current windows research includes developing new tools and measurement techniques to assess energy performance and comfort; advanced electrochromic coatings that automatically change the level of transparency depending on exterior lighting conditions; and technologies and design strategies for commercial buildings that maximize daylighting benefits. In addition, EETD works with industry partners in developing standards for rating windows.

Lighting

Lighting accounts for 25% of all electricity consumed in the United States, at a cost of more than $35 billion per year. Researchers here develop advanced light sources, optimize lighting fixtures and control systems for energy efficiency, design computer tools to quantify the energy performance of lighting systems, and test system performance in the field, including the impacts on human performance and health. The division's lighting team worked with manufacturers to develop electronic ballasts, a more efficient replacement for the magnetic ballasts used to control the current in fluorescent lamps. Electronic ballasts now account for 32% of the market, saving consumers hundreds of millions of dollars per year. Working with industry, the group developed a torchiere floor fixture based on the compact fluorescent lamp—an energy-efficient, lower- temperature alternative to the hot 300-watt halogen torchieres that are blamed for starting hundreds of fires.

Building simulation

Architecture and engineering firms use DOE-2—a computer program developed by division researchers that analyzes the energy performance of buildings— to increase the energy efficiency of their designs. According to a DOE-2 user survey, buildings designed with DOE-2 save an average of 20% of building energy use. EnergyPlus, now under development, will replace DOE-2 and offer many new features. Radiance—a computer program for lighting analyses, also developed by division

use of Radiance and increase its user base. In addition to analytical tools, division researchers are developing tools, like the Buildng Design Advisor, which change the way architects design buildings, by providing quick and easy access to multiple analysis tools linked to a single building database. In the first-ever such use of the Internet, a program called Home Energy Saver is available to anyone with Web access. The user inputs information about a home, and HES (using DOE-2) calculates total energy use and cost, and suggests economic ways of reducing the energy bill.

Commercial building systems

The commercial building sector spends $80 billion per year on energy. Maximizing efficiency can cut billions from this cost. Researchers have launched a major effort to address this opportunity, developing tools to benchmark energy performance. Such tools let designers, owners, and operators access data throughout the building lifecycle and ensure that building operations meet performance targets.

The division's energy analysts gather and interpret information about energy, including supply and consumption, energy technologies, management practices, government policies, and economic and environmental impacts. These studies examine the performance of energy-efficient technology in the marketplace; the impact of various regulatory policies; the feasibility of different approaches to designing energy-efficient standards and building codes; and technology options for reducing the emissions of greenhouse gases. The work provides local, state, and national governments, as well as regulatory agencies and international institutions with information to help them formulate effective energy and environmental policies.

Energy Analysis

Standards, codes, and policy analysis

Appliance energy-efficiency standards and provisions in building codes in the United States save consumers billions of dollars a year. Often inspired by the U.S. experience, dozens of nations have adopted or are currently developing appliance standards and building codes. Division research provides impartial technical information on the energy use of appliance technologies to the Department of Energy's standards development process. In addition, studies of building codes help code officials formulate and fine-tune energy-efficiency measures. Division researchers conduct studies of utility-related public policy issues, from transmission pricing and market power to the role of renewables and energy efficiency. As the electric utility industry undergoes restructuring in some states, division studies provide useful information to the industry and the regulatory community charged with guiding this evolution.

Energy-efficient procurement and labeling

An important approach to improving energy efficiency is to provide large buyers with information about energy-efficient products. The President directed federal agencies—collectively the world's largest customer of most energy-using products—to buy products that are among the top 25% most

products. EETD researchers also provide analytical support for the voluntary Energy Star programs in appliance labeling and new homes, administered jointly by the U.S. Environmental Protection Agency and its partner, the U.S. Department of Energy. The government harnesses market forces to promote energy efficiency and pollution prevention by inducing manufacturers to put Energy Star labels on their products.

Reducing greenhouse gas emissions

EETD's studies of energy use and greenhouse gas (GHG) emissions have made the division an important source of information on global climate change for policymakers. Researchers have analyzed the potential of energy-efficient technologies to reduce GHG emissions, and have evaluated the emissions of the world's buildings and industrial sectors. Our efforts include co-managing the policy study "Scenarios of U.S. Carbon Reductions," a cooperative effort of five U.S. Department of Energy national laboratories. Internationally, our contributions appear prominently in the United Nations-sponsored Intergovernmental Panel on Climate Change Scientific Assessments. Division researchers also provide technical support to developing nations creating programs, energy codes, and standards to reduce GHG emissions and encourage efficiency. A China energy group works extensively with the Chinese government to exchange information on energy use and energy-efficiency practices.

Urban heat islands

Cities are urban heat islands, zones of higher temperature relative to the surrounding countryside. The heat island effect intensifies the use of expensive air conditioning. Higher outdoor air temperatures also increase smog formation. Division researchers have pioneered an effective, simple approach to keeping cities cooler—the use of shade trees and solar reflective roofing and paving materials. EETD studies have found that the cooling effect from wide application of these measures could save billions of dollars and reduce smog in large cities nationwide.

Indoor Environment

Approximately one-third of the energy consumed in the United States is used in buildings. Energy for ventilation and thermal distribution in buildings accounts for roughly one-sixth of this total (4 to 5 quadrillion Btu/year) and is valued at about $40 to $50 billion annually. Reducing a building's infiltration and mechanical ventilation can save energy. However, this strategy may produce undesirable side effects, because building energy use, ventilation, indoor environmental quality, and occupant health, comfort, and productivity are interrelated. Buildings can be designed and operated to protect human health and enhance productivity, while using energy as efficiently as possible. EETD researchers have estimated that improvements in U.S. building environments could decrease annual health care costs by $4 to $10 billion and increase worker productivity by $40 to $240 billion.

Ventilation technologies

Division research on air infiltration and ventilation in commercial and residential buildings has led to

Conditioning Engineers) and state standards, as well as building codes governing ventilation and indoor air quality. EETD research includes developing new methods of measuring ventilation rates and their spatial distribution and evaluating new ventilation technologies with potential to improve indoor air quality and reduce energy use. Sealing leaky, energy-wasting ducts is one way to reduce energy use substantially. An EETD study showed that a typical house with ducts located in the attic or crawlspace wastes approximately 20% to 40% of heating and cooling energy through duct leaks, and draws approximately 0.5 kilowatts more electricity during peak cooling periods. Sealing leaks could save close to 1 quadrillion Btu of energy per year nationwide. Division research has led to the development of a major new duct sealant technology that uses aerosols to reach and seal areas of ducts inaccessible to humans. Its commercialization is underway

Batteries and fuel cells

A major goal of the division's electrochemistry research is to develop electrochemical power sources suitable for applications in electric and hybrid electric vehicles. Battery systems are expensive and don't hold enough electric charge to drive a vehicle the same distance as a comparable gasoline-powered automobile. EETD is undertaking research that will lead to the development of low-cost, rechargeable, advanced electrochemical batteries with the high-performance potential to compete with the combustion engine. Current work focuses on lithium- polymer and lithium-ion batteries.

Cleaner combustion

Combustion research generates the fundamental physical nd chemical knowledge necessary to reduce emissions and increase efficiency. Experimental and modeling studies lead to the design of better combustion devices. EETD researchers work with Berkeley Lab's National Energy Research Scientific Computing Center (NERSC) to model combustion processes using high-performance supercomputers. Turbulent combustion takes place in all heat and power generating systems, including combustion engines in automobiles and industrial boilers and furnaces. By studying the properties of turbulent fluid motion in combustion chambers, division researchers have devised a low-swirl burner that emits 20 times less nitrogen oxide than current technology. (Nitrogen oxides are greenhouse gases, and when exposed to sunlight, also generate smog.) The burner could be used in the residential and commercial sectors in water heaters and boilers.

Policy Recommendations

While there is so much that universities and other local entities can do to reduce their carbon footprints, global warming really must be addressed at the national level if we as a nation are going to have the kind of impact we must have to prevent further destruction of our atmosphere. To that end, passage of the S.2191 or similar legislation to impose strict limits on greenhouse gas emissions, is absolutely critical.

In even more specific terms, Congress can approve legislation that would address the following:

Buildings

new buildings is a vital issue to address to meet national climate goals. Universities are ideal laboratories for new, 'best practices', because they bring public and private sector funds, challenge and evolve green energy standards (e.g. LEED ratings), and can be monitored with unusual detail.

Support for universities to commission, design, and evaluate the best practices in green buildings would have important, and relatively rapid impacts on the sector.

Climate Goals

As took place at UC Berkeley, climate protection goals, can both evolve rapidly on campuses, and can then feed back to the wider set of professional groups (construction industry, electrical work, water/civil engineering) who provide services and build infrastructure for campuses. A cost-effective set of federal initiatives exist to accelerate this process. Among the initiatives that could be considered are:

i. Demonstration projects for plug-in hybrid vehicles are well-suited to campus deployment due to the central motor-pool and fleets that campuses maintain.
ii. Carbon pricing: Campuses are very good test-beds for novel accounting and economic schemes, including carbon footprint analysis, and direct pricing. More than half of the states in the union now have (or are completing) comprehensive "climate action plans" that align them with the level of effort expected if they were separate nations under the Kyoto Accord.

At present 30 of 50 states have adopted Renewable Energy Portfolio Standards that call for 10% to almost 30% of their energy to come from low- and no-carbon sources over the next two decades. These state-level efforts have been driven in many cases by important research and demonstration efforts at universities. One direct area of interaction at the federal level is to consider assessments of the economic costs and benefits of federal clean-energy standards, and to examine how U.S. DoE, HUD, and U.S. EPA funds could be used to support these state efforts.

These states have also formed three regional cap-and-trade alliances and trading in GHG credits, comparable to the system already in operation in Europe, will begin in the US as early as the third quarter of 2008.

Support for graduate research

The most important aspect of facilitating universities to be the laboratories for innovation is graduate students conducting research and implementation projects on campus and beyond. One way to facilitate this is to expand the pool of graduate fellowships, such as the NSF and EPA (STAR) awards. A new category of "sustainable energy" fellowships, or added slots within the existing NSF and EPA programs would be another way to do this. These positions are also among the most cost-effective ways to build the intellectual capital needed to meet the nation's long-term energy challenges.