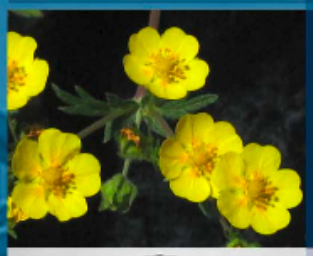
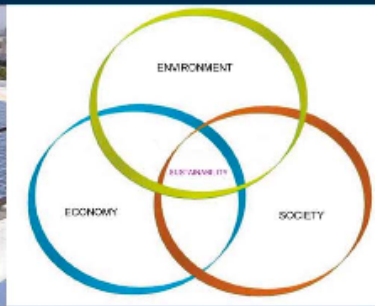
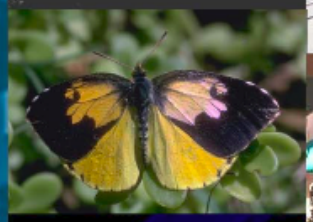
UC San Diego

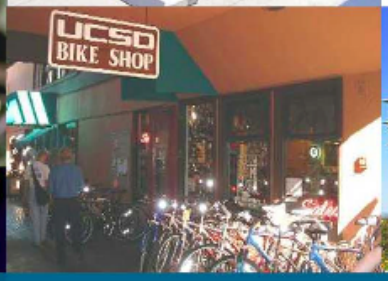
December 2008

UC San Diego Climate Action Plan









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AB 32	Assembly Bill 32
ACS	Advisory Committee on Sustainability
ACUPCC	American College and Universities Presidents Climate Commitment
	www.presidentsclimatecommitment.org/
CAP	Climate Action Plan
CCX	Chicago Climate Exchange
	www.chicagoclimatex.com/
CSWG	Climate Solutions Work Group
DEMROES	Decision-Making Using Real-Time Observations for Environmental Sustainability
	http://maeresearch.ucsd.edu/kleissl/demroes/
ESI	Environment and Sustainability Initiative
	www.esi.ucsd.edu/
e-waste	electronic waste
GHG	greenhouse gas
LEED-EB	LEED for Existing Building
MW	megawatt
PCW	post consumer waste
SRC	Sustainability Resource Center
UCOP	University of California Office of the President
	www.ucop.edu
UC San Diego	University of California, San Diego
	www.ucsd.edu
WCI	Western Climate Initiative
	www.westernclimateinitiative.org/

Executive Summary

Experts across the world now agree that climate change is real, and the effects of climate change are already visible. In response to what many believe is a global crisis, a number of institutions are taking bold actions to track and reduce GHG emissions. In March 2007, President Dynes of the University of California signed the American College and Universities Presidents Climate Commitment (ACUPCC) on behalf of all UC Chancellors. The ACUPCC includes a number of requirements, including the development of a Climate Action Plan to establish a target date and interim milestones for reaching climate neutrality.

In part, this Climate Action Plan (CAP) was created in response to the requirements in the ACUPCC. However, this document goes beyond those requirements to include the impacts and emissions from non-greenhouse gas (GHG) sources to form a holistic picture of sustainability planning on campus over the next several decades. In addition, this report considers how sustainability may be integrated throughout the curriculum so that all students gain an understanding of sustainability issues during their academic career at UC San Diego. Although called the Climate Action Plan, this document considers many topics not directly related to climate change and GHG emissions.

For the purposes of this report, sustainability is an all-inclusive guiding concept that applies to reducing energy usage, GHG emissions, air emissions, water usage, and material usage through campus operations and education of students, staff, and faculty. In this report, the concept of sustainability also considers the integration of social aspects with environmental issues. Also, social justice is a key motivation behind many of the goals and actions included in this document.

Relationship to Sustainability Assessment Report and Long Range Development Plan

This CAP builds on the *UC San Diego Sustainability Assessment Report*, published in November 2008, a document that creates a broad snapshot of campus sustainability performance in areas such as energy, water, waste and recycling, purchasing, land use and habitat, and other areas. Specifically, the CAP references much of the data and information included in the Sustainability Assessment Report. However, this report goes one step further by creating goals, timelines, and actions for achieving those goals, while the Sustainability Assessment was limited to program recommendations for improving sustainability performance. For example, the Sustainability Assessment Report included recommendations to increase monitoring and tracking systems for energy usage. This document includes GHG emission reduction goals. Implementing the recommendations in the Sustainability Assessment Report will create the tools that will be used to reach the emission reduction goals included in this plan.

In addition, this document is a sustainability planning document with a 41-year planning horizon to 2050. However, we note that it is difficult to plan beyond a short-term time frame due to unknown needs, resources, technologies, and other changes that may occur. Thus, this plan is a considered a guide for the future, as well as a living document that will be regularly reviewed and updated to reach the goals included herein.

Another key planning document for UC San Diego is the Long Range Development Plan (LRDP), which outlines the growth expected at UC San Diego through 2020. The LRDP provides a baseline for many of the assumptions in this document regarding continued growth at UC San Diego. For example, the GHG emissions trajectory under the “business as usual” scenario of this document is based in part on the growth in building square footage and the growth in the campus population planned at UC San Diego under the purview of the LRDP. Due to the interlapping nature of sustainability and climate action planning and the planning incorporated in the LRDP, we recommend that future updates or iterations of the LRDP contain considerations of sustainability, including the impacts of growth on emissions, resource usage, and the impacts of growth on UC San Diego’s emission reduction goals.

Purpose

The purposes of the CAP are the following:

- Establish a target date for climate neutrality;
- Identify how campus will include climate neutrality and sustainability in curriculum, student experience, and research;
- Establish interim goals and actions for reducing GHG emissions;
- Identify goals for reducing emissions and impacts from purchasing, campus operations, transportation, and water usage; and for improving recycling programs;
- Identify mechanisms for tracking progress;
- Identify financing mechanisms

As per the requirements of the ACUPCC, this document also creates a firm baseline of GHG emissions to compare against future reductions.

Summary of Goals

The recommended goals included in this document are as follows:

Academics and Research:

1. Wherever possible, include sustainability in the curriculum for undergraduates.
2. Continue to expand elective sustainability courses and other educational opportunities.
3. Connect students, staff, and faculty interested in collaborating on campus sustainability projects and develop tools for faculty and students to use in their classes and research.
4. Develop tools to track and measure student attitudes and knowledge of sustainability, as well as sustainability course offerings and enrollment data.
5. Develop tools to track and measure sustainability research projects and funding for those projects.

Energy and Climate:

1. Reduce UC San Diego's GHG emissions as follows:
    - 2000 levels by 2013;
    - 1990 levels by 2020;
    - Climate neutral by 2025.

Operations:

1. Improve performance of all campus buildings in terms of energy usage and water usage.
2. Reduce the impacts of cleaning supplies.
3. Establish as a standard LEED Gold for all new buildings, achieving LEED Silver where LEED Gold is not possible.
4. Continue to certify buildings under the LEED-EB program. The campus will work to establish a targeted number of buildings to certify annually.

Procurement:

1. Achieve 50% post consumer waste (PCW) recycled content in all paper purchases by 2012. This goal represents an increase in PCW content of paper purchases of about 8% per year.

   This goal is partially dependent on the technologies and equipment in use at UC San Diego. According to campus staff, some of the current equipment in use, such as printers, are unable to utilize high-PCW paper. However, if technologies continue to advance and allow usage of high-PCW paper, and if equipment using these technologies are implemented across campus, then this goal should be amended to be more aggressive.

2. Reduce per capita paper usage from 1,568 to 1,066 sheets per person per year by 2012; this goal represents an annual reduction of 8% from the baseline number of 1,568 sheets per person per year from 2009-2012. This also represents a total reduction of 32% from the baseline of 1,568 sheets per person per year. . The Procurement and Contracts department will play a key role in achieving this goal. However, Procurement and Contracts will not hold responsibility for achieving this goal, because reducing overall paper usage will require participation of all campus departments, and education of the entire campus community.
3. Reduce the total amount of printers, copiers, and other applicable electronic equipment purchased and used. As with goal #2 above, the Procurement and Contracts department will play a key role in achieving this goal. However, Procurement and Contracts will not hold responsibility for achieving this goal, because reducing the total amount of equipment purchased will require the participation of all campus departments, and education of the entire campus community.
4. Improve the energy efficiency of all computers, printers, copiers, and other equipment used, using the guidelines from the new Climate Savers program.
5. Increase spending on appropriate green vendors and products.

Recycling and Waste Minimization:

1. Meet the UCOP goals, which are:
   - 50% waste diversion by June 30, 2008
   - 75% waste diversion by June 30, 2012
   - Zero waste by 2020
2. Reduce the total emissions from the life cycle of materials purchased, used, and discarded on campus, including the emissions and impacts from extracting the materials, processing materials into products, transporting products to the campus for use, and transporting waste materials for final disposal or recycling. This goal includes the intention of finding local producers for materials, as well as local markets for recycling of waste materials, when possible. This goal is also related to Procurement, and is included in the Procurement section of this report.

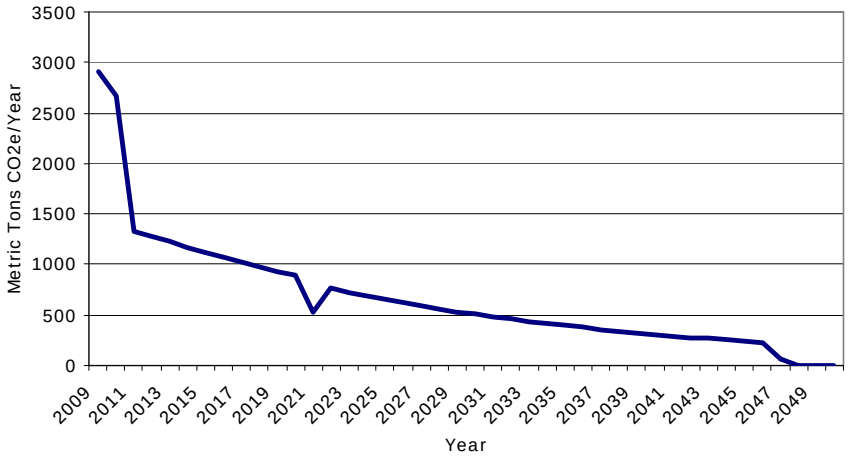
Transportation:

Air Travel:

1. At a minimum, reduce per-capita emissions from air travel by the following:
    - 11% reduction each year from 2009-2010, based on the previous year's emissions
    - 7% reduction each year from 2011-2020, based on the previous year's emissions
    - 5% reduction each year from 2021-2050, based on the previous year's emissions

These emission reductions are shown graphically in Figure 1 below; emission reductions are greatest from 2009 – 2010. Each year, the total emissions reduced continues to decrease because the reductions are cumulative.

Figure 1: Annual Amount of Emissions Reduced under Recommended Plan



These percentage reductions will allow UC San Diego to meet the California state target for emission reductions of 80% below 1990 levels by 2050 for air travel emissions. Under these reductions, UC San Diego will not reach the interim targets of 1990 levels by 2020 or 2000 levels by 2010 for air travel emissions. However, the plan recommended in this document will allow UC San Diego to reach overall emission reduction targets in interim years in spite of not achieving these targets with air travel emissions.

Commuting

1. At a minimum, reduce the GHG emissions from commuting by 2% per year, based on the previous year's emissions, from 2009 to 2050.
2. At a minimum, reduce the percentage of commuters using single occupancy vehicles from 49% to 39% by 2018. (This goal includes commuters at the Main Campus and the Hillcrest campus.)

Campus Fleet:

1. Reduce campus fleet emissions by at least 4.7% per year, based on the previous year's emissions, until 2020.
2. Reduce campus fleet emissions by at least 4.0% per year, based on the previous year's emissions, from 2021-2050.

This goal is based on the actual percentage reduction of emissions achieved from 2006-2007, which was 4.7%.

Water:

1. Continue to reduce overall water usage by 4% per year while increasing usage of reclaimed water, if possible.
2. Sub meter 100% of buildings for water usage. Buildings with potential for behavior change will be prioritized, such as dorms.
3. Sub meter 100% of water used for landscaping.

1.1 A HISTORY OF SUSTAINABILITY AT UC SAN DIEGO

The University of California, San Diego (UC San Diego) has a long history of education on sustainability issues and taking action to reduce its own emissions and resource use. For example, UC San Diego became a Charter Member of the California Climate Action Registry in 2002, and began publicly reporting greenhouse gas (GHG) emissions in 2003. Furthermore, UC San Diego has installed 1 megawatt (MW) of renewable energy generation on campus, performed retrofits to improve energy efficiency, and has also begun construction of several LEED-certified buildings on campus.

The recently-published *UC San Diego Sustainability Assessment Report* found that the campus is well-represented in the education of sustainability through numerous academic programs, and that the campus has made significant progress in areas such as reducing the impacts from transportation and improving recycling programs. In addition, a number of areas were identified for further improvements. As noted in the Executive Summary, this report draws upon many of the recommendations and findings in the *UC San Diego Sustainability Assessment Report*.

1.2 CLIMATE CHANGE COMMITMENTS

Numerous commitments to reducing GHG emissions are relevant to UC San Diego. A short summary of these commitments is included below.

Executive Order S-3-05

In June 2005, Governor Schwarzenegger of California issued Executive Order S-3-05, which established emission reduction targets for the State of California. These targets are as follows:

- Reduce GHG emissions to 2000 levels by 2010
- Reduce GHG emissions to 1990 levels by 2020
- Reduce GHG emissions 80% below 1990 levels by 2050.

However, the Executive Order did not specify how these targets would be met. Building on the momentum created by S-3-05 and a growing body of work in the field of climate change research, the California legislature passed Assembly Bill 32 (AB 32), the Global Warming Solutions Act, in August 2006. AB 32 was among the first legislation in the U.S. to regulate GHG emissions. At the time the only other legally-binding legislation regarding GHG emissions was the Regional Greenhouse Gas Initiative, an agreement among several northeastern U.S. states.

AB 32

AB 32 codified into law the second target listed in Executive Order S-3-05, that California reduce emissions to 1990 levels by 2020. AB 32 does not, however, include emission reduction targets beyond 2020. In addition, AB 32 calls for the establishment of a statewide emissions cap for 2020 based on 1990 emissions levels, as well as mandatory reporting for significant emitters of GHGs by 2009. The recently-released *Climate Change Proposed Scoping Plan: A Framework for Change* (October 2008)[1] lists several key strategies for

[1] www.arb.ca.gov/cc/scopingplan/document/psp.pdf

achieving the reductions outlined in AB 32, such as a statewide cap-and-trade plan for certain emitters, and many other state measures, including a revised statewide Renewable Portfolio Standard and energy efficiency standards.

Western Climate Initiative (WCI)

Following the passage of AB 32, the next agreement relevant to the State of California is the Western Climate Initiative (WCI), a collaboration of several western U.S. states and four Canadian provinces formalized in February 2007. The WCI establishes emission reduction goals that are not as stringent as AB 32's goals. However, the WCI is likely to create a regional cap-and-trade system for GHG emissions that will affect electricity generators and other energy producers in California, possibly including UC San Diego.

American College and Universities Presidents Climate Commitment (ACUPCC)

More recent developments are related specifically to the University of California. In March 2007, President Dynes of the University of California signed the American College and Universities Presidents Climate Commitment (ACUPCC) on behalf of all 10 University of California Chancellors. By signing the ACUPCC agreement early in the history of the ACUPCC, President Dynes became a Charter Signatory of the ACUPCC.

Chicago Climate Exchange (CCX)

UC San Diego also became the first campus on the West Coast to join the Chicago Climate Exchange (CCX), a voluntary but legally binding emission reduction commitment and trading system for GHG emissions. By joining CCX, UC San Diego committed to reducing GHG emissions by 6% below a baseline amount by 2010. UC San Diego has shown leadership by joining CCX and beginning the process of reducing and trading emission reductions before it is legally required.

All of these policy agreements create frameworks for reducing emissions. The State of California, the University of California, and UC San Diego have all taken a leadership position by pledging to report and reduce GHG emissions. This report serves to solidify our commitment to reducing GHG emissions and create a roadmap for achieving those reductions.

1.3 COMPARISON OF INSTITUTIONAL CLIMATE ACTION PLANS

A number of other universities and colleges have created Climate Action Plans, many in response to the ACUPCC. Below is a summary of some other institutions' commitments. Many similar themes are apparent in Table 1. For example, all Climate Action Plans stress efficiency and conservation as the first and most cost-effective means of reducing GHG emissions, followed by the use of renewable energy and the use of carbon offsets or purchasing green energy credits to reach emission reduction goals.

Table 1: Comparison of Institutional Climate Action Plans

Institution	Goals	Strategies and Actions	Source
Cornell University	7% below 1990 levels by 2012	Energy efficiency, new cogeneration plant, lake source cooling	Cornell University's website[2]
Middlebury College	-8% below 1990 levels by 2012 (adjusted on a per capita basis) -Carbon neutral by 2016	New biomass energy plant, conservation, efficiency, renewable energy, carbon offsets	Middlebury College's website[3]
University of California, Berkeley	1990 levels by 2014	Infrastructure-related emission reduction projects, energy efficiency, and Renewable Energy Credits	*CalCAP Feasibility Study 2006-2007 Final Report*[4]
University of Colorado, Boulder	Reduce energy use by 5% per square foot	Conservation, renewable energy, energy education, energy efficiency fund	*UC Boulder, Creating a Climate-Friendly Campus*[5]
Yale University	10% below 1990 levels by 2020	- Conservation (39% of reductions) - Renewable Energy (30% of reductions) - Carbon Offsets (31% of reductions)	*Yale's Greenhouse Gas Reduction Strategy* (August 2007)[6]

Note that each of these institutions has unique circumstances allowing them to set and meet different goals. For example, Cornell University is building a new cogeneration plant, which is scheduled to go online in 2009. This plant will significantly reduce Cornell's annual emissions. In contrast, UC San Diego installed a cogeneration plant in 2001; as an early adopter of this and other technologies, UC San Diego may find that additional emission reductions will be more difficult to achieve than other institutions.

1.4 DEVELOPMENT OF THE CLIMATE ACTION PLAN

UC San Diego recently completed the *UC San Diego Sustainability Assessment Report* (November 2008) to set a baseline for sustainability performance across the campus. The

[2] http://pressoffice.cornell.edu/Sept08/carbon.inventory.shtml

[3] http://www.middlebury.edu/administration/enviro/initiatives/climate/

[4] To download the Feasibility Study and view results from the implementation of the Climate Action Plan, visit the following website: http://sustainability.berkeley.edu/calcap/feasibility.html

[5] UC Boulder: Creating a Climate-Friendly Campus

[6] http://www.yale.edu/sustainability/greenhouse9_112.pdf

Sustainability Assessment Report also includes a snapshot of current relevant programs and policies related to sustainability, as well as a number of recommendations for improving sustainability performance.

This document builds upon the Sustainability Assessment Report by using much of the baseline data to develop specific goals and timelines for reaching those goals.

Following the drafting of the Sustainability Assessment Report, a preliminary outline was presented to the Climate Solutions Work Group (CSWG) regarding the development of the Climate Action Plan (CAP). After that presentation, the CSWG approved the development of a broader, more holistic CAP to include more than simply climate-related emission reductions.

The next step was to hold a series of campus-wide focus groups, each covering one area of sustainability to be included in this CAP. Specifically, focus groups covered the following topics: Academics and Research; Energy and Climate Neutrality; Operations; Procurement; Recycling; Transportation; and Water. The Focus Groups provided input on strategies for improving performance, and in some cases developed specific goals and timelines, which are included in this document. A combination of students, faculty, and staff attended the focus groups; a list of all attendees is provided in Appendix I.

This CAP was then drafted according to the results of the Focus Groups, and keeping in mind the various climate agreements and goals listed above. A number of groups will comment on this draft of the CAP, and a final version will be created based on comments received.

1.5 IMPLEMENTATION OF THE CLIMATE ACTION PLAN

UC San Diego has identified the following four strategies to guide implementation of this CAP.

1.5.1 Prioritize Emission Reductions in the Following Order: Conservation, Efficiency, Renewable Energy, and Carbon Offsets

UC San Diego plans to reduce emissions through an aggressive program prioritizing conservation, efficiency, and the installation of infrastructure to allow use of renewable energy, as well as the installation of renewable energy generation. Carbon offsets will only be considered for emission reduction as a last resort. If carbon offsets are purchased, local offset projects implemented on the UC San Diego campus or in the San Diego region will be prioritized.

Conservation and increased efficiency not only reduce GHG emissions, but also have other co-benefits. Both conservation and energy efficiency measures are expected to lead to cost savings in the form of reduced energy costs. In addition, conservation and efficiency reduce the total amount of energy demanded, therefore reducing all the environmental impacts of generating and distributing energy. Finally, conservation and efficiency tend to improve building performance and can even have other co-benefits such as improving worker productivity[7], as well as reducing the risk of fire and fire damage.[8]

[7] For example, see the following resources: Ogden, Douglas H. 1996. *Boosting Prosperity: Reducing the Threat of Global Climate Change through Sustainable Energy Investments*. San Francisco, Calif.: The Energy Foundation; Romm, Joseph. 1994. *Lean and Clean Management: How to Increase Profits and Productivity by Reducing Pollution.* New York, N.Y.: Kodansha America, Inc.

Renewable energy tends to be less cost-effective than conservation and efficiency. For example, the current efficiency projects planned for the campus are expected to cost a total of $174.2 million, after rebates and incentives are included. These projects will save about 127.1 million kwh per year, and 1.9 million therms per year. This represents a cost of about 5-7 cents per kwh reduced, when considered over a 20-year time frame. In contrast, the current solar photovoltaic projects are costing about 12-16 cents per kwh of electricity produced over the system's 20-year useful life. (These cost data include final costs once rebates and incentives are taken into account.)

Nonetheless, renewable energy is still a viable emission reduction option. Like conservation and efficiency, renewable energy has numerous environmental benefits beyond reducing GHG emissions, such as reduced pollution to the air, water, and land. Also, renewable energy tends to generate co-benefits, including supporting local jobs and local economies, and creating power on-site, which improves the efficiency of energy distribution. Renewable energy sources tend to have a lifetime of 20-40 years, providing benefits far into the future and cost savings after an initial payback period.

In contrast to conservation, efficiency, and renewable energy, most carbon offsets are a one-time purchase with no ongoing emission reductions. Carbon offsets must be purchased annually for continued emission reductions. Because the offset market is new, many options exist for purchase, some of which are more credible and transparent than others. Yet, the purchase of carbon offsets could lead to additional co-benefits, such as stimulating job growth, and providing other environmental co-benefits. For example, a reforestation project in a sensitive area could help to restore a threatened ecosystem, and could provide jobs for the local community in the project area. Local carbon offsets may provide even greater opportunities for co-benefits than carbon offset projects conducted in remote areas. However, due to their limited cost-effectiveness, carbon offsets are considered as an emission reduction option in this document as a last resort after all conservation, efficiency, and renewable options are exhausted.

1.5.2 Review the Plan Annually, and Revise the Plan Every 3 Years

New technologies and other approaches to reducing emissions and impacts are expected to become available rapidly. In addition, new policies and programs at the regional, state, or federal level could come on-line, which would affect the content and implementation of the CAP. In order to remain flexible and responsive to changing conditions, the CAP will be reviewed every year, and revised at least every 3 years.

The Campus Sustainability Coordinator will be responsible for coordinating the review and update of this plan, with support and guidance from the CSWG. Also, any revisions to the plan will be made in an open and transparent manner; input will be received from multiple parties and groups across campus before changes are enacted.

During the first review and revision of this document, one topic that should be considered in more detail is the interface of social issues with the goals and actions in this plan. Currently, social issues are not adequately included in this document. Another area that needs further study, and that should be included in the first review, is the issue of costs and savings from the various actions included in this document. Where possible, costs and savings are provided in this CAP, but for many actions, there are no data available.

[8] For example, see the following report regarding insurance and climate change, which discusses how energy-efficient buildings are less prone to water and fire damage: Mills, Evan and Eugene Lecomte. *From Risk to Opportunity: How Insurers Can Proactively and Profitably Manage Climate Change.* Ceres, 2006.

1.5.3 Perform All-Inclusive Outreach

While many students and other members of the campus community have shown increasing support for UC San Diego's sustainability programs, some are still not aware of UC San Diego's leadership role in the field of campus sustainability and climate action. New programs are needed to teach the campus community about behavioral changes necessary to reduce emissions and impacts. Simple behavioral changes, such as turning off computers at night and reducing the water used for basic tasks, can add up to create large positive changes across the entire campus.

UC San Diego plans to create an all-inclusive outreach and information program to teach and engage the campus community about sustainability issues. The goal of the program is to perform outreach to 100% of incoming students in the fall of 2009. The group that will likely oversee and administer the outreach program to the campus community is the Advisory Committee on Sustainability (ACS). ACS will partner and work closely with stakeholders and groups across campus, such as Housing, Dining, and Hospitality (HDH), and the University Centers, to develop and implement outreach and education programs.

This program will include education on all aspects of sustainable living and sustainable operations at UC San Diego. Examples of topics to be included in the outreach program are: water and energy conservation practices, methods to reduce material waste, and other ways to reduce each person's environmental footprint.

1.5.4 Ongoing Monitoring

Monitoring and evaluating the CAP is crucial to success. At the macro level, a formal review of sustainability performance and emissions as related to the goals in this document will occur annually. Also, monitoring of the program will help frame the new goals.

Additionally, monitoring is needed at the micro level. Specifically, real-time building-level monitoring is needed to help campus decision-makers understand which buildings are under- and over-performers in terms of resource usage. Other micro-monitoring, such as that in Project GreenLight, will help improve performance. In Project GreenLight, servers and other computer processing equipment are located in energy-efficient datacenters, which contain sensors that constantly monitor temperature, humidity, energy consumption, and other variables. One of the goals of this project is to find ways to make computing and networking more energy efficient. In another example, real-time monitoring of soil moisture levels and weather patterns could aid in deciding when and where to irrigate landscaping.

Monitoring is not only used as a tool to track and improve performance, but can be used as an educational outreach tool. Publishing real-time data on sustainability performance has been demonstrated to motivate people to improve behaviors, thus enhancing sustainability performance in buildings.[9]

A number of the recommendations in the *UC San Diego Sustainability Assessment Report* are related to monitoring and will be crucial for implementing the CAP. These recommendations include the following:

- If feasible, use microclimate data at each building site to further improve energy and water management systems.

[9] See, for example, results from the Oberlin College Campus Resource Monitoring System program: http://www.oberlin.edu/dormenergy/news.htm

- Continue tracking and reporting GHG emissions. To simplify data collection and management, develop a process and a centralized mechanism for tracking GHG data. For future inventories, continue to improve commuting and air travel data, two emission sources that are required by the ACUPCC.
- Ensure that all campus buildings are sub metered for electricity and natural gas usage to more easily manage these energy resources. Investigate the possibility of sub metering departments or laboratories to allow these academic units to be more accountable for their energy usage.
- Establish visible, real-time, campus or building displays showing energy, water, waste, and other resource or emissions data to increase campus community awareness of sustainability issues.
- Implement tracking mechanisms to collect data for environmentally-preferable purchasing, both by Procurement & Contracts and by campus departments, and for other savings such as waste diversion, avoidances, etc.
- Improve sub metering for water at the building and field level to allow for better management of water usage.

1.5.5 Responsibility of Implementation

Various campus staff and administrators will assume responsibility for each of the goals and actions listed in this document. The staff or department that assumes responsibility for each action will depend on current campus organizational structures and existing campus roles and responsibilities. Where possible, responsibilities for existing programs are included in this document. However, responsibility for new goals and actions are not yet included, as they may not yet have been formally assigned.

1.6 STRUCTURE OF THIS REPORT

The main body of this report includes seven sections, each of which includes discussion of different areas of sustainability from a different perspective. The seven sections are:

- Academics and Research
- Energy and Climate Change
- Operations
- Procurement
- Recycling and Waste Minimization
- Transportation
- Water

Some of these areas are interconnected and deal with related issues. For example, procurement includes discussion of purchasing water and energy efficient devices, which relate to the sections on water and energy, respectively. Areas of crossover and synergies within these seven areas will be noted in the text of this document when possible.

Each of these sections of the report includes the following components:

Introduction: The Introduction describing relevant results from the *UC San Diego Sustainability Assessment Report* and other background information relating to that topic.

Goals and Actions: Goals describes the specific goals that UC San Diego will commit to, while *Actions* provides details on how the goals will be met.

Challenges: This portion of each section of the report discusses the major challenges that UC San Diego will face in meeting its goals, as well as potential solutions to those challenges.

2.1 INTRODUCTION

UC San Diego has a comprehensive set of offerings for students interested in sustainability and environmental education. Currently, about 200 distinct courses and seminars are offered that include teaching or discussion of sustainability, social justice, the environment, and conservation.[10] There are far too many courses, majors, and minors to list in this document, but some of the more prominent academic offerings are discussed in the *UC San Diego Sustainability Assessment Report*. Some concern exists that budgetary issues may affect the offerings of these courses in the future. The campus may need to allocate resources to continue offering all of these courses and seminars in the future.

Additionally, UC San Diego has a long history of conducting sustainability-related research throughout the university, and faculty and researchers continue to lead cutting-edge research today. Some of these research projects include testing of new technologies and methods to improve sustainability performance of the campus and UC San Diego's ongoing operations. Unique to UC San Diego is the collaboration that occurs across disciplines including faculty, students, administration, and operations.

The indicators included in the Sustainability Assessment Report showed that UC San Diego is well represented in the area of educating students in environmental and sustainability courses. More difficult to measure is the extent to which sustainability education influences the behavior of the campus community, e.g., do students choose to take the bus to campus more often once they learn about the science and the implications of climate change? Also, it is difficult to measure the total percentage of the campus community that is educated about sustainability.

Additionally, sustainability is by nature a multidisciplinary topic; the concepts of sustainability cross over into many departments and include applications in science, policy, economics, history, art, and many other disciplines. However, the extent to which sustainability education is a multidisciplinary process is difficult to measure. Another difficulty is measuring the actual percentage of the student body that is enrolled in these courses. A small subset of the student body may be taking all of these courses.

The ACUPCC Commitment

In addition to setting a goal for climate neutrality, the ACUPCC requires each campus to integrate sustainability into the curriculum, and to make it part of the educational experience. As noted above, a number of sustainability-related courses, majors, minors, internships, and other educational experiences are available to students, in a number of departments and institutes across campus. For example, the interdisciplinary Environmental Systems (ESYS) program is highly popular, and currently 175 students are majoring in the ESYS program. ESYS draws the Biological Sciences division, the Chemistry & Biochemistry Department, and the Scripps Institution of Oceanography. Also, about 40 students pursue the interdisciplinary Environmental Studies minor, and there is also a minor in Marine Science. In addition, the Scripps Institution of Oceanography offers a number of courses in sustainability topics, and includes many faculty and staff performing cutting-edge research in areas such as climate change and the impacts of climate change on global ecosystems. One of the undergraduate colleges, Muir College, named for the famed environmentalist John Muir, provides numerous sustainability educational opportunities for its students,

[10] *UC San Diego Sustainability Assessment Report*, 2008. In 2007/2008, there were 196 courses with sustainability content; however, this is an estimate based on a broad definition of the term "sustainability course."

including the ability of students to perform independent research projects. Additionally, the Environmental Engineering major within the department of Mechanical and Aerospace Engineering deals with the technological aspects of sustainability. Other key departments with environmental and sustainability offerings include Biology, Earth Science, Environmental Engineering, Environmental Chemistry, and Ecology, Behavior, and Evolution.

There has also been work to begin integrating sustainability into the curriculum through a program called "Sustainability Across the Curriculum," developed and administered by the Environment and Sustainability Initiative (ESI). Sustainability Across the Curriculum is a workshop open to any UC San Diego faculty, regardless of their background or area of expertise, and is designed for faculty who want to incorporate ideas about the environment and sustainability into courses that they regularly teach. ESI also sponsors the Greenovation Forum series, an innovative set of forums that brings together experts from various sectors.

These examples are only a sampling of the many courses, majors, minors, forums, and other educational opportunities provided in the fields of sustainability at UC San Diego.

The remainder of this section seeks to show how the campus will begin the systematic integration of sustainability into all academic offerings, so that every student is exposed to the concepts of sustainability during their academic career at UC San Diego.

2.2 GOALS AND ACTIONS

Summary of Goals

1. Wherever possible, include sustainability in the curriculum for undergraduates.
2. Continue to expand elective sustainability courses and other educational opportunities.
3. Connect students, staff, and faculty interested in collaborating on campus sustainability projects and develop tools for faculty and students to use in their classes and research.
4. Develop tools to track and measure student attitudes and knowledge of sustainability, as well as sustainability course offerings and enrollment data.
5. Develop tools to track and measure sustainability research projects and funding for those projects.

Goals and Relevant Actions

Goal:

1. Wherever possible, include sustainability in the curriculum for all undergraduates.

Relevant Actions:

- Work with the Advisory Committee on Sustainability (ACS) to develop a campus definition of sustainability that is agreeable to the Academic Senate. Currently, UC San Diego has not developed a definition of sustainability for the campus, nor does the campus have definitions for "sustainability course" or "sustainability research." The ACS is an existing committee made up of students, faculty, and staff that provides recommendations to the campus regarding sustainability issues. This group is the likely committee to be charged with the tasks of developing these definitions. Once these definitions are developed, they will be reviewed and approved by the Academic Senate. The definition of sustainability will then be used to determine what core principles will be included in sustainability courses in the future.

- Working with the Academic Senate and other key groups, incorporate sustainability into the existing curriculum at all six undergraduate colleges through new labs, problem sets, guest lectures, or other means, where possible. Instead of developing new sustainability courses, UC San Diego will incorporate sustainability concepts and principles in existing undergraduate courses through new problems sets, labs, lectures, or other means (such as readings or other assignments),where possible. This strategy will also include training faculty and other teachers to use and integrate the new sustainability materials into their classes, and will also require the cooperation and support of the undergraduate colleges. The Academic Senate reviews and approves the current curriculum offered at UC San Diego, and will be involved in all decisions related to incorporating sustainability into the current curriculum.

Goal:

2. Continue to expand elective sustainability courses and other educational opportunities.

Relevant Actions:

- Continue to offer Sustainability Across the Curriculum Workshops. These workshops have successfully brought together multidisciplinary groups of faculty to discuss how sustainability and environmental issues could be incorporated into their existing courses and class work.
- Continue to develop new electives, such as a new multidisciplinary course with exciting guest speakers. Due to the multidisciplinary nature of sustainability, new electives could be developed across departments to include instruction on several issues in different fields related to sustainability.
- Develop new opportunities for supervised independent study and research (199 courses) with sustainability curriculum development. Students often learn the most while completing real-world projects and research; 199 courses provide an opportunity for students to earn academic credit for independent research and action.
- Create a database populated with actual campus sustainability data. For example, data that could be included in the database are campus energy and water usage by building, and solar panel performance. Students, faculty, and campus staff could use this database for both educational purposes, and for improving campus performance and projects. The database should be accessible, transparent, and easy to use.
- Create a “Sustainability Walk” to expand campus sustainability outreach efforts. The “Sustainability Walk” is a project designed to expand inform campus users and visitors about sustainability efforts on the UC San Diego campus. The Walk is envisioned as a permanent installation of plaques, monitors, and other displays along several prominent campus walkways. Some of these displays will show real-time energy usage and could also show other real-time data.

Goal:

3. Connect students, staff, and faculty interested in collaborating on campus sustainability projects and develop tools for faculty and students to use in their classes and research.

Relevant Actions:

- Improve existing websites containing information regarding sustainability courses, research, internships, and other opportunities on campus. Currently, some faculty and students report that finding sustainability-related information on academic offerings, research projects, and other opportunities is difficult. This problem is likely due to the decentralized nature of the UC San Diego campus, and the many departments and other groups offering sustainability and environmental programs. Some existing websites do bring together this information; most notably, the ESI website[11] and the Sustainability at UC San Diego website[12]. However, these resources could be improved and promoted more widely, so that the campus community can better connect. One website with various resources could also be created in the future.
- Develop a Sustainability Resource Center to connect students, faculty, and staff, and resources in a central location. One tool that will be used towards reaching this goal is the new Sustainability Resource Center (SRC). The SRC will provide a distinct and recognizable location for the campus community to connect on issues of sustainability. The SRC will include space for meetings, as well as a sustainability resource library, campus displays showcasing sustainability projects, computer workstations to facilitate student sustainability project development, and office space for the UC San Diego Sustainability Coordinator.

Goal:

4. Develop tools to track and measure student attitudes and knowledge of sustainability, as well as sustainability course offerings and enrollment data.

Relevant Actions:

- Develop and administer a pre- and post-experience survey to measure student attitudes and knowledge of sustainability, and/or add sustainability questions to the existing senior exit survey. Using a before-and-after survey will help campus leaders better understand if students are gathering and retaining knowledge about sustainability, and whether or not these students are changing their behavior and lifestyle in response to this information. Also, a survey could help shape the direction of future education and outreach measures.
- Develop tools to track course offerings in sustainability, potentially by creating a standard designation for sustainability courses and seminars in the course catalog. As noted in the *UC San Diego Sustainability Assessment*, it is difficult to track the total number of sustainability courses offered at UC San Diego. Also, a standard definition of "sustainability course" is needed to effectively track these data. By placing a designation in the course catalog for sustainability courses, these offerings could be tracked electronically.

[11] www.esi.ucsd.edu

[12] www.sustain.ucsd.edu

- Develop tools to track the total number of individual students enrolled in sustainability courses. The campus does not currently have the tools to track the total number of individual students enrolled in sustainability courses. Tracking these data will enable the campus to better understand the academic offerings related to sustainability and the total number of students that gain sustainability knowledge through coursework.

Goal:

5. Develop tools to track and measure sustainability research projects and funding for those projects.

Relevant Actions:

- Develop a definition for "sustainability research projects" and create tracking mechanisms for these projects. Currently, the campus does not separately track the number of sustainability research projects, or the funding that is received for these projects. Campus staff will work with the Office of Contracts and Grant Administration and other key departments to track these data in the future.

2.3 CHALLENGES

Bringing together multidisciplinary groups to conduct research and educate students on sustainability issues may be challenging, given the historic decentralized and departmentalized nature of the university setting. However, increasing the amount of collaboration on campus is an ongoing trend across all disciplines and through collaboration, disparate groups and departments may find new opportunities for research and funding.

Creating new courses and adding sustainability to the existing undergraduate curriculum will take time and resources on the part of administrators, faculty, and instructors. In today's busy times, finding the time and resources to integrate sustainability into the curriculum may be challenging. Another challenge will be for the academic community to set priorities in the area of sustainability education. However, by collaborating and sharing resources, the task will be lessened.

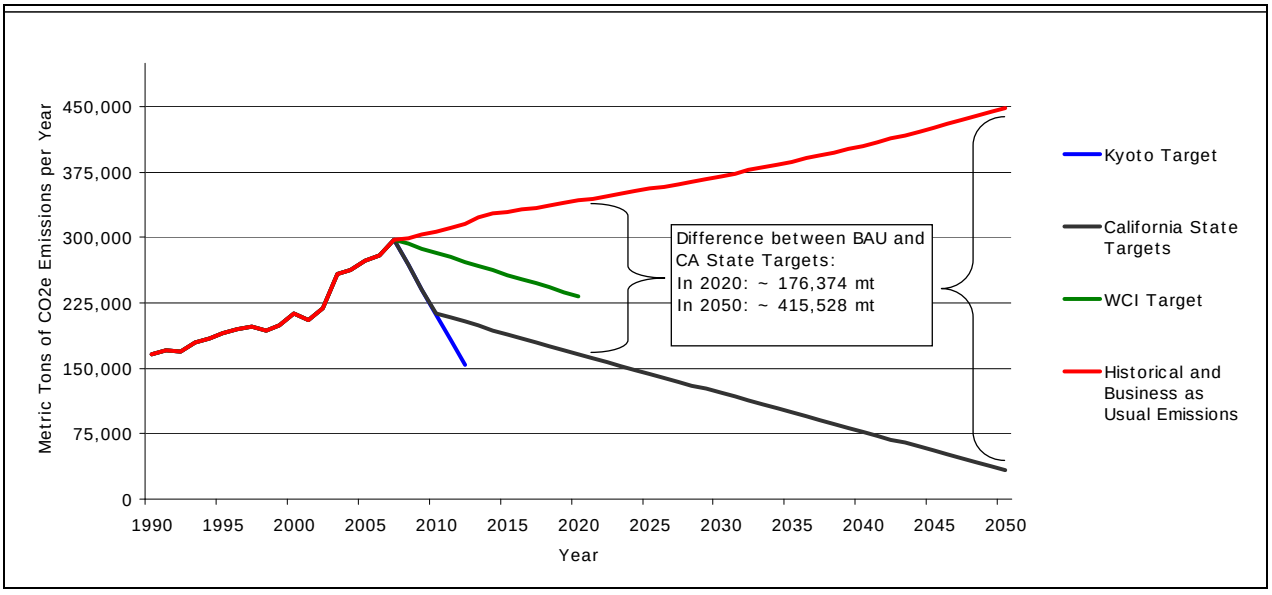
Funding may also be needed to develop a campus-wide database for sustainability information, although some of the infrastructure needed for the database is already in place. This goal is related to other goals in this document, such as the goals related to building-level monitoring.

3.1 INTRODUCTION

UC San Diego has been at the forefront of energy management and tracking campus GHG emissions for several years, as evidenced by our Charter Membership in the California Climate Action Registry, as well as our commitment to emission reduction through the Chicago Climate Exchange. Notable actions taken to date include the installation of a 30-megawatt (MW), ultra-low emission cogeneration plant on campus, and more recently, the installation of 1 MW of solar photovoltaic panels. Other notable actions include building energy conservation projects, which have been implemented for years on campus. Numerous other projects have been completed or are ongoing, such as energy efficiency retrofits, departmental energy audits, dormitory energy competitions, and the construction of high performance green buildings. UC San Diego is also working to reduce the energy usage of computing and other electronic equipment through various energy efficiency projects and cyberinfrastructure programs.

However, in spite of our leadership and aggressive action to manage energy usage, total energy consumption and total GHG emissions have been rising in recent years due to ongoing campus growth, and are likely to continue increasing due to continued growth plans until 2020. Figure 2 shows an estimate of historical emissions, as well as the emissions that will likely result under "Business as Usual" conditions (red line) in comparison to emission reduction targets set by the Kyoto Protocol (blue line) California AB 32 and Executive Order S-3-05 (black line), and the Western Climate Initiative (green line).

Figure 2: UC San Diego CO2 Equivalent Emissions Trend and Trajectories



As is evident from Figure 2, a great challenge lies ahead. Reducing emissions is particularly challenging for an entity such as UC San Diego, which has already taken numerous early actions to reduce energy consumption and increase efficiency.

Also, GHG emissions intensity, which is a normalized measure of GHG emissions, has increased in recent years. Figure 3 shows UC San Diego's GHG emissions in relation to campus population, and Figure 4 shows GHG emissions in relation to campus building square footage. Both of these measures have also increased in recent years, although emissions per gross square foot of building space have remained fairly steady from 2005 to 2006. Data for 2007 and 2008 are not yet available.

Figure 3: UC San Diego GHG Emissions per Capita

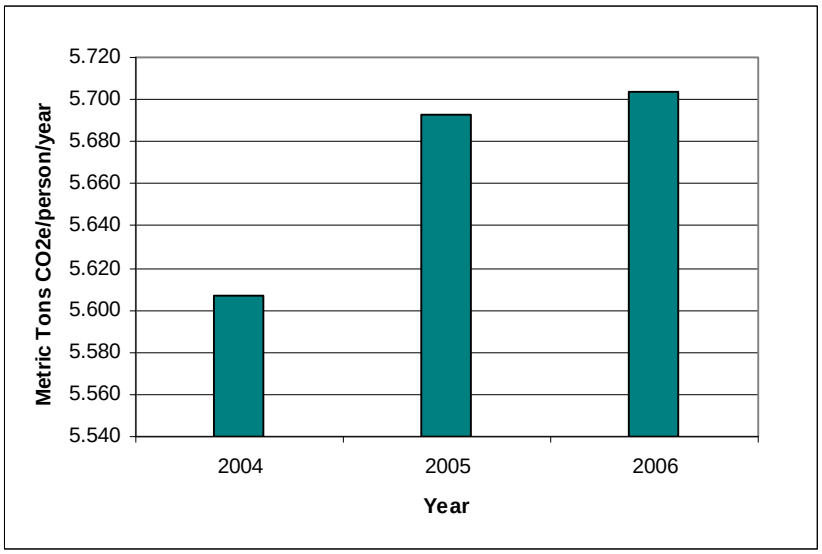
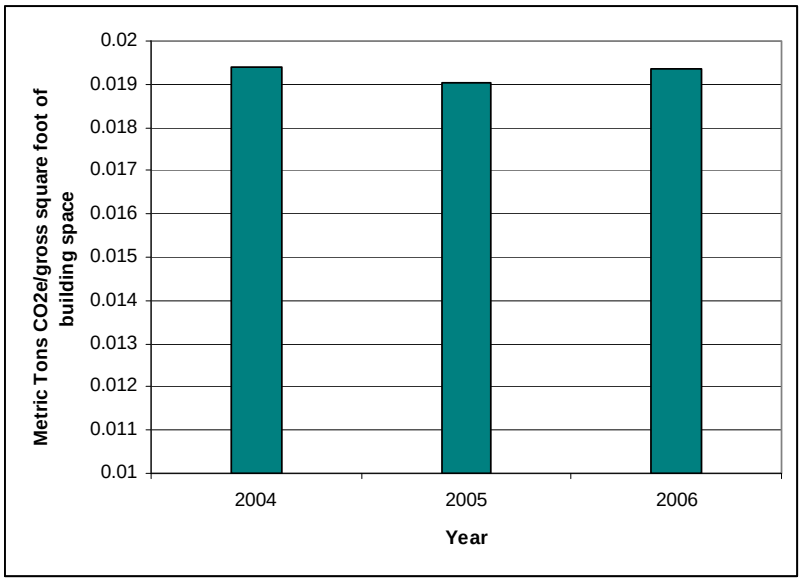


Figure 4: UC San Diego GHG Emissions per Gross Square Foot of Building Space



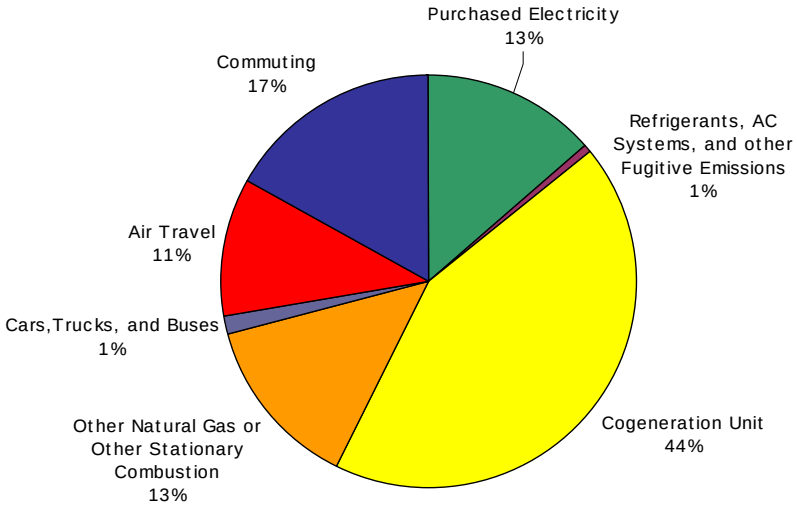
UC San Diego may not be required under law to meet the California State targets from Executive Order S-3-05 and AB 32. These targets are meant to apply to the entire state as a whole; every entity in California may not and should not reach these targets. In fact, the concept behind a cap-and-trade system, which is a primary policy mechanism that will be used to reach the California and WCI targets, is to allow flexibility in the system. Under cap-and-trade systems, emitters who can easily and cheaply reduce emissions will, and those emitters that are unable to reduce emissions further may trade credits for emission reductions.

Three emission reduction scenarios are included in this plan. Each uses the California State targets as a guide for how UC San Diego could reduce emissions and eventually reach climate neutrality. However, a final solution will likely need to consider emissions in a regional and state-wide context.

For example, the current Scoping Plan for AB 32 encourages entities to build and operate cogeneration as a means to reduce emissions. In 20 or 30 years, UC San Diego may be encouraged to continue operating its cogeneration plant (or to build another cogeneration plant) as part of a regional or statewide strategy to reduce emissions. Shutting down the cogeneration plant and purchasing energy from the grid might be less carbon intensive at some point in the future, but UC San Diego may be encouraged to continue running the cogeneration plant so that other entities may use the low-carbon energy from the grid. In other words, in some future situations, emissions might increase at UC San Diego and other locations, but total emissions regionally or statewide will decrease. However, the scenarios included in this report show how UC San Diego could reduce emissions to certain levels without consideration of regional and statewide strategies noted above.

A breakdown of current GHG emissions by source is provided in Figure 5. The GHG emissions inventory includes emissions from commuting and air travel, as required by the ACUPCC. Emissions from purchasing, waste disposal, and recycling, are not included in the current inventory. All emissions were calculated according to the current General Reporting Protocol of the California Climate Action Registry (CCAR)[13], and all emissions were reported to CCAR with the exception of the air travel and commuting emissions. The emissions reported to CCAR are also verified by a third party.

Figure 5: UC San Diego GHG Emissions by Source



As evident from Figure 2, emissions from purchased electricity and the cogeneration unit, which generates electricity and heat, account for 57% of all campus emissions. Transportation, including commuting, air travel, and the campus fleet, make up 29% of all emissions. A successful reduction strategy must include conservation and efficiency

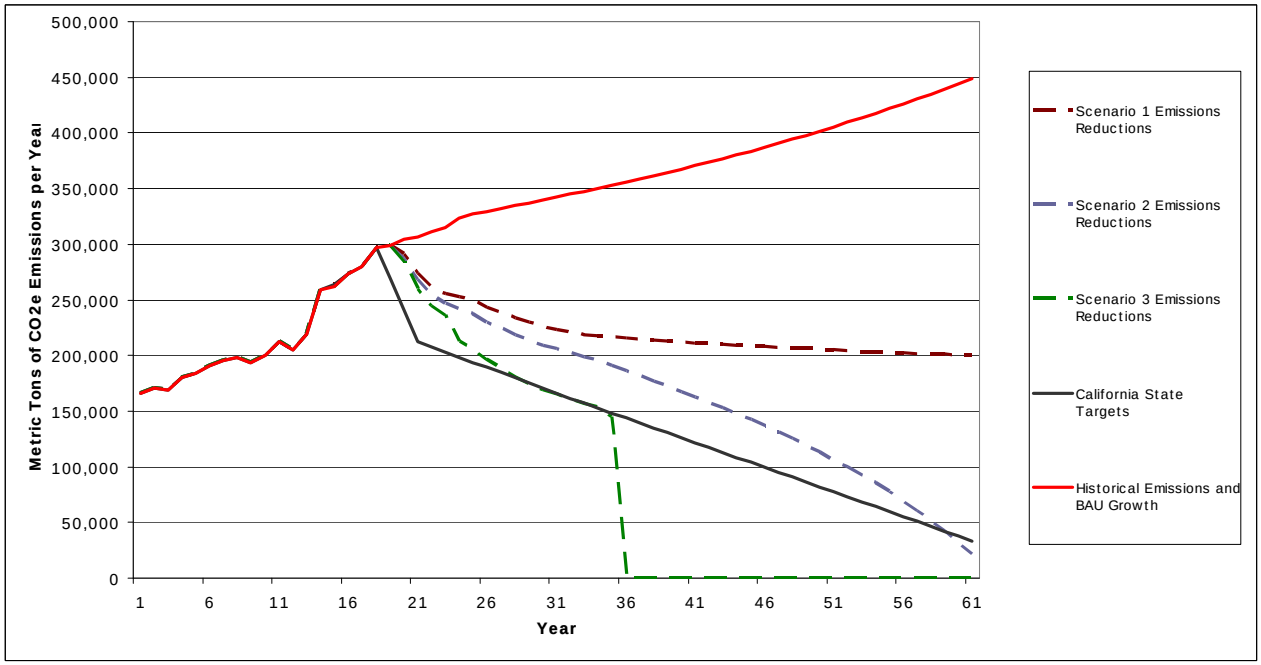
[13] http://www.climateregistry.org/resources/docs/protocols/grp/GRP_V3_April2008_FINAL.pdf

measures to reduce the demand, and thus the emissions, from electricity and natural gas usage, as well as strategies to reduce the emissions from transportation. Because the fugitive emissions from refrigerants, air conditioners, and other sources are so small (1% of total campus emissions), they are not discussed further in this report.

3.2 EMISSION REDUCTION SCENARIOS

In order to analyze emission reduction possibilities and facilitate greater understanding of the decision-making process used to enable UC San Diego to meet various emission reduction goals, we have generated three scenarios of emission reductions. These scenarios illustrate the general approach that UC San Diego will take to achieve emission reductions, and provide a general road map for reaching emission reduction goals. Each scenario is increasingly stringent, in terms of emission reduction, than the previous scenario. Also, each scenario is based on a number of assumptions out to 2050. The actual emissions and emission reductions that are possible in 2050 are difficult to predict; thus, each scenario demonstrates how different levels of activity will lead to a different emission reduction, assuming the "business as usual" (BAU) emissions continue growing. A summary of the reductions achieved in each scenario is shown in Figure 6.

Figure 6: Summary of Emission reduction Scenarios



All scenarios use the same BAU base case that is shown graphically in Figure 2. The assumptions for the BAU emissions trajectory are provided in Appendix II. Each scenario also includes emission reductions from the following sources: energy efficiency projects, renewable energy installations, reductions in air travel, reductions from commuting, and reductions from the campus fleet. Table 2 shows the different assumptions on emission reductions included in each scenario.

The scenarios build on one another. For example, all the emission reductions in Scenario 1 are included in Scenario 2, where they are augmented by additional reductions; Scenario 3 contains the Scenario 2 reductions plus others. Also, all scenarios include emission

reductions from current projects that are in place or planned and funded, such as the 1 MW solar energy installation planned for 2009, and the energy efficiency projects that have been funded and will be implemented from 2009-2012.

Carbon Offsets are included in Scenarios 2 and 3. However, offsets will only be used as a last resort. UC San Diego will continue to research, develop, and implement new technologies to reduce emissions. If offsets are used, then UC San Diego will purchase or develop local and regional offsets to gain maximum co-benefits from implementing offsets. Although offsets may not be necessary, they are included in current scenarios. In Scenario 2, emissions from air travel, transportation, and the campus fleet continue to be reduced until they are at 80% below 1990 levels. At that point, offsets are used to continue emission reductions. Significant offsets are also included in Scenario 3 to allow UC San Diego to reach climate neutrality by 2025.

Also, conservation through behavior change is already occurring, as evidenced by the recent decrease in energy use per square foot found in the *UC San Diego Sustainability Assessment Report*.[14] This ongoing reduction in emissions is actually built into the BAU baseline. The BAU baseline includes emissions increase from "load creep" at 1% growth per year. Emissions from load creep include both additional campus users in each building due to campus population growth, and additional devices and equipment that are plugged in to electrical outlets each year. However, an average rate of growth for load creep is 3% per year. Thus, by using the 1% growth rate, we have incorporated ongoing conservation efforts through behavior change.

In all the scenarios, we assume that reductions from renewable energy increase at a faster rate than reductions from energy efficiency. However, the total reductions from renewable energy are far fewer than the reductions from energy efficiency. These assumptions are based on several factors. First of all, energy efficiency and conservation projects are more cost-effective methods for achieving reductions, often leading to cost savings over time. Renewable energy has a longer payback period. Thus, the scenarios assume that the campus will initially invest greater amounts in efficiency and conservation projects than renewable energy projects, and that these investments will slowly increase (in the cases of Scenarios 2 and 3). We also assume that less will be invested in renewable energy in initial years, but these investments will grow at a faster rate than investments in efficiency. This strategy places a larger percentage of investment in renewable energy in the years 2030-2050; by that time, the costs of renewable energy may become more favorable.

[14] See the UC San Diego Sustainability Assessment Report, p. 30.

Table 2: A Comparison of Assumptions Included in Emission Reduction Scenarios

	Reductions from Energy Efficiency	Reductions from Renewable Energy	Reductions from Limits to Air Travel	Reductions from Commuting	Reductions from the Campus Fleet	Reductions from Offsets	Percentage Emission Reduction by 2050 (compared to 1990 levels)
Scenario 1	-Reductions decrease by 1% per year from 2024-2050.	- Reductions increase by 2.5% per year from 2020-2050.	- Per capita emissions decrease by 11% per year from 2009-2010. - Per capita emissions decrease by 7% per year from 2011-2020. -Per capita emissions decrease by 5% per year from 2021-2050	-Total emissions decrease by 2% per year	- Emissions decrease by 4.7% per year from 2009-2020. -Emissions decrease by 4% per year from 2021-2050.	None assumed	21% *increase* above 1990 levels in 2050
Scenario 2	- Reductions increase by 3.5% per year from 2024-2050.	- Reductions increase by 8% per year from 2020-2050.	- *Per capita* emissions decrease by 14% per year from 2009-2010. - *Per capita* emissions decrease by 12% per year from 2011-2020. -*Per capita* emissions decrease by 10% per year from 2021-2050	- *Per capita* emissions decrease by 6% per year	- Emissions decrease by 10% per year from 2009-2020. -Emissions decrease by 8% per year from 2021-2050.	Offsets begin when transportation emissions are reduced to 80% below 1990 levels	70% below 1990 levels in 2050
Scenario 3	- Reductions from currently planned projects increase by 50% from 2013 t0 2023. -Reductions increase by 6% per year from 2024-2050.	- Reductions from currently planned projects increase by 50% from 2010-2020. -Reductions increase by 10% per year from 2021-2050.	- *Per capita* emissions decrease by 16% per year from 2009-2010. - *Per capita* emissions decrease by 14% per year from 2011-2020. -*Per capita* emissions decrease by 10% per year from 2021-2050	- *Per capita* emissions decrease by 8% per year	- Emissions decrease by 10% per year	Offsets begin in 2025 to allow UC San Diego to become climate neutral	97% below 1990 levels in 2050

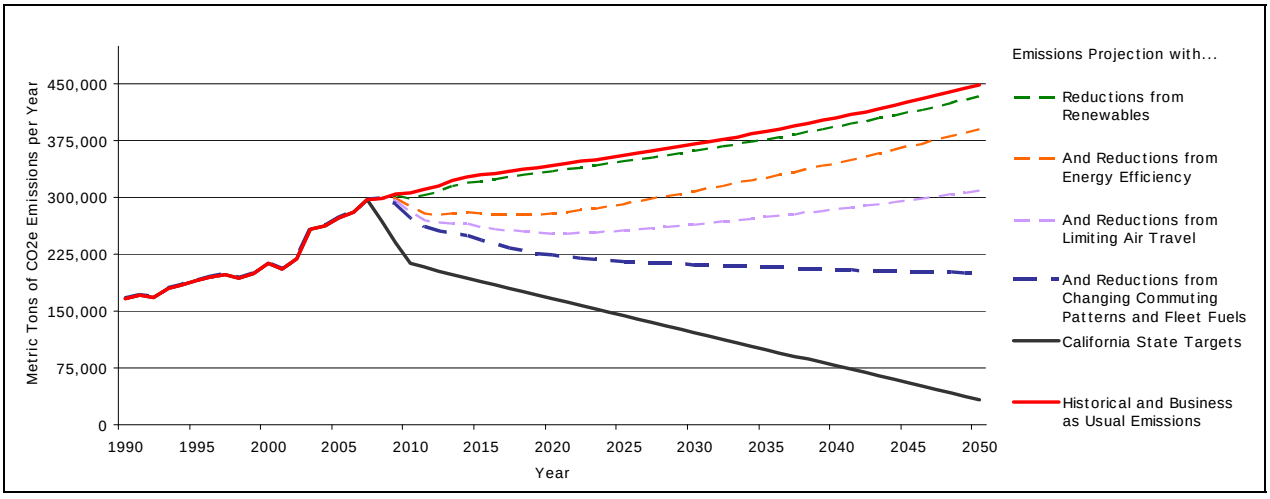
Notes on Table 2: All annual emissions percentage reductions are calculated based on the previous year's emissions, so that the emission reductions are cumulative. Also, emission reductions for air travel, commuting, and the campus fleet continue until levels that are 80% below 1990 levels are reached. At that point, offsets are used to continue emission reductions

Scenario 1

Scenario 1 is the most modest scenario, with the least emission reductions. This scenario includes all planned emission reductions, as well as some additional reductions. Figure 7 illustrates the emission reductions achievable in Scenario 1. Ongoing energy efficiency reductions are assumed to decline in this scenario after 2024, based on the concept that only the "low-hanging fruit" or the easily obtained reductions would be achieved. Also, reductions for air travel were chosen based on the reductions necessary to meet the California state target of 80% below 1990 levels by 2050. Furthermore, reductions from commuting (2% decrease in total emissions per year) are those that were suggested during the Focus Group meeting for Transportation. Finally, reductions from the campus fleet are based on the actual annual reduction achieved from 2006 to 2007, based on the GHG inventories for those years.

With this scenario, UC San Diego would be able to reduce emissions by about 33% from current (2007) levels by 2050. However, this represents a 21% increase over 1990 levels by 2050. In Figure 7, the total emission reductions are shown by the dark blue line, which includes reductions from commuting and the campus fleet, as well as all the other emission reductions. The dark black line shows the California State Targets set forth in Executive Order S-3-05; under this scenario, UC San Diego would not achieve the California state targets, unless carbon offsets were purchased.

Figure 7: Emission reductions under Scenario 1



Scenario 2

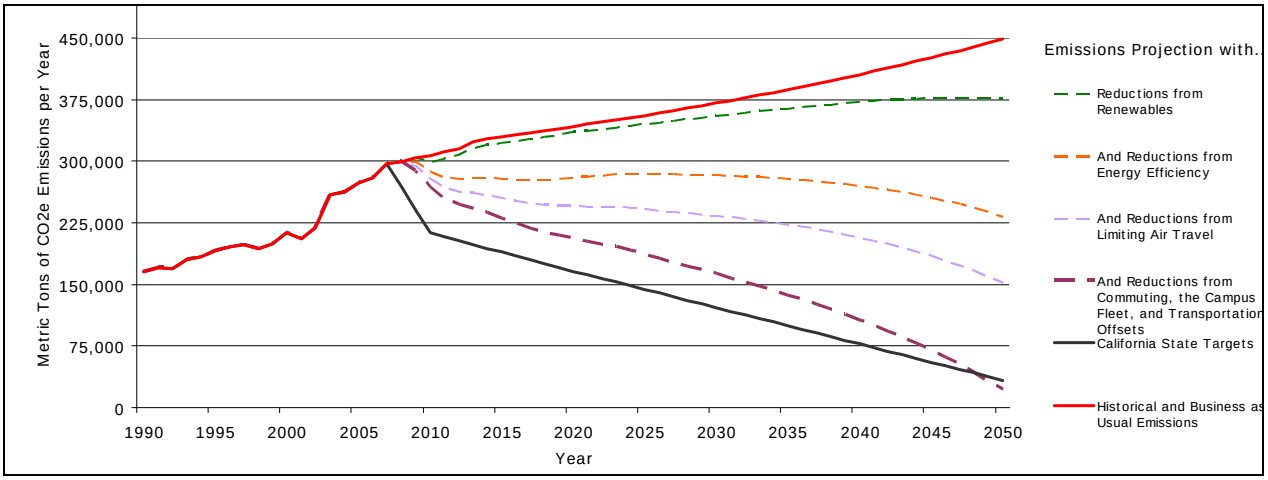
Scenario 2 is the next most aggressive scenario, resulting in a total emission reduction of 87% below 1990 levels by 2050. See Figure 8 for a graph showing these reductions. In this scenario, energy efficiency reductions increase by 3.5% per year from 2024-2050, forming one of the largest "wedges," or sources of reductions. In contrast to Scenario 1, both Scenario 2 and Scenario 3 include growth in emission reductions from energy efficiency after 2024, based on the concept that new technologies and other opportunities will

continue to provide “low hanging fruit,” or easily-obtained and cost-effective reductions through energy efficiency. The second largest source of reductions comes from limiting commuting emissions.

In Scenario 2, UC San Diego will be able to achieve California State Targets by 2050, although UC San Diego will not achieve the 2020 target without the use of carbon offsets. In this scenario, UC San Diego will also be able to achieve climate neutrality by 2054.

Also, offsets are used in this scenario when transportation emissions reach 80% below 1990 levels, based on the assumption that new technologies may not be developed or incorporated quickly enough to allow emissions to continue decreasing below this emissions threshold. However, only offsets for transportation emissions are incorporated in this scenario.

Figure 8: Emission Reductions under Scenario 2

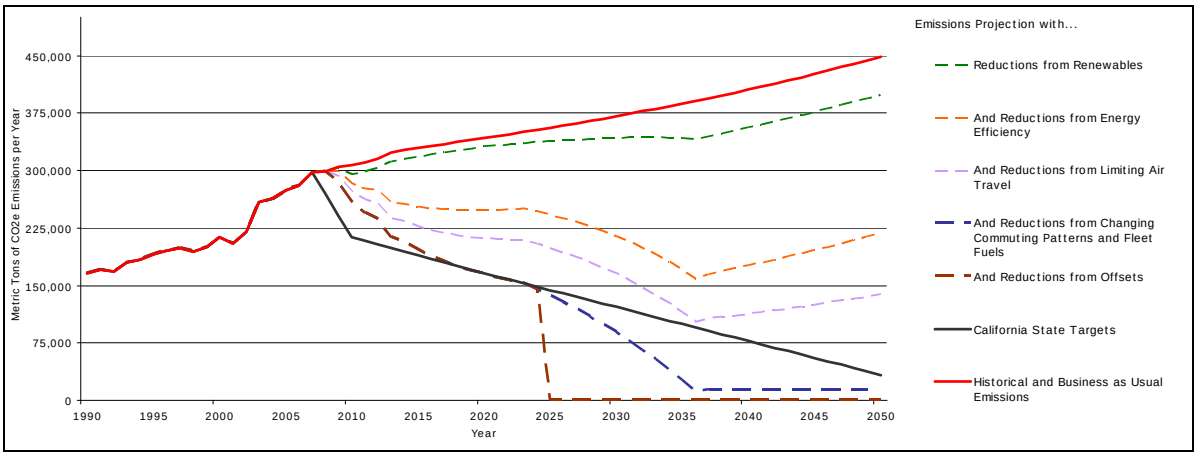


Scenario 3

Scenario 3 is the most aggressive scenario, and includes the goal of climate neutrality by 2025. See Figure 9 for a graphic illustration of this scenario. This scenario also allows UC San Diego to reach the interim target of 1990 levels by 2020.

For the years 2009-2024, this scenario includes additional emission reductions on top of the currently planned projects for both renewable energy and energy efficiency. (Scenarios 1 and 2 assume that only emission reductions from the currently planned projects for renewable energy and energy efficiency will be achieved from 2009-2024.) Emission reductions from renewables and efficiency also continue to increase rapidly from 2024 to 2050 in this scenario. However, emission reductions from renewable energy and energy efficiency are only assumed to grow until all emissions from natural gas usage and electricity usage are neutralized. In other words, once the business-as-usual emissions expected from natural gas usage and electricity usage are completely covered by renewable energy and energy efficiency, there will be no further renewable energy installations or energy efficiency projects. In this scenario, the reductions from renewables and energy efficiency reach this maximum in 2037, which is why the “wedges” or reductions appear to discontinue growing in 2037.

Figure 9: Emission Reductions under Scenario 3



In addition, this scenario includes more aggressive reductions for all transportation emissions than the other scenarios. However, like Scenario 2, this scenario also assumes that emissions from transportation will only decrease to 80% below 1990 levels. After this point, additional reductions will be created by offsets. In spite of all of these aggressive emission reductions, significant levels of offsets are needed to reach climate neutrality by 2025.

New and improved technologies, as well as carbon offsets, will both be needed to achieve the reductions under all of these scenarios and to achieve climate neutrality by 2025. For example, by 2050, Scenario 3 assumes that energy efficiency will reduce all the emissions from natural gas usage and purchased electricity by 78%. However, it may not be possible to reduce emissions from these sources by 78% with efficiency alone. (Renewable energy will reduce about 22% of these emissions by 2050.)

In another example, this scenario assumes that emissions from air travel, commuting and the campus fleet will reduce to 80% below 1990 levels. It is unlikely that all air travel will cease completely; thus, in order for these emissions to reduce to 80% below 1990 levels, carbon offsets could be purchased, or air travel could rely on biofuels by 2050. Similarly, in order for all commuting emissions reduce significantly, all campus members would need to commute by climate-neutral methods such as walking or bicycling, or in vehicles or transit run completely on renewable energy.

Although the situations described above are possible using today's current technologies, they will depend on the improvement and wide-scale adoption of these technologies. For example, biofuels have recently been tested in commercial aircraft but are not typically used as a fuel for in commercial airplanes. Thus, biofuels would need to be improved for usage in aircraft, and the aircraft would also need to be retrofitted or replaced to use biofuels.

Other major changes could occur that lead to the emission reductions in Scenario 3. For example, a large portion of classes, conferences, and meetings could be held via webinar or other electronic means, meaning that a large percentage of students, faculty, and staff could work from home every day. While teleconferencing and video conferencing may increase some energy usage, these technologies would lead to significant GHG emission reductions. Additional technologies and culture changes beyond our imagination might also occur, changing the landscape of everyday life.

In conclusion, many of the situations in Scenario 3 are based on the availability, affordability, and uptake of new technologies. Carbon offsets could also be used to achieve

some of the reductions in this scenario, and major changes to how we conduct daily business could also allow UC San Diego to achieve these reductions.

3.3 GOALS AND ACTIONS

Summary of Goals

To retain a leadership role in climate change science and policy, we recommend that the campus leadership and the CSWG consider adopting Scenario 3 as the guideline for emission reductions, which includes the following goals to reduce UC San Diego's emissions as follows:

- 2000 levels by 2013;
- 1990 levels by 2020;
- Climate neutral by 2025.

Goals and Relevant Actions

Numerous strategies and actions are already underway or planned that will lead to significant emission reductions. As explained in section 3.2 above, some new technologies or changes in how we do business may affect emission reductions in the future in ways we are unable to describe or imagine today.

Below are some of the current actions that will be used to achieve the emission reductions goals listed above. This report includes a separate section for Transportation, which includes discussion of strategies and actions for reducing emissions from air travel, commuting, and the campus fleet. Please see the Transportation section for this information.

- Implement various energy efficiency projects and retrofits to buildings. Numerous energy efficiency retrofits are already planned and funded, and will be implemented from 2009 until 2012. These projects include diverse actions, such as updating heating, ventilation, and air conditioning equipment in buildings, to lighting retrofits, to building commissioning. Other projects include replacement of pre-2001 refrigerators with Energy Star models, replacement of lab freezers with more efficient models, and installation of occupancy sensors and sensors on vending machines. In total, $174.2 million worth of projects have been identified that will save a total of over 127 million kwh per year, and over 1.9 million therms of natural gas each year.
- Implement other efficiency projects. UC San Diego has worked to improve the efficiency of computing systems and other electronic equipment, and will continue to perform research and implement new projects in these areas. Additional information regarding purchasing standards for energy efficient equipment is located in the "Procurement" section of this document.
- Install renewable energy. UC San Diego has already installed 1 MW of solar panels on various rooftops on campus, including placing solar panels in the form of shading "trees" on two parking structures. An additional 1 MW is planned for installation in 2009. UC San Diego will also be installing one 2.8 MW fuel cell powered by renewable waste methane from the local wastewater treatment facility. Other renewable energy options are under consideration, such as purchasing off-peak power from local wind turbines, and a UC system-wide solar array or wind farm, which would be constructed using resources from all the UC campuses. Another option is using recovered methane from

the local landfill to fuel the campus cogeneration plant. Unfortunately, initial assessment has revealed that this option may not be cost-effective at this time. Finally, another technology under consideration is using cold seawater from an offshore deep sea trench to provide cooling for campus buildings. This project is under study, and has the potential to save up to 4MW of energy and $4 million/year, plus it could reduce cooling tower freshwater usage by 100 million gallons/year.

- Perform outreach to all campus community members. Additional outreach is needed to inform campus community members of their impacts on the environment through energy usage, and ways that they can reduce energy consumption. This outreach will be performed as part of a larger sustainability outreach campaign, and is described in more detail in the Introduction of this report.
- Promote teleconferencing and video conferencing. Teleconferencing and video conferencing rely upon technologies available today at UC San Diego. Both of these options may currently be underutilized due to lack of awareness or lack of support and encouragement.

3.4 CHALLENGES

The challenges that UC San Diego faces are not unique, nor will they be easily overcome. Our current economy relies on fossil fuels for most of its energy needs. Although important steps have been taken by UC San Diego to reduce energy usage and begin the transformation to a low-carbon energy future, there lies much work ahead, especially considering the campus plans for future growth. Some specific challenges to achieving reductions are financing and technology limitations.

Thus far, much of the renewable energy and energy efficiency projects on campus have been funded by public-private partnerships and utility rebates through the UC system-wide utility partnership. While this funding has allowed UC San Diego to begin taking a leadership role in energy issues, it may not be available for future projects. UC San Diego may need to identify additional funding sources for future projects. One possibility is the use of donations from private or public donors to fund new renewable energy or energy efficiency projects.

Another challenge is the current limitations and uptake of emission reduction technology. New technologies are rapidly being developed and deployed. In one example, a fuel cell would not have been commercially available and cost effective 5 years ago but is currently being installed at UC San Diego. In the future, new technologies will likely become available. However, it is impossible to predict what types of technologies will come on line, their cost, and the amount of emission reductions that will be possible using these technologies. In part, however, all the emission reduction scenarios in this plan assume that new technologies will become commercially available and viable.

4.1 INTRODUCTION

The campus operations staff implements policies and practices to reduce UC San Diego's impacts on the environment. The maintenance of buildings and other facilities, including the cleaning of buildings, is included in this category. Solid waste, recycling, and composting also fall under Operations, but are included under a separate category of this report called "Recycling."

UC San Diego has implemented a number of green building policies. For example, all new buildings will be constructed to be certified LEED Silver, with a goal of achieving LEED Gold. In addition, buildings will continue to be certified under the LEED for Existing Building (LEED-EB) program. Currently, about 3% of all building space is in a green-certified building, but this percentage will increase to 15% after new construction and existing buildings are certified in the next few years. The *UC Policy on Sustainable Practices* may include revisions relevant to green building certification; UC San Diego will continue to implement these policy recommendations as they are approved by the UC Regents.

Also, about 76% of the cleaning supplies used in UC San Diego's buildings are Green Seal-certified; Green Seal Certification is issued by an independent, nonprofit organization.

4.2 GOALS AND ACTIONS

Summary of Goals

1. Improve performance of all campus buildings in terms of energy usage and water usage.
2. Reduce the impacts of cleaning supplies.
3. Establish as a standard LEED Gold for all new buildings, achieving LEED Silver where LEED Gold is not possible.
4. Continue to certify buildings under the LEED-EB program. The campus will work to establish a targeted number of buildings to certify annually.

Goals and Relevant Actions

Goal:

1. Improve performance of all campus buildings in terms of energy usage and water usage.

Relevant Actions:

- Improve the data in the FacilitiesLink Building database. FacilitiesLink is a database of all buildings owned or leased by UC San Diego, and it includes numerous data regarding each building, e.g. gross square footage, the age of the building, the date of occupancy, and the owner. However, sustainability-related data are currently not included in FacilitiesLink. Adding environmental performance data to FacilitiesLink will enable campus staff to better manage and maintain buildings for optimal performance. In order to enhance the existing FacilitiesLink database, various campus stakeholders will be consulted regarding their needs, and the features to be included in the enhanced database.

- Continue to implement "preventative maintenance." A new preventative maintenance program is being developed and will be implemented by July 2009. This new program will focus on preventing problems by regularly checking and updating equipment before repairs are needed.

Goal:

2. Reduce the impacts of cleaning supplies.

Relevant Actions:

- By 2009, use 100% Green Seal-certified cleaning supplies.
- By 2009, use only cleaning supplies purchased in bulk and diluted before use.
- By 2009, convert to reusable rags and recycled paper alternatives for cleaning and maintenance.
- Research green cleaning supplies that are currently available and convert to them when possible. Currently, green cleaning supplies are not available for some products, such as germicides. The campus staff will continue to research options for new green cleaning and maintenance supplies and will use these options whenever possible.

Goals:

3. Establish as a standard LEED Gold for all new buildings, achieving LEED Silver where LEED Gold is not possible.
4. Continue to certify buildings under the LEED-EB program. The campus will work to establish a targeted number of buildings to certify annually.

Relevant Actions:

- Prioritize order in which LEED-EB certification is accomplished. The University of California Office of the President required that a pilot building be submitted for certification under the LEED-EB standard by July 1, 2008. Additional buildings will be certified under this standard. To achieve this goal, the campus staff will prioritize the existing buildings in need of retrofits that may be able to achieve significant performance improvements by undergoing LEED-EB certification. The campus is also investigating the use of volume certification under the LEED program, in which several buildings located near each other and sharing certain similarities are certified at once.

4.3 CHALLENGES

Currently, green alternatives are not available for some cleaning supplies, or if they are available, they are not cost-competitive with conventional products. UC San Diego staff anticipate that this problem will be resolved over time as the market continues to demand greener products.

A second challenge is that achieving LEED-EB certification can be a time-intensive process. However, the USGBC has issued a new LEED-EB standard known as LEED-EB: Operations and Maintenance, which may be easier to apply to existing buildings, making certification a faster, simpler process. In addition, the UC system is working with the USGBC on the volume certification processes in which campus can prototype credits to be applied across a portfolio of buildings allowing more rapid certification. Volume certification will likely save time and money by simplifying the certification process.

Achieving LEED certification also requires some costs; however, the campus expects that the costs of certification will be offset by the savings generated from energy- and water-saving retrofits and improved building operations.

Finally, UC San Diego has a large number of buildings to operate and maintain. Currently, 720 buildings are listed in the FacilitiesLink database, and additional buildings are being constructed in the next few years. Campus staff may not have adequate time to perform the proper preventative maintenance on all buildings, and additional staff may be needed. However, new staff could be justified by the cost savings that occur through improved maintenance programs. For example, the energy savings that result from testing and updating equipment in older buildings could justify the additional cost of a new staff person to work on building maintenance.

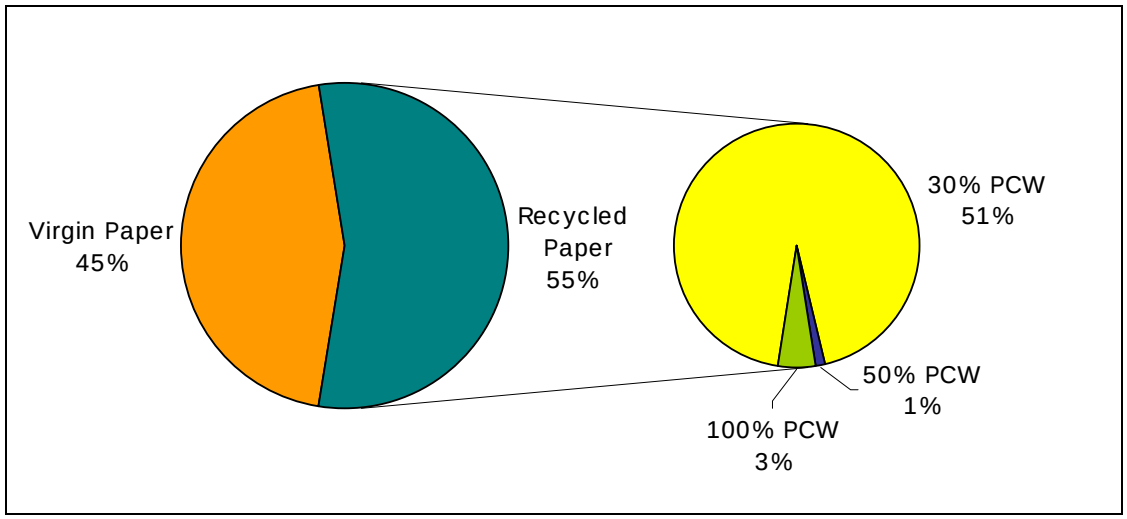
5.1 INTRODUCTION

The UC San Diego Procurement and Contracts Department has initiated a number of policies and programs to reduce the emissions and impacts associated with purchasing. For example, procurement staff have identified and begun to purchase green-certified products, such as Energy Star and Green Seal-certified products. In other examples, the staff have worked with vendors to reduce or eliminate packaging, and have begun to purchase more paper with recycled content.

A key challenge lies in the structure of purchasing at UC San Diego. While the staff in the Procurement and Contracts department handle all large or major purchases, small purchases are often made by other departmental staff. Educating these purchasers on more sustainable options will be a challenge.

For example, about 45% of all paper purchased on campus is virgin paper. While 55% of the paper purchased does contain recycled content, most of this paper is only made of 30% post consumer waste (PCW). PCW is recycled paper that has been used by a consumer and then recycled, as opposed to paper made from recycled scraps, which has never actually been used by a consumer. Thus, of the total amount of paper purchased by UC San Diego, 18.6% of the content is made from recycled fiber. See Figure 10 for a graphical illustration of PCW paper purchases at UC San Diego.

Figure 10: Post Consumer Waste Content in Paper Purchases



Another indicator regarding paper usage is the total amount of purchased per capita. In 2006/2007, UC San Diego used an average of 1,568 sheets of paper per person and 3,002 sheets of paper per student.

5.2 GOALS AND ACTIONS

Summary of Goals:

1. Achieve 50% PCW recycled content in all paper purchases by 2012. This goal represents an increase in PCW content of paper purchases of about 8% per year.

2. Reduce per capita paper usage from 1,568 to 1,066 sheets per person per year by 2012; this goal represents an annual reduction of 8% from the baseline number of 1,568 sheets per person per year from 2009-2012. This also represents a total reduction of 32% from the baseline of 1,568 sheets per person per year. The Procurement and Contracts department will play a key role in achieving this goal. However, Procurement and Contracts will not hold responsibility for achieving this goal, because reducing overall paper usage will require participation of all campus departments, and education of the entire campus community.
3. Reduce the total amount of printers, copiers, and other applicable electronic equipment purchased and used. As with goal #2 above, the Procurement and Contracts department will play a key role in achieving this goal. However, Procurement and Contracts will not hold responsibility for achieving this goal, because reducing the total amount of equipment purchased will require the participation of all campus departments, and education of the entire campus community.
4. Improve the energy efficiency of all computers, printers, copiers, and other equipment used, using the guidelines from the new Climate Savers program.
5. Increase spending on appropriate green vendors and products.
6. Reduce the total emissions from the life cycle of materials purchased, used, and discarded on campus, including the emissions and impacts from extracting the materials, processing materials into products, transporting products to the campus for use, and transporting waste materials for final disposal or recycling. This goal includes the intention of finding local producers for materials, as well as local markets for recycling of waste materials, when possible. This goal is also related to Recycling and Waste Minimization, and is included in the Recycling and Waste Minimization section of this report.

While some of these goals are highly relevant to the activities of Procurement and Contracts department, the ultimate responsibility for meeting these goals will be placed outside the Procurement and Contracts department.

Goals and Relevant Actions

Goal:

1. Achieve 50% PCW recycled content in all paper purchases by 2012. This goal represents an increase in PCW content of paper purchases of about 8% per year.

This goal is partially dependent on the technologies and equipment in use at UC San Diego. According to campus staff, some of the current equipment in use, such as printers, are unable to utilize high-PCW paper. However, if technologies continue to advance and allow usage of high-PCW paper, and if equipment using these technologies are implemented across campus, then this goal should be amended to be more aggressive.

Relevant Actions:

- Require purchase of at least 30% PCW recycled paper. Ban use of virgin paper unless specifically authorized by the departmental chair or dean. The 30% PCW paper is roughly equal to virgin paper in terms of cost, and does not cause problems with printers or copiers on campus. Instituting this policy will immediately reduce the amount of virgin paper purchased on campus.

- Research available recycled paper and work with vendors to offset higher cost of high PCW content paper. Continuing to research paper purchasing vendors for the campus will likely reveal new options for higher PCW-content paper.

Goal:

2. Reduce per capita paper usage from 1,568 to 1,066 sheets per person per year by 2012; this goal represents an annual reduction of 8% from the baseline number of 1,568 sheets per person per year from 2009-2012. This also represents a total reduction of 32% from the baseline of 1,568 sheets per person per year.

Relevant Actions:

- Utilize e-versions instead of paper versions for all reports. Archive reports in PDF formats. Reducing overall paper usage requires policies and training so that all campus members begin to replace printer versions with electronic versions whenever possible.
- Research the possibility of using centralized, multi-function printers to reduce paper usage and to reduce the amount of equipment in use. Many UC San Diego employees automatically receive their own printer at their workspace when a centralized, multi-function printer connected to several employees' computers would serve the same purpose.
- Mandate purchases of duplex capable printers and set all defaults to duplex. Purchasing more duplex-enabled printers and using them to print double-sided documents will greatly reduce paper usage.

Goal:

3. Reduce the total amount of printers, copiers, and other applicable electronic equipment purchased and used.
4. Improve the energy efficiency of all computers, printers, copiers, and other equipment used, using the guidelines from the new Climate Savers program.

Relevant Actions:

- Institute a policy requiring a review process for non-standard computer equipment configurations, e.g. multiple monitors, personal printers. Most UC San Diego staff do not need a second monitor or their own printer. Instituting this policy will reduce the amount of unnecessary equipment that is purchased.
- Implement the requirements of the Climate Savers Computing Initiative. UC San Diego recently became a member of the Climate Savers Computing Initiative, a nonprofit group made up of organizations dedicated to improving the energy efficiency of computing. The goal of Climate Savers is to reduce the power used by computing equipment by 50% by 2010. As a member, UC San Diego has pledged to continue purchasing power-efficient computing products. Specifically, all new computers and other electronic equipment will meet the ENERGY STAR 4.0 standard, to begin. Also, UC San Diego has committed to using power management features whenever possible.[15]

[15] For more technical specifications of the Climate Savers Computing Initiative, see the following website: http://www.climatesaverscomputing.org/about/tech-specs/#1

Goal:

5. Increase spending on appropriate green vendors and products.
6. Reduce the total emissions from the life cycle of materials purchased, used, and discarded on campus, including the emissions and impacts from extracting the materials, processing materials into products, transporting products to the campus for use, and transporting waste materials for final disposal or recycling. This goal includes the intention of finding local producers for materials, as well as local markets for recycling of waste materials, when possible. This goal is also related to Recycling and Waste Minimization, and is included in the Recycling and Waste Minimization section of this report.

Relevant Actions:

- Perform a survey on Marketplace regarding green vendors. A survey on Marketplace will serve to gather information from campus buyers regarding their attitudes and knowledge of biotech vendors, green labels, and what green products would be beneficial for UC San Diego to purchase.
- Highlight environmentally-preferred products on Marketplace, and ensure that the first option for any product is the environmentally-preferred product. Many campus purchasers use the Marketplace website for browsing and selecting products. By highlighting the environmentally-preferred products, and by making these products the first option available, the Procurement and Contracts department can help drive consideration and purchase of these products.
- Perform outreach to users and buyers. This strategy is crucial for informing non-Procurement and Contracts staff about sustainable purchasing options. Outreach and education will likely take many forms, such as developing green pages on the website with environmentally-certified products, sharing green features of contracts, and sharing UC San Diego goals with vendors. The website may also prioritize “green” products for increased visibility, and also market these products to buyers to encourage their selection.
- Hire one FTE staff person. A new staff person focused solely on sustainable purchasing will increase the capacity of the Procurement and Contracts staff to achieve the goals included in this document. This action is expected to cost approximately $92,250 per year, including employee benefits. Expected savings from this action are unknown.
- Improve tracking and monitoring of green purchasing and packaging reduction programs. Understanding the success of the sustainable purchasing programs requires detailed tracking of green purchases, as well as monitoring the reduction of packaging. New systems are being installed that will enable tracking and monitoring through the new Marketplace website. Additional programming may be required to estimate accurate tracking of volumes of materials diverted through strategic contracting and purchasing. Vendors and contractors may also be required to track and monitor what departments are purchasing their goods and services.
- Reduce emissions through use of consolidated procurement activities, which lowers emissions by taking advantage of full truckload purchasing. Consolidating purchasing leads to many efficiencies that will reduce emissions.

5.3 CHALLENGES

As noted above, UC San Diego is a highly decentralized campus with many buyers on campus and many vendors that do business with the school. As a result, education and outreach to all parties in the supply chain is a difficult task. To overcome this challenge, automatic messages and descriptions on the Marketplace website and through other media could begin the process of educating buyers and vendors about the sustainable purchasing programs.

Another challenge is the feasibility of same-day delivery from the central receiving plant on Trade Street. Deliveries from Trade Street are often consolidated, reducing the amount of truck traffic coming to and from the campus. However, these deliveries are sometimes not available rapidly, leading some purchasers to use vendors that do not consolidate shipments, thus increasing traffic and emissions.

In regards to purchasing paper with 50% or greater PCW content, UC San Diego has identified several challenges. As noted above, some equipment are not able to handle high PCW content; these copiers and printers often jam when paper with over 30% PCW content is used. Also, some campus users find that high PCW-content paper does not have the same characteristics as virgin paper or 30% PCW paper; for example, the 100% PCW paper it is not as bright as 30% PCW paper and doesn't bind well. In order to achieve a higher percentage of PCW paper in total paper purchases, UC San Diego will continue to test high PCW paper from different vendors. UC San Diego will also investigate the success of other institutions that have made commitments to using 100% PCW content paper, and will work to amend our goals if other institutions' programs are proven successful.

A final challenge in this area is cost. Currently 100% PCW paper is about 20% more expensive than 30% PCW paper, based on the prices of the current vendors used by UC San Diego.

6.1 INTRODUCTION

The University of California Office of the President (UCOP) has outlined the following voluntary recycling goals for all UC campuses:

- 50% waste diversion by June 30, 2008
- 75% waste diversion by June 30, 2012
- 100% waste diversion by 2020 – Zero waste

UC San Diego has instituted a single-stream recycling program for glass, paper, plastic, and metals, and is currently diverting about 67% of all solid waste from the landfill for recycling, thus reaching the first goal shown above. This diversion rate includes construction and demolition waste, which made up a large percentage of the UC San Diego waste stream (by weight) in the 2007-2008 fiscal year. In the previous fiscal year, which included virtually no construction and demolition waste, the recycling diversion rate was 37%. Additional work is needed to maintain this high diversion rate when construction and demolition activities begin to slow.

Nonetheless, campus staff has made important strides in improving and expanding the recycling programs. Currently, a pilot composting project is underway at one Housing, Dining, and Hospitality dining facility on campus known as Sierra Summit.

Some information relevant to achieving zero waste goals is included in the Procurement section of this report. For example, procurement staff purchases items that are recyclable, and staff also work to reduce the packaging of items purchased.

6.2 GOALS AND ACTIONS

Summary of Goals

1. Meet the UCOP goals outlined above, including achieving zero waste by 2020.

2. Reduce the total emissions from the life cycle of materials purchased, used, and discarded on campus, including the emissions and impacts from extracting the materials, processing materials into products, transporting products to the campus for use, and transporting waste materials for final disposal or recycling. This goal includes the intention of finding local producers for materials, as well as local markets for recycling of waste materials, when possible.

Goals and Relevant Actions

Goal:

1. Meet the UCOP goals outlined above, including achieving zero waste by 2020.

Relevant Actions:

- Improve the single-stream recycling program by updating and homogenizing containers and signage. Currently, an assortment of recycling and waste containers is spread throughout campus. In some locations, the number of recycling bins is adequate. In other locations, larger recycling bins are needed, as the ones in place are too small to handle the volume of recyclables generated. Improving the location, size, and placement of bins will improve participation in the program. Also, developing consistent signage will improve participation, as all campus community members and

visitors will better understand where to discard their recyclable waste with the proper signage posted. The goal for posting consistent signage is June 2009. The cost of this action is unknown at this time. Currently, two informal campus committees are working on implementing this action; for best results, we recommend that these committees be formalized.

- Improve waste reduction efforts. Waste reduction should occur before recycling in order to minimize the waste stream. Adding new equipment, such as high efficiency electric hand dryers in restrooms, can help reduce the waste stream. Education efforts may also focus on reducing waste through encouraging the use of durable, re-usable products whenever possible.

- Add one FTE for the recycling program. The current staff member in charge of recycling also has several other duties, and often does not have adequate time to make recycling program improvements. One additional FTE is needed; the target date for adding new staffing is June 30, 2009 and is expected to cost $80,000 per year (including employee benefits.)

- Develop a campus-wide composting program. Currently, very little food waste is composted on campus; a pilot composting project is underway at one facility, but the current composting bin does not have capacity for all the waste generated from that one facility. The exact tonnage or percentage of food waste generated at UC San Diego is unknown at this time; however, given the large number of food outlets on campus, the tonnage is likely quite high. One estimate is that one third of a pound of waste is generated for every meal served. By September 2009, UC San Diego will develop a comprehensive plan for implementing campus-wide composting. This plan will be part of the long-term Zero Waste Strategy, described in more detail below.
- Recycle all construction and demolition debris. Construction and demolition debris tends to be both heavy and bulky, in relation to other forms of waste. Almost all construction and demolition debris is recyclable and should be diverted from the landfill. Contractors and other vendors that are hauling construction and demolition debris will be required to recycle their waste and to report the tonnages of materials recycled. Next steps may include a campus-wide stakeholder discussion regarding construction and demolition debris recycling, with the goal of developing and implementing a campus-wide recycling policy for these materials.
- Supply new water fountains and water distribution stations to reduce the need for bottled water. Bottled water is considered a highly wasteful practice, considering that much bottled water does not have better water quality than local tap water, and must be contained in plastic bottles and shipped from afar to get to UC San Diego. However, as bottled water has become more available, drinking water fountains and other outlets for drinking water have become scarcer. The campus will conduct a study by September 2009 to determine the cost and feasibility of adding more drinking water outlets across campus to support the elimination of bottled water. After the feasibility study, the campus could develop an implementation plan for adding more drinking water outlets. An additional recommendation regarding bottled water is included in the Water section of this report.
- Host periodic electronic waste (e-waste) collection events. A large amount of e-waste is generated in the form of computers, printers, monitors, cell phones, and other types of e-waste. In order to prevent these items from being thrown into the trash, regularly-scheduled events are needed to capture the recyclable e-waste at UC San Diego. Currently, Environment, Health, and Safety manages the e-waste recycling program.

- Evaluate tools for improved data collection and record keeping and implement the new record keeping program. A number of groups on campus reduce waste or divert waste through their programs. For example, the Surplus Sales group takes unwanted goods and sells them to the campus and the general public. Yet, the campus does not have a thorough record of the waste amounts reduced or recycled on campus. Also, measuring the amount of materials diverted as a result of strategic contracting and purchasing requiring minimal packaging or return programs has not been accomplished. Another example is the construction and demolition debris that is recycled. These materials are not handled by the normal waste and recycling hauler, and must be counted separately. By June 2009, the campus will evaluate available tools and policies needed to improve record keeping regarding waste and recycling. By December 2010, the campus will implement the new record keeping program.
- Increase education of all staff, students, and faculty regarding the recycling program. All campus stakeholders need to be included in education efforts, since participation from all groups is needed to continue improving the recycling program. Campus users need to know how to sort their waste and place it in the proper bins, and the campus custodial staff should be regularly trained so that they properly handle the waste and recyclables.

Goal:

2. Reduce the total emissions from the life cycle of materials purchased, used, and discarded on campus, including the emissions and impacts from extracting the materials, processing materials into products, transporting products to the campus for use, and transporting waste materials for final disposal or recycling. This goal includes the intention of finding local producers for materials, as well as local markets for recycling of waste materials, when possible.

Relevant Actions:

- Develop a long-term Zero Waste Strategy and review and revise the strategy as needed. Some campus members have questioned the effectiveness and cost of the single-stream recycling program. Additional research into other options, including the cost of those options, is needed. New research is also needed to understand local and national markets for recycling, and to implement a policy requiring the use of local markets for recyclables when possible to reduce the life cycle impacts of recycling. These research results will inform a long-term Zero Waste Strategy for improvement of the recycling and composting programs, and other programs related to zero waste. The strategy will be regularly reviewed and revised based on new information and technologies available. The new zero waste strategy should be completed by December 2009. As noted above, two informal committees are currently working on improvements to the campus-wide recycling program. We recommend that these committees be formalized. These committees will likely take responsibility for development of the long-term Zero Waste Strategy.

6.3 CHALLENGES

As noted above, the recycling program is currently understaffed. Additional staff time is needed to improve and manage the program and will likely be added in the next year. Also noted above is the existence of two informal committees working on improvements to waste management and recycling. These committees should be formalized and tasked with development of the long-term Zero Waste Strategy.

Another challenge is the lack of recycling and composting facilities and markets near the UC San Diego campus. Because few facilities exist, UC San Diego may need to develop its own composting facility or partner with other local organizations to develop a composting solution. Also, local markets for certain recyclable materials do not have enough capacity to handle the waste generated, so that some recyclable materials are shipped overseas for recycling. Local and regional facilities and markets may develop in upcoming years if fuel prices rise, causing overseas shipping of recyclable materials to become cost-prohibitive. Campus staff will continue to investigate local companies and local options for handling and recycling the various waste streams generated at UC San Diego.

In some buildings on campus, sufficient space is lacking for recycling bins. The majority of buildings were constructed before the recycling program was initiated, and were not designed with recycling in mind. Consequently, certain locations do not have room for both trash and recycling bins, nor is there enough space to store the recyclables once they have been collected. Once a formal committee has been charged with working on recycling and waste management, the committee will likely research and implement solutions for this issue.

Finally, capturing data on the diversion rate is difficult. Additional data on the makeup of the waste stream are also needed to better understand what is recycled and what is thrown in the trash. The campus plans to research and implement better record keeping regarding waste and waste diversion activities to address this challenge; moreover, these data will inform future efforts to improve recycling on campus.

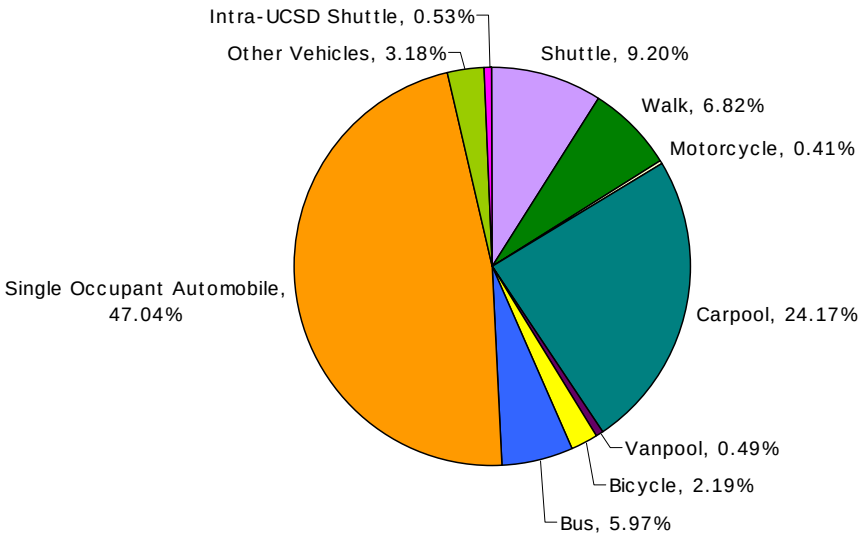
7.1 INTRODUCTION

In 2006, transportation accounted for 29% of total GHG emissions in the U.S. Transportation is also the fastest-growing source of U.S. GHG emissions, accounting for 47% of the net increase in GHG emissions in the U.S. since 1990.[16] At UC San Diego, transportation, including commuting, the campus fleet, and air travel, also composes 29% of GHG emissions (see Figure 5). The campus has several programs in place to reduce emissions and impacts from transportation.

UC San Diego has an aggressive transportation program that encourages the campus community to use alternative transportation for commuting to campus. Alternative transportation options include carpools, vanpools, bicycling, walking, and public transportation such as buses and trains. UC San Diego runs a campus shuttle around the campus, and to and from several local bus stops and the nearby train station. Also, UC San Diego runs a free bus zone for all Metropolitan Transit System (MTS) and North County Transit District buses that service the UC San Diego Main Campus area, and for MTS buses that service the Hillcrest Campus area. Free bus rides are available to any student, staff, or faculty with a valid UC San Diego identification.

Progress in reducing the number of single occupancy vehicles used for commuting has been considerable. As recently as 2001, about 67% of commuters were using single occupancy vehicles to travel to and from the Main Campus; currently, only 49% of commuters are commuting via single occupancy vehicles to and from the Main Campus. Figure 11 shows the results of the most recent cordon count (Winter 2008) and shows the current modal split among all UC San Diego commuters (including commuters from the Hillcrest Campus).

Figure 11: Transportation Modal Split for all UC San Diego Commuters



Source: Survey of Pedestrian and Vehicular Traffic Tables, UC San Diego, Winter 2008 Transportation and Parking Services

[16] U.S. EPA, see: http://www.epa.gov/OMS/climate/index.htm

Note that these data are collected by counting the number of people using each mode of transportation as they enter and leave campus. Thus, some information is not captured in these data. For example, some commuters may take a train and then use a shuttle, while others could drive alone, park elsewhere, and then use a shuttle to get to campus. However, these data are the most accurate and updated data currently available.

The campus has also purchased alternatively-fueled vehicles for the campus fleet. Alternatively-fueled vehicles include hybrids, electric vehicles, and vehicles fueled by biofuels and compressed natural gas. Currently, 37% of the campus fleet is composed of alternatively-fueled vehicles.

However, little attention has been paid to the emissions resulting from air travel, which includes travel to and from conferences, and travel for official university business. Air travel emissions do *not* include trips to and from the San Diego area for matriculating students who are traveling to and from their homes each year or semester. Emissions from air travel account for 11% of UC San Diego's total GHG emissions.

7.2 GOALS AND ACTIONS

Key goals for reducing emissions from transportation are outlined below for each category of emissions: commuting, the campus fleet, and air travel. A number of key emission reduction strategies are also identified for and described in more detail below.

7.2.1 Air Travel

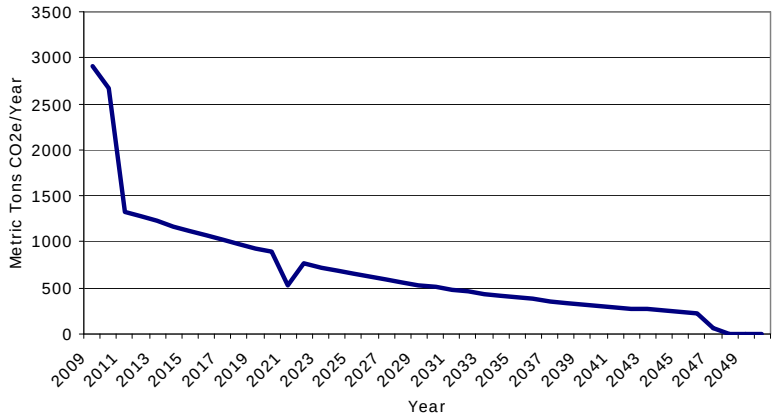
Summary of Goals:

At a minimum, reduce *per-capita emissions* from air travel by the following:

- 11% reduction each year from 2009-2010, based on the previous year's emissions
- 7% reduction each year from 2011-2020, based on the previous year's emissions
- 5% reduction each year from 2021-2050, based on the previous year's emissions.

These emission reductions are shown graphically in Figure 13 below; emission reductions are greatest from 2009 – 2010. Each year, the total emissions reduced continues to decrease because the reductions are cumulative.

Figure 12: Annual Amount of Emissions Reduced under Recommended Plan



These percentage reductions will allow UC San Diego to meet the California state target for emission reductions of 80% below 1990 levels by 2050 for air travel emissions. Under these reductions, UC San Diego will not reach the interim targets of 1990 levels by 2020 or 2000 levels by 2010 for air travel emissions. However, the plan recommended in this document will allow UC San Diego to reach overall emission reduction targets in interim years in spite of not achieving these targets with air travel emissions.

Relevant Actions:

- Replace in-person meetings with video conferences. Although meeting in person can be more effective, some meetings could be conducted over the telephone or by video conferencing. UC San Diego has video conferencing capability through the Media Center and the California Institute for Telecommunications and Information Technology (Calit2). Encouraging employees and faculty to increase videoconferencing could greatly decrease air travel emissions. In addition, video conferencing is a cost-effective option: currently, 1 hour of videoconferencing is $168, and each additional hour is $78. Many conferences and meetings are also now broadcast via webinars online. These options will also reduce the need for air travel to attend specific meetings or specific sessions at conferences.

7.2.2 Commuting

Summary of Goals

1. At a minimum, reduce the GHG emissions from commuting by 2% per year, based on the previous year's emissions, from 2009 to 2050.
2. At a minimum, reduce the percentage of commuters using single occupancy vehicles from 49% to 39% by 2018. (This goal includes commuters at the Main Campus and the Hillcrest campus.)

Relevant Actions

- Continue to advance carpool and vanpool programs. Currently, about 24% of the campus population commutes via carpool, a significant percentage. Additional room for carpools could exist, although additional study is needed. Also, only about 0.5% of the total commuting population uses vanpools. Typically, vanpools are used as a tool for commuters who live in regions that do not have convenient access to public transportation options. Offering vanpools in additional regions and publicizing the vanpool program could increase this percentage.
- Improve bicycling programs. Bicycling could be increased by improving all the facilities and infrastructure related to bicycling at UC San Diego and in the general region. Additional bicycle lanes and safe bike paths, especially to avoid on-freeway riding, in the areas near campus could also increase the percentage of commuters cycling to work. Other bicycling improvements include end-of-trip facilities at UC San Diego, such as additional showers and secure bicycle racks and storage facilities. Also, the 1993 UC San Diego Bicycle Plan at UC San Diego will be updated by 2010.

  Finally, UC San Diego has a program known as "Triton Bikes," which is a bicycle sharing program across campus. Students, faculty, and staff can register with Triton Bikes and then access a free bike, helmet, and lock. However, the program has not been highly utilized. Increasing participation in the program could involve adding more

bicycle sign-out locations, and additional publicity for the program. This program has the capacity to reduce short car trips around or near the campus.

- Improve Local Public Transportation Options and Infrastructure. In 2006, UC San Diego staff conducted a survey of commuters' attitudes toward driving and alternative transportation options. According to the data gathered in this survey, respondents who commute by driving reported that they have considered using alternative transportation, including public transit, carpooling, vanpooling, and other options. The reasons respondents provided for not using alternative means of transportation included "reduced flexibility coming and going to work or school" (69% of respondents) and "increased travel time" (65% of respondents).[17] These data reveal that continuing to improve and expand alternative transportation programs to provide more flexibility and reduced travel time could have a positive effect on increasing participation in these programs. Although local public transportation options and infrastructure are not under the control of UC San Diego, the campus can work with local transit agencies to encourage new options and infrastructure. Thus, UC San Diego will continue to lobby for programs that maximize the number of commuters using public transportation.

  Although a number of local buses and a local commuter train service the UC San Diego area, current plans exist to add more transit service to UC San Diego. One planned service is the "Super Loop," a new two-way circular bus transit system. The Super Loop will include priority traffic treatments to allow the Super Loop vehicles to move through traffic more rapidly than traditional buses. The Super Loop will begin operations in Spring 2010.[18]

  Another new planned service is extending the San Diego Trolley to the UC San Diego region via the Mid-Coast Trolley line. This new service would connect UC San Diego to the region's light rail system, eliminating the need to use buses to connect to the light rail system while increasing connectivity and reducing travel time. The light rail extension is due to be constructed beginning in 2012, with trolley service starting as soon as 2015, and no later than 2018.[19]

- Increase Telecommuting and Use of Flexible Work Hours. Currently, UC San Diego offers telecommuting and a flexible work hour program to employees. Eligible employees may sign up for the program and work with their supervisor to select a schedule to fit their needs. Current data regarding the utilization of the program are unavailable. We recommend that the campus gather data regarding the number of employees that use the program. These baseline data should then inform future efforts to expand the programs. Increasing awareness about the program among employees and supervisors could increase the participation rates in the program.

- Increase housing to accommodate more than 50% of the student population. The current Long Range Development Plan (LRDP) calls for the campus to build new housing so that 50% of eligible students may be housed on campus. Additional housing has the advantage of reducing the need for additional parking and transportation

[17] UCSD Commuting Survey, Survey Findings. Provided by the Assistant Director, Transportation and Parking Services.

[18] See the following SanDag website for more information: http://www.sandag.org/index.asp?projectid=293&fuseaction=projects.detail

[19] See the following SanDag website for more information:

http://www.sandag.org/index.asp?projectid=250&fuseaction=projects.detail

services, but adds GHG emissions and other impacts at each new building. However, increasing housing capacity is generally viewed as a positive strategy for reducing transportation impacts as well as the total footprint for the region, and should be considered after the purview of the LRDP ends in 2020. There also may be an advantage to considering increasing the housing capacity before the purview of the LRDP ends in 2020. Future considerations will include the student and staff demand for additional housing, as well as the overall environmental impacts of adding more housing.

7.2.3 The Campus Fleet

Summary of Goals

1. Reduce campus fleet emissions by at least 4.7% per year, based on the previous year's emissions, until 2020.
2. Reduce campus fleet emissions by at least 4.0% per year, based on the previous year's emissions, from 2021-2050.

(Note: The campus reduced emissions from the campus fleet by 4.7% from 2006 to 2007; thus, the goal from 2009-2020 is to reduce emissions by at least this percentage annually. After 2020, the percentage reduction will fall to 4.0%.)

Relevant Actions

- Replace Gasoline-Powered Vehicles with Alternatively-Fueled Vehicles. UC San Diego will continue to phase out the use of gasoline-powered vehicles, and will replace them with alternatively-fueled vehicles. Currently, plans are being made to build a campus compressed natural gas and hythane fueling station. In addition, all propane or gasoline-powered carts will be replaced by electric vehicles by 2012.

  The average life of a vehicle is about 13 years, according to the U.S. Department of Transportation. Thus, within 13 years, UC San Diego could potentially replace all gasoline-powered vehicles with alternatively-fueled versions. Some of these vehicles will still emit GHGs by burning natural gas or small amounts of gasoline (in the case of hybrids), but the total emissions from these vehicles will be greatly reduced.

- Optimize Fleet Usage. Many departments on campus own and operate their own vehicles. However, there could be opportunities for car-sharing among campus groups. In addition, UC San Diego may find opportunities to use current vehicles more effectively. For example, a pickup truck is not needed to transport a small item across campus. We recommend that UC San Diego perform a study to better understand fleet usage, and to research the possibility of instituting car-sharing among departments on campus.

7.3 CHALLENGES

Reducing the emissions from transportation will be challenging, given the planned growth in the campus population expected over the next several years. In addition, the campus will need to address the challenge of financing additional transportation options. Currently, the alternative transportation programs are all financed through parking fees. Reducing the number of campus commuters who drive and park will likely reduce the income that is available to fund the alternative transportation programs. Thus, the campus Transportation and Parking Department may need to revise parking fees or find new sources of funding for

the alternative transportation programs. One potential alternative funding source is student fees, which are used to fund alternative transportation programs at other UC campuses. Another potential funding source is increased user fees. The campus will be completing a Transit Funding Study in the upcoming year to analyze these issues in more depth.

Another key challenge is that public transportation decisions are outside of UC San Diego's control. Campus leaders will need to work with other agencies and groups to expand public transportation to the area in a responsible fashion.

In the area of air travel, a key challenge has been gathering accurate data. UC San Diego staff are currently working with the travel agency contracted by the campus to gather data on air travel in order to calculate air travel emissions. However, travel arrangements are managed separately by administrative staff in each department on campus, and some staff may not be using the contracted travel agent. Thus, gathering accurate data is a difficult task. However, a new, centralized database is being developed for travel arrangements, which may help facilitate data collection for air travel.

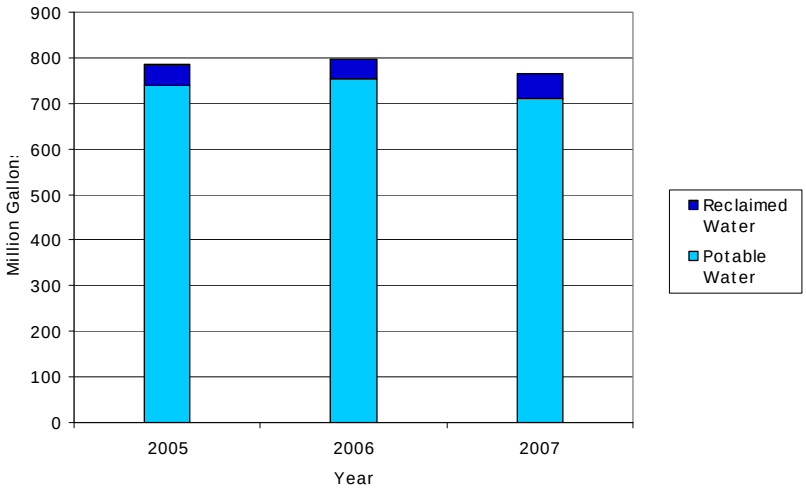
Finally, due to campus class schedules, the Transportation and Parking Department has noted that peak parking occurs from Tuesday-Thursday. Parking needs are greater during these days than other days, and parking capacity must be available to meet the parking demand during peak days. However, this parking capacity is then underutilized on other days. Reducing the need for parking on Tuesdays, Wednesday, and Thursdays by offering more classes and scheduling other activities on Mondays and Fridays could reduce the need for additional parking on campus.

8.1 INTRODUCTION

About 80-90% of San Diego's water supply is imported from either the Colorado River (via a 242-mile-long aqueduct from Lake Havasu) or from Northern California (via the 444-mile-long California Aqueduct). Water supplies from the Colorado River and from Northern California could be endangered due to the effects of climate change. With both sources, UC San Diego is located at or near the end of the water system. In addition, San Diego only receives an annual average rainfall of about 12 inches per year. Because the area depends on uncertain supplies of imported water, water conservation and efficiency will continue to be important topics at UC San Diego.

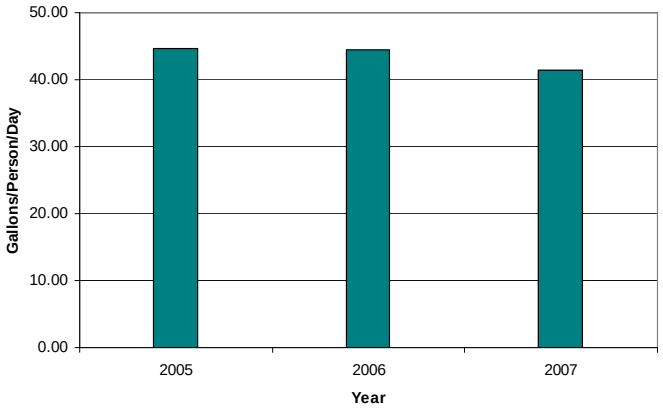
UC San Diego's water usage has remained relatively steady in recent years at about 750-800 million gallons per year. Of that amount, about 6-7% is reclaimed water used for irrigation. See Figure 13 for a summary of potable and reclaimed water usage. The slight decrease from 2006 to 2007 represents a 4% reduction in water usage.

Figure 13: UC San Diego Water Usage



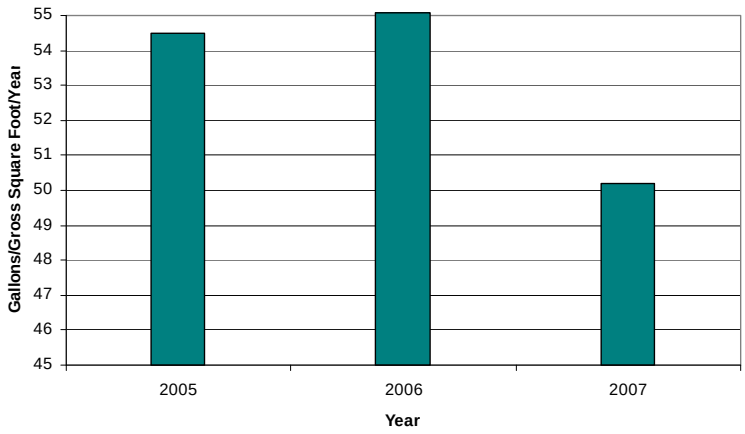
The Sustainability Assessment Report also found that per capita water usage has declined slightly, from 44 gallons per person per day to about 41 gallons per person per day, which is a decrease of 7% from 2005 and 2007. See Figure 14 for data regarding water usage per person per day.

Figure 14: UC San Diego Water Usage Per Person Per Day



Similarly, water usage per gross square foot of building space has declined in recent years. Between 2005 and 2007, water usage per gross square foot has decreased by about 8%. See Figure 15 for a graph illustrating water usage per gross square foot per year.

Figure 15: UC San Diego Water Usage per Gross Square Foot of Building Space per Year



Also, about a third of the water fixtures on campus are water-efficient models; thus, an opportunity exists to retrofit older buildings with newer, more efficient water fixtures.

Perhaps the most important task ahead is education and awareness regarding water usage. Changing the behavior of the campus community through increased education regarding water conservation has the potential to sharply reduce usage.

Also, additional research is needed to understand exactly where and how water is being used on campus. Water usage is not well tracked on campus, with only about 54% of buildings installed with a meter for water usage. In comparison, about 95% of buildings have a meter for natural gas and electricity usage. Water is also connected to energy use on campus, since energy is used for pumping water and for other water devices. Thus, reducing water usage through efficiency programs will reduce energy usage and energy-related emissions.

Finally, stormwater runoff is an issue of importance at UC San Diego. One method used to reduce stormwater runoff is implementation of Low Impact Development, which also reduces the water used for landscape irrigation. One definition of Low Impact Development is "a sustainable landscaping approach that can be used to replicate or restore natural watershed functions and/or address targeted watershed goals and objectives."[20] Low Impact Development is used in this document as a recommended action to reduce stormwater runoff and to reduce the amount of water used for landscape irrigation.

[20] Greening EPA Glossary: http://www.epa.gov/oaintrnt/glossary.htm#l

8.2 GOALS AND ACTIONS

Summary of Goals

1. Continue to reduce overall water usage by 4% per year while increasing usage of reclaimed water, if possible.
2. Sub meter 100% of buildings for water usage. Buildings with potential for behavior change will be prioritized, such as dorms.
3. Sub meter 100% of water used for landscaping.

Goals and Relevant Actions

Goal:

1. Continue to reduce overall water usage by 4% per year while increasing usage of reclaimed water

Relevant Actions:

Actions in this section of the report are divided into the following categories: General Actions, which relate to central water usage or water usage in buildings across campus; and Landscaping Actions, which refer specifically to irrigation of landscaping; and Education and Outreach Actions.

General

- Expand the reclaimed water system to the Central Utility Plant. Potable water is not needed for the applications in the Central Utility Plant, but reclaimed water could be used for these utilities. The expected timeline for completion is 3 years, and the potential cost is $1-2 million. Potential savings from reduced usage of potable water are unknown. However, future development of indirect potable reuse projects is possible; this process treats recycled water to meet potable water standards and blends it with untreated water supplies. If indirect potable reuse projects are implemented, then it may not be beneficial to consider reclaimed water for use in the Central Utility Plant.
- Continue with installation of irrigation water meters and associated water management equipment to increase accuracy and control over water use within the landscaping.
- Explore additional technologies and opportunities for using reclaimed water. UC San Diego is already exploring some additional opportunities for using reclaimed water, such as capturing and reusing condensate from heating, ventilation, and air conditioning systems, and performing fog capture. New technologies will continue to be evaluated in terms of cost and overall environmental benefits and implemented when possible.
- Develop purchasing standards for water fixtures. As noted above, about a third of the buildings on campus, mostly the newer buildings, have water efficient fixtures installed. The campus has an opportunity to take advantage of new technology available in ultra-efficient fixtures in all new buildings that will be constructed in the next few years, and in buildings that are retrofitted. Newer fixtures do show significant water savings. For example, a former standard for aerators for lavatory sinks is 2.0 gallons per minute. Newer fixtures achieve a flow rate of 0.5 gallons per minute, while still allowing enough flow for hand washing and other uses. Creating purchasing standards for new fixtures will limit campus buyers to the most efficient models. These purchasing standards should be developed within 6 months and should be required for all new fixtures.

- Assess future building and new landscaping projects for water usage before construction. All new buildings constructed at UC San Diego will be certified at a LEED Silver or higher standard. The LEED standard does include consideration of water usage, but additional assessment may be needed to measure and reduce potential water usage at new projects.
- Obtain a commitment from the administration to allow all bottled water contracts to expire. To many, single-serving bottled water has become a symbol of consumerism and waste. Most bottled water is not local, and must be packaged in plastic bottles and shipped long distances to come to market. Eventually eliminating bottled water from campus will send a message to the campus community to conserve resources by carrying reusable water bottles and using water fountains. The commitment from the campus administration to allow bottled water contracts to expire is the first step toward eliminating bottled water from campus. The commitment should be obtained in 6 months.
- Supply new water fountains and water distribution stations to reduce the need for bottled water. This action is also included in the "Recycling and Waste Minimization" section of this report. Bottled water is considered a highly wasteful practice, considering that much bottled water does not have better water quality than local tap water, and must be contained in plastic bottles and shipped from afar to get to UC San Diego. However, as bottled water has become more available, drinking water fountains and other outlets for drinking water have become scarcer. The campus will conduct a study by September 2009 to determine the cost and feasibility of adding more drinking water outlets across campus to support the elimination of bottled water. After the feasibility study, the campus could develop an implementation plan for adding more drinking water outlets.

Landscaping

- Expand the reclaimed water system to landscape areas adjacent to North Point Entry and future Central Plant distribution pipe lines. When the reclaimed water system is expanded to the Central Utility Plant, the new expansion could also supply reclaimed water to additional landscaped areas. The expected timeline for completion is 3 years. As noted above, it is possible that the campus will participate in indirect potable reuse programs, which treat recycled water to meet potable water standards for blending with untreated water supplies. If indirect potable reuse projects are implemented, then reclaimed water may not be used for landscaping irrigation.
- Analyze the amount of water used in unmetered areas. Most outdoor areas that use water for landscaping are not metered. Thus, the campus staff have only rough estimates of the amount of water used for landscaping. Water usage in landscaped areas will be analyzed where building and landscape usage cannot be separately metered. Gathering data on where, when, and how water is used for landscaping will help to inform future irrigation policies and conservation efforts.
- Develop a Landscape Irrigation Watering Strategy and Outreach Plan. The Landscape Irrigation Watering Strategy and Outreach Plan will outline best practices for landscape irrigation, as well as a plan for educating landscaping staff regarding best practices. Some best practices are, for example, to water only in the early morning or late afternoon hours to avoid evaporation. Another best practice is to irrigate landscaping according to the amount of water needed, based on the type of plantings and the actual moisture in the soil. The Landscape Irrigation Watering Strategy and Outreach Plan should be completed within 1 year.

- Within 6 months, identify turf areas to convert to low impact development and convert 25% of identified areas to low impact development in 3 years. Continue to reprioritize areas for turf replacement. According to the Building and Landscape Services Assistant Director, about 84 acres of turf are planted on the UC San Diego campus. The majority of the turf areas are for specific programmed-functional uses. These turf areas include landscaped areas on the Main Campus and at all UC San Diego-owned housing areas. Also, remnant turf from older developments remain. Many of these areas could be converted to low impact development, a type of landscaping that uses significantly less water than turf, in addition to reducing stormwater runoff. This action is expected to cost $10 per square foot of area converted; the initial cost to convert 25% of identified areas is $450,000. However, converting these areas will create approximately $18,000 in annual savings through reduced water usage. If water prices rise, these savings will continue to increase. Currently, UC San Diego pays $4-5 for one hundred cubic feet of water, which is equal to 748 gallons.

- Continue to replace non-native plants with native or drought-tolerant species, when possible. Replacing non-native plants with species that naturally require less water is a simple way to reduce water usage while still providing landscaping across the campus. This action applies to non-turf areas that are planted with non-native species.

Education and Outreach

- Perform outreach to 100% of incoming students and post signage with sustainability/conservation messages. Education to the campus community will be crucial, especially for students and others who live in campus housing. Campus signage could include reminders to conserve water, to conserve energy, and other information regarding campus efforts to conserve. This strategy should be implemented in 1 year. Outreach will likely be overseen by the ACS, and will stress ongoing behavioral changes that the campus community can take to reduce water usage.

Goal:

2. Sub meter 100% of buildings for water usage. Buildings with potential for behavior change are prioritized, such as dorms.
3. Sub meter 100% of water used for landscaping.

Relevant Action:

- Purchase and install water meters in all buildings and in areas where water is used for landscaping. The estimated cost to purchase water meters for all buildings is $5-8 million. The cost to purchase meters for outdoor areas is unknown. In order to implement this strategy, more data are needed regarding the exact number of meters needed for both buildings and landscaped areas.

8.3 CHALLENGES

As with all areas, reducing water usage will be challenging given planned campus growth, both in the number of new buildings constructed, and in population growth.

One challenge is related to expectations regarding landscaping. Some campus users have come to expect “traditional” landscaping, including turf, to beautify the campus. Expectations in this regard must change if the campus is to continue reducing water usage.

Another challenge lies in education and awareness-raising. Ongoing reductions through behavior change will be necessary for reducing water demand. However, reaching the entire campus population (currently over 50,000 persons) is a daunting task. The education and outreach program will begin with educating incoming students and will eventually expand to all students and all staff and faculty. External resources and partners will likely help address this challenge. For example, one potential resource is the educational programs at the San Diego County Water Authority.

A final challenge lies in financing. Water has traditionally been quite inexpensive in the state of California. Conservation programs may not be cost-effective when the cost of water is so low. However, water prices have been increasing over the past 15 years, and one report predicts that water prices could rise by 40% between 2000 and 2030.[21] The result of higher water prices is that the economics of conservation and efficiency programs will continue to grow more favorable over time.

[21] Gleick, Peter, Cooley, H., and Groves. D. *California Water 2030: An Efficient Future.* Pacific Institute, September 2005.

Appendix I: Attendees of Climate Action Plan Focus Groups

Faculty and Administration

Steve Cassedy	Associate Dean, Office of Graduate Studies
Dana Dallstrom	Lecturer, Computer Science and Engineering
Ivan Evans	Associate Professor, Sociology
Sarah Gille	Professor, Scripps Institution of Oceanography and Mechanical and Aerospace Engineering
Kim Griest	Professor, Physics
Jan Kleissl	Assistant Professor, Mechanical and Aerospace Engineering
Janice Klippel	Assistant Vice Chancellor, SVC Academic Affairs
Paul Linden	Chair, Mechanical/Aerospace Engineering; Director, Environment and Sustainability Initiative; Professor Mechanical/Aerospace Engineering
Keith Pezzoli	Faculty, Urban Studies and Planning
Robert Pomeroy	LPSOE, Chemistry and Biochemistry
Kaustuv Roy	Professor, Ecology, Behavior, & Evolution
Lynn Russell	Professor, Scripps Institution of Oceanography/CAPPO
Barbara Sawrey	Associate Vice Chancellor, Academic Affairs; Vice Chair for Education, Chemistry & Biochemistry
Lisa Shaffer	Executive Director, Environment and Sustainability Initiative
Susan Smith	Provost, Muir College
George Tynan	Professor, Mechanical and Aerospace Engineering; Associate Vice Chancellor, Research

Staff

Todd Adams	Senior Manager, Procurement & Contracts
Wendy Hunter Barker	Deputy Director, Finance & Operations
Donna Bean	President, Associated Students
Steve Benedict	Director, Environment, Health, & Safety
Diana Bergen	Landscape Architect, Facilities Management
Kristin Blackler	Analyst, Environment and Sustainability Initiative
Kim Carnot	Senior Manager, Business Contracts, Procurement & Contracts
Don Chadwick	Director, Sports Facilities
Linda Collins	Senior Director, Procurement & Contracts

Staff

DeAnn Coombs	Associate Director, Housing, Dining, and Hospitality, Procurement & Contracts
Sam Corbett	Assistant Director, Transportation and Parking Services
Lourdes Dawson	Business Officer, Sports Facilities
John Dilliot	Energy Manager, Facilities Management
Larry Fox	Director, IMPRINTS
Krista Francis	Sustainability Manager, Housing, Dining, and Hospitality
Alfonso Gomez	Supervisor, Sports Facilities
Julie Hampel	Environmental Manager, Environment, Health, & Safety
Ted Johnson	Director, Procurement & Contracts Operations
Gary R. Jones	Operations Manager, Facilities Management
Lisa Kaczmarczyk	Chief Technology Officer, Sixth College
Chuck Morgan	Assistant Director, Facilities Management
Greg Nishihira	Business Manager, Fleet Services, Facilities Management
Alonso Noble	Assistant Superintendent, Facilities Management
John Payne	Associate Director, University Centers
Jana Severson	Assistant Director, Housing, Dining, and Hospitality
Patti Seyfert	Facility Planner, Vice Chancellor Student Affairs
Maggie Souder	Campus Sustainability Coordinator
Bernard Thompson	Custodial Services Manager, University Centers
Stephen Thompson	Associate Director, Maintenance, Housing, Dining, and Hospitality
Ron Van Boxtel	Facilities Manager, Scripps Institution of Oceanography
Dave Weil	Assistant Director, Facilities Management
Bob Wintringer	Project Manager, Storehouse

Students

Ashley Ferrer	Student
Michelle Kizner	Undergraduate Student; Green Campus Intern, Facilities Management
Erika Kociolek	Graduate Student
Meagan Moore	Graduate Student
June Reyes	Student; Green Campus Intern, Facilities Management

Students

Chris Westling	Undergraduate Student; Academic Senator; Member, Social & Environmental Sustainability Committee; Member, One Earth, One Justice
Melanie Zauscher	Graduate Student; Member, Graduate Student Association; Member, Advisory Committee on Sustainability

Consultants

Amy Jewel	Sustainability Consultant, URS Corporation
Byron Washom	Director, UC San Diego Strategic Energy Initiatives

Appendix II: Summary of Goals, Actions, Costs, and Savings

Table 3: Academics and Research – Goals, Actions, Costs, and Savings

Academics and Research		
Goals	**Actions**	**Costs and Savings**
1. Wherever possible, include sustainability in the curriculum for undergraduates.	• Work with the Advisory Committee on Sustainability (ACS) to develop a campus definition of sustainability that is agreeable to the Academic Senate. • Working with the Academic Senate and other key groups, incorporate sustainability into the existing curriculum at all six undergraduate colleges through new labs, problem sets, guest lectures, or other means, where possible.	Cost: Staff and faculty time Savings: None expected
2. Continue to expand elective sustainability courses and other educational opportunities.	• Continue to offer Sustainability Across the Curriculum Workshops. • Continue to develop new electives, such as a new multidisciplinary course with exciting guest speakers. • Develop new opportunities for supervised independent study and research (199 courses) with sustainability curriculum development. • Create a database populated with actual campus sustainability data. • Create a "Sustainability Walk" to expand campus sustainability outreach efforts.	Cost: Staff and faculty time Savings: None expected
3. Connect students, staff, and faculty interested in collaborating on campus sustainability projects and develop tools for faculty and students to use in their classes and research.	• Improve existing websites containing information regarding sustainability courses, research, internships, and other opportunities on campus. • Develop a Sustainability Resource Center to connect students, faculty, and staff, and resources in a central location.	Cost: Staff and faculty time Savings: None expected

Academics and Research		
Goals	**Actions**	**Costs and Savings**
4. Develop tools to track and measure student attitudes and knowledge of sustainability, as well as sustainability course offerings and enrollment data.	• Develop and administer a before-and-after survey to measure student attitudes and knowledge of sustainability, and/or add sustainability questions to the existing senior exit survey. • Develop tools to track course offerings in sustainability, potentially by creating a standard designation for sustainability courses and seminars in the course catalog. • Develop tools to track the total number of individual students enrolled in sustainability courses.	Cost: Staff and faculty time Savings: None expected
5. Develop tools to track and measure sustainability research projects and funding for those projects.	• Develop a definition for "sustainability research projects" and create tracking mechanisms for these projects.	Cost: Staff and faculty time Savings: None expected

Table 4: Energy and Climate – Goals, Actions, Costs, and Savings

Energy and Climate		
Goals	**Actions**	**Costs and Savings**
1. Reduce UC San Diego's GHG emissions as follows: • 2000 levels by 2013; • 1990 levels by 2020; • Climate neutral by 2025.	• Implement various energy efficiency projects and retrofits to buildings. • Implement other efficiency projects. • Install renewable energy. • Perform outreach to all campus community members. • Promote teleconferencing and video conferencing.	Cost of Energy Efficiency: 5-7 cents per kwh saved Cost of Renewable Energy: 12-16 cents per kwh generated Cost of Outreach: Staff time Teleconferencing and video conferencing: Unknown costs and savings when widely implemented Other actions: Unknown costs and savings

Table 5: Operations – Goals, Actions, Costs, and Savings

Operations		
Goals	**Actions**	**Costs and Savings**
1. Improve performance of all campus buildings in terms of energy usage and water usage.	• Improve the data in the FacilitiesLink Building database. • Continue to implement "preventative maintenance."	Costs: Unknown Savings: Unknown
2. Reduce the impacts of cleaning supplies.	• By 2009, use 100% Green Seal-certified cleaning supplies. • By 2009, use only cleaning supplies purchased in bulk and diluted before use. • By 2009, convert to reusable rags and recycled paper alternatives for cleaning and maintenance. • Research green cleaning supplies that are currently available and convert to them when possible.	Costs: Unknown Savings: Unknown
3. Establish as a standard LEED Gold for all new buildings, achieving LEED Silver where LEED Gold is not possible. 4. Continue to certify buildings under the LEED-EB program. The campus will work to establish a targeted number of buildings to certify annually.	• Prioritize order in which LEED-EB certification is accomplished.	Costs: Unknown Savings: Unknown

Table 6: Procurement – Goals, Actions, Costs, and Savings

Procurement		
Goals	**Actions**	**Costs and Savings**
1. Achieve 50% PCW recycled content in all paper purchases by 2012. This goal represents an increase in PCW content of paper purchases of about 8% per year.	• Require purchase of at least 30% PCW recycled paper. Ban use of virgin paper unless specifically authorized by the departmental chair or dean. • Research available recycled paper and work with vendors to offset higher cost of high PCW content paper.	Costs: No additional costs Savings: No additional savings
2. Reduce per capita paper usage from 1,568 to 1,066 sheets per person per year by 2012; this goal represents an annual reduction of 8% per year from 2009-2012, and a total reduction of 32%.	• Utilize e-versions instead of paper versions for all reports. Archive reports in PDF formats. • Research the possibility of using centralized, multi-function printers to reduce paper usage and to reduce the amount of equipment in use • Mandate purchases of duplex capable printers and set all defaults to duplex.	Costs: No additional costs Savings: Unknown savings to occur from reduced equipment purchases and reduced paper usage
3. Reduce the total amount of printers, copiers, and other applicable electronic equipment purchased and used. 4. Improve the energy efficiency of all computers, printers, copiers, and other equipment used, using the guidelines from the new Climate Savers program.	• Institute a policy requiring a review process for non-standard computer equipment configurations, e.g. multiple monitors, personal printers. • Implement the requirements of the Climate Savers program	Costs: Unknown Savings: Unknown

Procurement		
Goals	**Actions**	**Costs and Savings**
5. Increase spending on appropriate green vendors and products. 6. Reduce the total emissions from the life cycle of materials purchased, used, and discarded on campus, including the emissions and impacts from extracting the materials, processing materials into products, transporting products to the campus for use, and transporting waste materials for final disposal or recycling. This goal includes the intention of finding local producers for materials, as well as local markets for recycling of waste materials, when possible. This goal is also related to Recycling and Waste Minimization.	• Perform a survey on Marketplace regarding green vendors. • Highlight environmentally-preferred vendors on Marketplace and ensure that the first option for any product is the environmentally-preferred option. • Perform outreach to users and buyers. • Hire one FTE staff person. • Improve tracking and monitoring of green purchasing and packaging reduction programs. • Reduce emissions through use of consolidated procurement activities, which lowers emissions by taking advantage of full truckload purchasing.	Costs: Cost of one FTE staff person: $92,250 per year. Other costs unknown. Savings: Unknown savings from green products, consolidated purchases, and other activities.

Table 7: Recycling and Waste Minimization – Goals, Actions, Costs, and Savings

Recycling and Waste Minimization		
Goals	**Actions**	**Costs and Savings**
1. Meet the UCOP goals outlined above, including achieving zero waste by 2020	• Improve the single-stream recycling program by updating and homogenizing containers and signage. • Improve waste reduction efforts. • Add one FTE for the recycling program. • Develop a campus-wide composting program. • Recycle all construction and demolition debris. • Supply new water fountains and water distribution stations to reduce the need for bottled water. • Host periodic electronic waste (e-waste) collection events. • Evaluate tools for improved data collection and record keeping and implement the new record keeping program. • Increase education of all staff, students, and faculty regarding the recycling program.	Costs: Cost of one FTE for the recycling program: $80,000/year. Other costs unknown. Savings: Savings from reduced waste and waste removal costs are unknown.
2. Reduce the total emissions from the life cycle of materials purchased, used, and discarded on campus, including the emissions and impacts from extracting the materials, processing materials into products, transporting products to the campus for use, and transporting waste materials for final disposal or recycling. This goal includes the intention of finding local producers for materials, as well as local markets for recycling of waste materials, when possible.	Develop a long-term Zero Waste Strategy and review and revise the strategy as needed.	Costs: None expected from developing the Zero Waste Strategy Savings: None expected from developing the Zero Waste Strategy

Table 8: Transportation – Goals, Actions, Costs, and Savings

Transportation: Air Travel		
Goals	**Actions**	**Costs and Savings**
1. At a minimum, reduce *per-capita emissions* from air travel by the following: • 11% reduction each year from 2009-2010, based on the previous year's emissions • 7% reduction each year from 2011-2020, based on the previous year's emissions • 5% reduction each year from 2021-2050, based on the previous year's emissions.	• Replace in-person meetings with video conferences.	Costs: 1 hour of videoconferencing is $168, and each additional hour is $78. Savings: Some savings may be available, depending on travel and hotel costs compared to video conferencing costs.
Transportation: Commuting		
Goals	**Actions**	**Costs and Savings**
1. At a minimum, reduce the GHG emissions from commuting by 2% per year, based on the previous year's emissions, from 2009 to 2050. 2. At a minimum, reduce the percentage of commuters using single occupancy vehicles from 49% to 39% by 2018. (This goal includes commuters at the Main Campus and the Hillcrest campus.)	• Continue to advance carpool and vanpool programs. • Improve bicycling programs. • Improve Local Public Transportation Options and Infrastructure. • Increase Telecommuting and Use of Flexible Work Hours. • Increase housing to accommodate more than 50% of the student population.	Costs: Unknown Savings: Unknown

Transportation: The Campus Fleet		
Goals	**Actions**	**Costs and Savings**
1. Reduce campus fleet emissions by at least 4.7% per year, based on the previous year's emissions, until 2020. 2. Reduce campus fleet emissions by at least 4.0% per year, based on the previous year's emissions, from 2021-2050.	• Replace Gasoline-Powered Vehicles with Alternatively-Fueled Vehicles. • Optimize Fleet Usage.	Costs: Unknown Savings: Unknown

Table 9: Water – Goals, Actions, Costs, and Savings

Water		
Goals	**Actions**	**Costs and Savings**
1. Continue to reduce overall water usage by 4% per year while increasing usage of reclaimed water, if possible.	• Expand the reclaimed water system to the Central Utility Plant. • Continue with installation of irrigation water meters and associated water management equipment to increase accuracy and control over water use within the landscaping. • Explore additional technologies and opportunities for using reclaimed water • Develop purchasing standards for water fixtures. • Assess future building and new landscaping projects for water usage before construction. • Obtain a commitment from the administration to allow all bottled water contracts to expire. • Supply new water fountains and water distribution stations to reduce the need for bottled water. • Expand the reclaimed water system to landscape areas adjacent to North Point Entry and future Central Plant distribution pipe lines. • Analyze the amount of water used in unmetered areas. • Develop Landscape Irrigation Watering Strategy and Outreach Plan. • Within 6 months, identify turf areas to convert to low impact development and convert 25% of identified areas to low impact development in 3 years. Continue to reprioritize areas for turf replacement. • Continue to replace non-native plants with native or drought-tolerant species, when possible. • Perform outreach to 100% of incoming students and post signage with sustainability/conservation messages.	Costs: The cost to expand the reclaimed water to the Central Utility Plant is $1-2 million. The cost to convert 25% of identified turf areas to low impact development is $450,000. Other costs are unknown. Savings: The savings from converting 25% of identified turf areas to low impact development are $18,000/year. Significant savings from reduced water usage are expected from other actions, but total savings are unknown.

Water		
Goals	**Actions**	**Costs and Savings**
2. Sub meter 100% of buildings for water usage. Buildings with potential for behavior change will be prioritized, such as dorms. 3. Sub meter 100% of water used for landscaping.	Purchase and install water meters in all buildings and in areas where water is used for landscaping	Costs: The cost to install water meters in all buildings is estimated at $5-8 million. Savings: Savings are expected from reduced water usage by improved management of water once meters are installed. Total savings are unknown.

Appendix III: Assumptions for Business as Usual (BAU)

Base Case for GHG Emissions at UC San Diego

Assumptions:

- Emissions from new buildings for 2009-2020 are based on current construction plans for new buildings.
- Emissions from new buildings for 2021-2050 are based on an annual emissions percentage growth of 0.5% per year.
- Emissions from "load creep" includes both additional users in each building, as well as additional devices and equipment that are plugged in to electrical outlets each year. Normally, load creep grows at about 3% per year, but the BAU estimates this growth at 1% per year, based on behavior changes from ongoing conservation education (which is already occurring on campus).
- BAU growth in air travel emissions is based on an annual percentage growth of 2.29%, which is the average growth percentage from 1990-2007. This percentage is based on emissions estimates that are tied to campus population data from that time period, and actual data from the 2007 GHG reporting year.
- BAU growth in commuting emissions is based on an annual percentage growth of 2.12%, which is the average growth percentage of estimated emissions from 1990-2007. This percentage is based on emissions estimates that are tied to campus population data from that time period, and actual data from the 2003-2007 GHG reporting years.
- BAU growth in emissions from the campus fleet is based on an annual percentage growth of 2.1%, which is the average growth percentage of estimated emissions from 1990-2007. This percentage is based on emissions estimates that are tied to campus population data from that time period, and actual data from the 2004-2007 GHG reporting years.
- Fugitive emissions (emissions from refrigerants and air conditioner units) did not decline, but remained a steady percentage of overall emissions at 0.6%.