CSULB CLIMATE ACTION PLAN

Transforming today for a better tomorrow

California State University, Long Beach

December 2014

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I am pleased to submit California State University, Long Beach's Climate Action Plan.

Climate change is real and will lead to devastating consequences for people, wildlife, the environment, and the economy unless we address it now. That's why CSULB made a commitment to reduce campus greenhouse gas emissions and achieve climate neutral operations as soon as possible—with the goal of reaching climate neutrality by 2030. We join nearly 700 other colleges and universities in this endeavor, as signatories to the American College and University Presidents' Climate Commitment (ACUPCC).

As a university located on California's coast, we must be particularly concerned about the role of climate change on rising sea levels, acidification of the ocean, and increasingly volatile weather events. We've already done a lot to reduce our CO2 emissions down to 60,000 metric tons annually. Energy efficiency in buildings, renewable solar energy, alternative transportation and green building programs have resulted in the elimination of nearly 16,000 metric tons of campus greenhouse emissions per year. But we must do more.

The Climate Action Plan—developed by dedicated faculty, students and staff on our Sustainability Task Force—outlines ambitious strategies to achieve the kind of reductions needed to meaningfully address the climate crisis. Mitigation efforts include scaling up and sustaining an aggressive energy efficiency and renewable energy program, implementation of our transportation demand management plan to cut CO2 emissions from commuting, transitioning to clean fuel for our fleet vehicles, landfill waste reduction, eliminating fluorinated gases in our operations and procurement processes that reflect a commitment to ecologically responsible products.

Our campus is a living laboratory for sustainability. Research by faculty and students will add to scientific knowledge and accelerate the progress of current mitigation efforts. Courses that emphasize the role humans play in contributing to climate change and the potential that exists for finding solutions will equip our students, faculty, staff and alumni to become champions for climate-neutral lifestyles.

Thanks to ACUPCC for organizing this important effort and to my fellow presidents across the nation for joining the cause. I'm convinced that our combined strength and serious commitment will help save our planet.

Sincerely,

Jane Close Conoley
President

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EXECUTIVE SUMMARY

In 2013, Working Group 1 of the Intergovernmental Panel on Climate Change (IPCC) delivered 3 key messages from their findings: 1) the warming of the Earth's climate is unequivocal, 2) human influence on the climate system is clear, and 3) continued greenhouse gas emissions will cause further climate change. These findings led the IPCC to conclude that limiting climate change will require substantial and sustained reductions in greenhouse gas emissions.

What is Climate Change?

Climate change is a global problem with national, regional and local implications. According to the National Climate Assessment (NCA) released this year, every region in the US will experience negative effects of climate change including more extreme weather events, water and food shortages, and the loss of biodiversity. Furthermore, the NCA points out that certain populations--such as children, the elderly, the sick and disabled, the poor and certain communities of color--are especially vulnerable to the impacts of climate change (USGRP, 2014). According to the National Oceanographic and Atmospheric Administration (NOAA), droughts, wildfires, and floods here in the U.S. have become more frequent, intense, and expensive in the past decade, and the Natural Resources Defense Council estimated that disasters cost the American economy more than $100 billion (or about $1,100 per taxpayer) in 2012 alone (NOAA, 2013) (NRDC, 2013).

It is clear that we cannot stop climate change from unfolding; we can, however, slow down its progress by reducing our greenhouse gas emissions and limit its negative effects by implementing mitigation and adaptation measures. But time is not on our side. We must act swiftly and with resolve to lead the change.

What is CSULB doing to fight Climate Change?

At California State University Long Beach (CSULB), we recognize the important role we play in leading climate action. Institutions of higher learning are uniquely positioned to take a leadership role by implementing sustainable practices on our own campuses, equipping our students with a sense of environmental stewardship to carry into their professional endeavors, and supporting path breaking research to help find new and better solutions to the challenges we face. We take this responsibility very seriously, which is why in 2011 CSULB's President signed the American Colleges and University Presidents' Climate Commitment (ACUPCC).

Central to the ACUPCC commitment is the development of a Climate Action Plan (CAP) that will serve as a framework for direct climate change mitigation action to reduce CSULB's emissions of global warming gases such as carbon dioxide (CO_2) methane, and fluorinated gases.

CSULB's campus population of over 40,000 students, faculty, and staff is equivalent to that of a small city. The infrastructure, transportation, and energy resources required to support the mission and activities of the University are significant and so are the greenhouse gas emissions from the operations and activities associated with our 322 acre campus. Collectively, CSULB emits a total of 60,000 metric tons of greenhouse gases (GHG) every year.

This CAP recommends strategies for reducing these GHG emissions levels to achieve climate neutrality by 2030 at the latest.

How will we achieve climate neutrality by 2030?

The practice of reducing greenhouse gas emissions is not new to CSULB. From its successful energy efficiency and alternative transportation programs, campus actions have mitigated over 16,000 metric tons of GHG emissions over the past 20 years. Continuation of these programs and practices are expected to drive down our future GHG emissions. However, the rate of those projected reductions would not have a meaningful enough impact on climate change nor meet the spirit of the ACUPCC commitment to achieve climate neutrality as soon as possible.

This Climate Action Plan seeks to expand and accelerate current GHG reduction activities through energy efficiency, transportation demand management, renewable energy, zero waste initiatives, net zero energy buildings, and if necessary, through GHG offsets.

How will we fund CAP implementation?

Funding these GHG reduction measures will require a combination of internal and external funding sources. The CAP seeks to leverage internal funding sources with external sources such as grants, utility incentives, green revolving funds, and other innovative financial models that leverage operational savings to help pay for the cost of the required investment projects.

How will we stay on track to meet our goal?

This Climate Action Plan outlines a strategy for monitoring our progress along the way by delegating data collection and reporting responsibilities to various campus entities. These entities will be tasked with ensuring that we are on track to meet our target, recommending corrections and improvements to the CAP, and administering biennial CAP update reports.

Mitigating annual emissions of 60,000 metric tons of GHG emissions over the next 15 years will not be an easy task but given the will, commitment, and support of the campus community, we are confident that we can achieve climate neutrality by 2030.

SECTION 1: INTRODUCTION

The latest assessment report from the Intergovernmental Panel on Climate Change (IPCC) reaffirms what scientists have been warning us about for decades, that "human interference with the climate system is occurring, and climate change poses risks for human and natural systems" (IPCC, 2014, p. 3). In fact, IPCC researchers agree that the probability that human activity is "the dominant cause of observed [global] warming since the 20th century" is 95% or higher (IPCC, 2014, p. 3). The most recent National Climate Assessment likewise concluded that "evidence of human-induced climate change continues to strengthen and its impacts are increasingly felt across the country" (USGCRP, 2014).

It has become clear that two of the activities which are contributing most to climate change are burning fossil fuels to power our cities and vehicles, and land-use changes such as cutting down forests to expand development and agriculture. For many years, scientists have been urging world leaders to prioritize a rapid transition to renewable energy and more sustainable development models in order to slow climate change and avoid its most devastating impacts.

While climate change is a global scale issue, its impacts, which vary widely from one place to another, are more readily felt at the national and local level. For this reason, actions big and small taken at all levels have the potential to add up to real change. The speed and scale of efforts across the country and around the world, however, have so far been insufficient to meaningfully address the severity of predicted future climate scenarios. All the while, the reality of our changing climate has become more and more evident as we endure increasingly frequent and intense heatwaves, droughts, wildfires, hurricanes and other extreme weather events.

The window of opportunity to "stop" climate change has closed, however, we can take steps to slow its progression and minimize current and future impacts to natural systems and human wellbeing. To achieve this we must institute aggressive mitigation measures to reduce the greenhouse gas emissions that are contributing to climate change. At the same time, we must develop strategic adaptation measures that will allow us to adjust to and recover from future shocks brought on by a more volatile climate. At California State University Long Beach (CSULB), we recognize the important role we play in leading these efforts. Institutions of higher learning are uniquely positioned to take a leadership role by implementing sustainable operations and practices on our own campuses, equipping our students with a sense of environmental stewardship to carry into their professional endeavors, and supporting path breaking research to help find new and better solutions to the challenges we face. We take this responsibility very seriously, which is why in 2011 CSULB's President signed the American Colleges and University Presidents' Climate Commitment (ACUPCC). In doing so, CSULB joined the hundreds of higher education institutions across the United States that have pledged to eliminate net greenhouse gas emissions from campus operations and support research and educational goals geared toward addressing our biggest climate challenges.

So far, the work of fulfilling this commitment has been led by the Sustainability Task Force (STF) and its subcommittees--advisory bodies made up of more than 40 faculty members, staff, and students. The STF

has worked closely with campus facilities, student organizations, and faculty to identify opportunities to prioritize and institutionalize greenhouse gas emissions reductions, energy efficiency, renewable energy production, green building, alternative transportation, and sustainability focused education.

This Climate Action Plan (CAP) represents a significant step in CSULB's journey as environmental leaders and, more broadly, as leaders in creating a more sustainable future. Although all signatories to the ACUPCC are required to produce a CAP, this document was not created merely to meet this obligation, but rather to guide us on our path forward.

This CAP describes our approach to achieving climate neutrality by the year 2030. The primary focus of the CAP is mitigation through reduction of greenhouse gas emissions, however, the role that research and curriculum play in broader adaptation efforts is also an essential component of the plan.

We will achieve our climate neutrality goal by setting clear targets, outlining specific implementation strategies, recommending a variety of funding mechanisms, and committing to consistent monitoring and reporting schedules. The intention of the CAP is to present a practical, functional plan for the road ahead but it is by no means the final word on how we can achieve climate neutrality. The CAP is an initial framework that is intended to evolve and adapt over time, a living document that will be passed on to future generations of CSULB stakeholders that will keep the CAP moving forward until we achieve our ultimate goal.

> *"My goal is that we prepare students for chosen careers and professions that don't exist yet…that we as a university* ***contribute to solutions to global and local challenges such as sustainability, climate change, and global conflicts.*** *In other words, help our students and us invent our futures, not just make predictions about it."*
>
> -- CSULB President Jane Close Conoley, 2014 Convocation

Based upon the preponderance of the scientific evidence, it is clear that climate change is one of the most daunting challenges that humanity has ever faced. It is not an exaggeration to say that our way of life and our very survival as a species depends on the decisions that we make and the actions we take today to ensure that current and future generations can continue to thrive on our planet.

Achieving climate neutrality for our campus by 2030 will require an unprecedented commitment from the entire CSULB community. Without the active participation and support of students, faculty members, staff, alumni, the City of Long Beach, and other community partners, this plan will be little more than words on paper. It is up to all of us to fight for a better future and the plan presented in the CAP can help lead the way.

SECTION 2: BACKGROUND INFORMATION

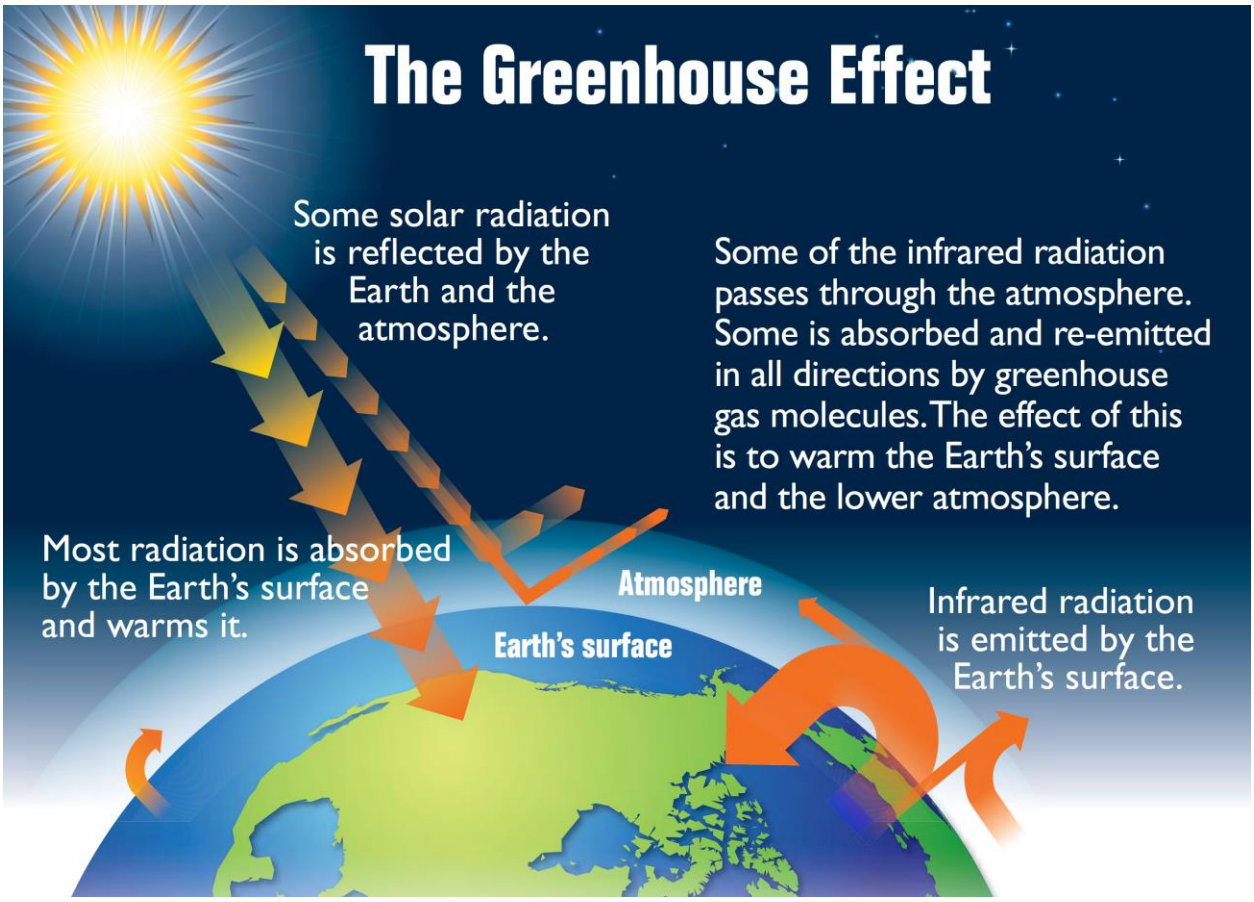
Many people may be surprised to know that our basic scientific knowledge about climate change dates back more than 150 years (AIP, 2014). That's when scientists first discovered that the Earth's atmosphere is what allows the planet to retain some of the sun's heat, preventing it from simply reflecting off the surface and back into space. This phenomenon came to be known as the greenhouse effect. Not long after this was discovered, scientists started to speculate that humans may have the potential to affect Earth's climate by increasing the concentration of certain gases in the atmosphere. Since then, our scientific understanding of global warming and its impact on the planet has evolved rapidly, particularly over the last 40 years; however, the public's awareness of the issue has been somewhat limited until about the last decade.

Global Warming 101

The Earth's climate has undergone great changes over the millennia. Until recently, these changes were solely a result of natural variations in the atmosphere. However, human activities over the last century have altered the composition of the atmosphere, causing global temperatures to increase at a much more rapid rate than that which would be expected to occur naturally.

In order to understand the global warming phenomenon, it is important to first understand the greenhouse effect. In a greenhouse, internal temperatures exceed surrounding temperatures because its transparent windowpanes allow incoming solar radiation to pass through while also trapping most of the infrared radiation reflected off of the plants and surfaces inside. Certain gases, such as water vapor, carbon dioxide, methane, nitrous oxides, and several fluorocarbon organic compounds (CFCs), behave in a similar fashion -- they allow solar radiation to pass through to heat up the planet's surface (and the air above it) but absorb and reradiate the reflected terrestrial infrared radiation blanketing the Earth (see figure 2.0). The higher the concentrations of these gases present in the atmosphere, the more infrared radiation (heat) is present.

Figure 2.0: The Greenhouse Effect



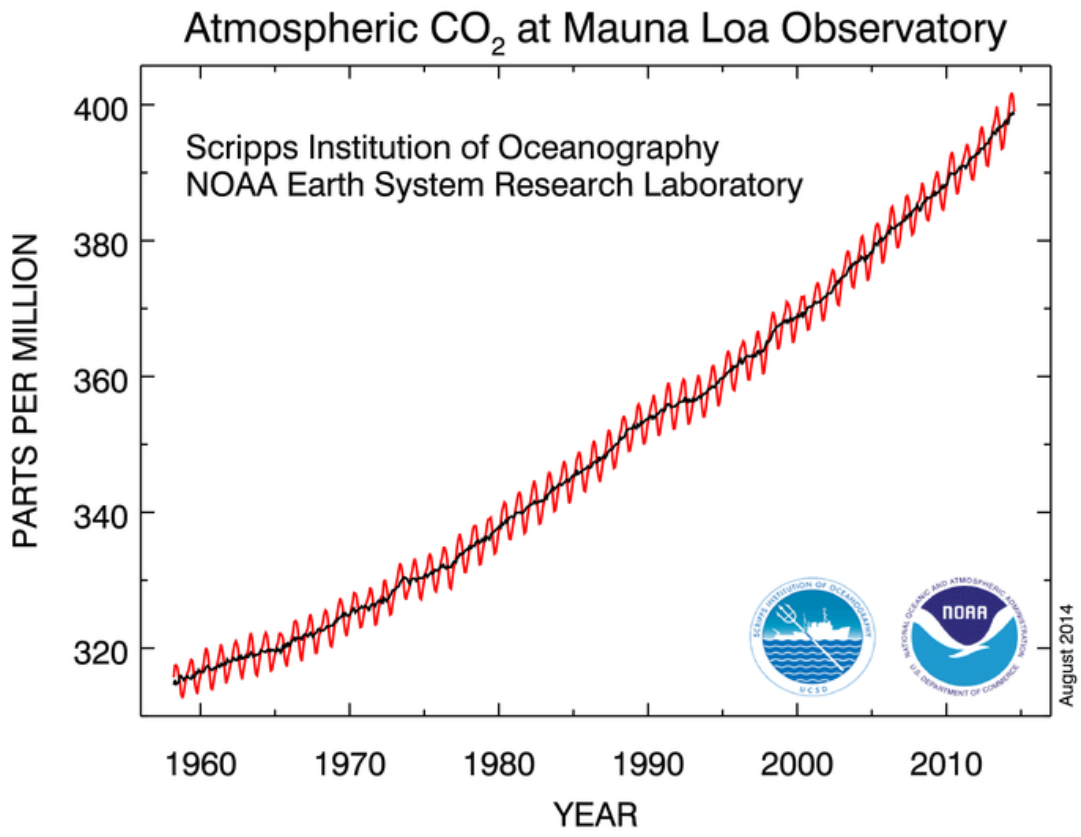
Source: US EPA [Public domain], via Wikimedia Commons

The degree to which these so called "greenhouse gases" contribute to global warming depends not only on the nature of the gases and their concentrations, but also on the length of time that they remain in the atmosphere. Some gases remain for short periods of time while others, such as CFCs, can last for hundreds of years. Because of its large concentration, the gas that contributes most to the greenhouse effect is carbon dioxide (CO_2), the main product of fossil fuel combustion. Methane and nitric oxides are also important, but to a lesser degree. Methane leaks into the air from coalmines and gas pipelines, and is produced by cattle, termites, wetlands, municipal waste dumps, and rice patties. Nitric oxides come primarily from fertilizers and animal waste and CFCs are widely used in fire extinguishers, refrigeration systems, and aerosol spray cans.

Efforts to reduce atmospheric concentrations of all greenhouse gases are vital, but cutting CO_2 emissions is the highest priority. Scientists have estimated that the "safe" level of atmospheric CO_2 is 350 parts per million (ppm)—meaning that for every million molecules in the atmosphere, only 350 (or less) should be CO_2 molecules. According to the National Oceanographic and Atmospheric Association (NOAA), the level of atmospheric CO_2 recently exceeded 400 ppm—the highest level found on Earth for millions of years.

Figure 2.1 illustrates the steady increase in atmospheric CO_2 over time. Note that the seasonal variation of the background carbon dioxide concentration (depicted by the red line) can be explained by the fact that in spring and summer (in the Northern Hemisphere), when photosynthesis is more predominant, plants use some atmospheric carbon dioxide as food. It is returned to the atmosphere in fall and winter, when plants die. The Northern Hemisphere's spring and summer seasons have a bigger impact on global CO_2 levels because it is the region where most of the Earth's land mass and vegetation is contained.

Figure 2.1: Seasonal variation (red line) and annual trend (black line) of atmospheric CO_2 levels



Source: NOAA

Impacts of Climate Change

Global warming is the driving force behind a larger phenomenon known as climate change. Climate change manifests itself in many ways, such as more extreme and often violent weather changes, longer and hotter summers, rising sea levels, the proliferation of infectious diseases, and vast areas of lands being flooded or turned into deserts. It is also linked to the displacement of millions of people around the world, sometimes referred to as "climate refugees". The latest IPCC assessment predicts that climate change will pose significant risks to global and regional food security and will increase the proportion of the global population that experiences water scarcity (IPCC, 2014). According to the National Oceanographic and Atmospheric Administration (NOAA), droughts, wildfires, and floods here in

the U.S. have become more frequent, intense, and expensive in the past decade, and the Natural Resources Defense Council estimated that disasters cost the American economy more than $100 billion (or about $1,100 per taxpayer) in 2012 alone (NOAA, 2013)(NRDC, 2013). In 2013, an unprecedented one third of the U.S. population experienced temperatures of 100 degrees or more for at least 10 days (TFC, 2013).

The most recent report released by the National Climate Assessment (NCA) highlights the fact that every region in the U.S. will experience negative effects of climate change, such as more extreme weather events, water and food shortages, and loss of biodiversity (USGCRP, 2014). The NCA also points out that certain people and communities are especially vulnerable to the impacts of climate change, particularly children, the elderly, the sick and disabled, the poor, and some communities of color (USGCRP, 2014).

The research tells us that failing to act to address climate change now would mean risking economic and human costs that increase every year.

Addressing the Challenge

Mitigation and adaptation are the two strategies for addressing climate change. Mitigation is an intervention that reduces the emissions sources or enhances the sinks for greenhouse gases. Examples of mitigation strategies include employing green building measures such as lighting and insulation upgrades that conserve electricity; transitioning away from dirtier fuel sources such as coal and oil in favor of cleaner renewable energy sources; and investing in public transportation and bicycle and pedestrian amenities to reduce vehicle emissions.

An adaptation measure is described as an "adjustment in natural or human systems in response to actual or

National & International Climate Change Research Bodies

Established at the request of member governments of the United Nations, the Intergovernmental Panel on Climate Change (IPCC) was formed by the UN Environment Program (UNEP) and World Meteorological Organization (WMO) in 1988. Its primary function is to provide policymakers with regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation. To date, the IPCC has published five assessment reports, the most recent in 2014. These assessments have been used to help guide governments at all levels in the development of climate related policies and programs. They also serve as the foundation for negotiations of the UN Framework Convention on Climate Change (UNFCCC), an international environmental treaty signed in 1992. Participation in the IPCC is open to all member countries of the WMO and the UN. IPCC assessments are written by hundreds of leading scientists who volunteer their time and expertise as Coordinating and Lead Authors. They also enlist hundreds of other experts as Contributing Authors to provide additional expertise in specific areas (IPCC, 2014).

Here in the United States, the U.S. Global Change Research Program (USGCRP) was established by Presidential initiative in 1989 and reinforced by Congress via the Global Change Research Act of 1990. The USGCRP coordinates climate change research across numerous federal agencies and synthesizes this research into the National Climate Assessment (NCA), a report that summarizes the current and anticipated future impacts of climate change on the United States. The NCA is produced by a team of more than 300 experts, guided by a 60-member Federal Advisory Committee, and reviewed by the public, experts, federal agencies (such as NOAA, NASA, DOE, USGS, EPA and others), and a panel of the National Academy of Sciences (USGCRP, 2014).

expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC, 2007). Adaptation strategies include building levee systems to protect low-lying areas against flooding and sea level rise, developing neighborhood cooling centers and other healthcare infrastructure to serve residents in times of extreme heat, and taking steps to reduce demands on fresh water supplies through measures such as rainwater harvesting and desalination.

Mitigation and adaptation strategies are both important and should be pursued simultaneously to ensure community resilience and sustainability over the long term.

California's Leadership

California has been a pioneer in providing leadership and setting the stage for a transition to an environmentally sustainable, low-carbon future. Assembly Bill 32, California's 2006 Global Warming Solutions Act (AB 32), was the first program in the country to take a comprehensive, long-term approach to mitigating the risks associated with climate change, while improving energy efficiency, expanding the use of renewable energy resources and cleaner transportation, and reducing waste (CARB, 2006). AB 32 requires California to reduce its GHG emissions from vehicles, electricity production, fuels, and other sources to 1990 levels by 2020 through a combination of policies, planning, direct regulations, market approaches, incentives and voluntary efforts (CARB, 2014).

> "The college and university presidents and chancellors who are joining and leading the Commitment believe that exerting leadership in **addressing climate disruption is an integral part of the mission of higher education** and will stabilize and reduce their long-term energy costs, attract excellent students and faculty, attract new sources of funding, and increase the support of alumni, business and local communities."
>
> -- ACUPCC, 2014

California has also shown significant leadership in the areas of energy efficiency and renewable energy production. It was first in the nation to adopt a statewide green building code to mandate higher levels of energy and water efficiency in buildings. It also has one of the most ambitious Renewables Portfolio Standards (RPS), which requires all utilities in California to source 33% of their electricity sales from clean, renewable sources such as wind, solar, geothermal and biopower, by 2020 (CPUC, 2007).

Educational Institutions Step Up

In California and throughout the U.S., universities and research centers have played a critical role in understanding the science of climate change, educating the public about the risks it poses, pushing

policymakers to take action, and providing a roadmap to a sustainable future. Recognizing the unique role they play in the fight against climate change, a small group of educators established the American College & University Presidents' Climate Commitment (ACUPCC) in 2006. By becoming a signatory of the ACUPCC, each president commits their institution to crafting and adopting a plan to reduce greenhouse gas emissions associated with their campus, integrating sustainability into their curriculum, and producing knowledgeable and educated graduates to advance climate solutions. By the summer of 2014, 684 institutions of higher learning had signed the ACUPCC (ACUPCC, 2014).

The Response of the CSU

The California State University system has responded to the call for climate leadership by becoming an early enrollee in the Climate Registry, a voluntary public disclosure registry of greenhouse gas emissions. In 2006, the CSU also became one of the first institutions to calculate its greenhouse gas emissions back to 1990. The institution has also adopted design standards that require all new construction projects and major renovations projects to exceed (by 15% and 7.5% respectively) the 2008 California Energy Code energy conservation standards, which are already the most stringent in the nation (CSU, 2013). The CSU Board of Trustees originally set a goal to install 10 megawatts (MW) of solar power generation by 2014, a goal that it surpassed by the end of 2012. The CSU now has 11.5 MW of solar power generation spread across its 23 campuses. Along with the solar installations, CSU campuses have also installed 32 MW of cogeneration capacity (which relies on cleaner burning natural gas) for a total of 43.5 MW of on-site power generation. The CSU intends to increase that amount to 80 MW by 2020 and has also set the goal of exceeding the California Public Utilities Commission's RPS target of 33% electricity procurement from renewable sources by 2020.

In May 2014, the CSU continued this tradition of leadership by adopting a system-wide sustainability policy, signaling its intention to pursue sustainable practices and reduce emissions in all areas, including business operations such as procurement; information technology; student services; food services; facilities operations; design and construction; and self-funded entities such as student housing, student unions, parking, children's centers, and auxiliary operations. The policy puts forth the goal of reducing facility GHG emissions to 80 percent below 1990 levels by 2040. It also outlines the CSU's intention to promote the use of alternative transportation and alternative fuel vehicles as a means to reduce GHG emissions from university transportation, business travel, and commuting.

On May 31, 2011, CSULB signaled our own commitment to climate action when President Alexander signed the ACUPCC, making ours the 6th campus in the CSU system to do so. At the same time, CSULB leadership called for the formation of a Sustainability Task Force (STF) and the creation of a Climate Action Plan (CAP). The STF's first step in creating this CAP was to conduct a comprehensive Greenhouse Gas Emissions Inventory, which was completed in January 2013 and submitted to the ACUPCC. With this baseline data in hand, the STF was able to move forward with the development of this CAP which officially outlines our goal to achieve climate neutrality by 2030.

SECTION 3: CURRICULUM, RESEARCH, and COMMUNITY ENGAGEMENT

Within the mission and vision of CSULB we define our university to be a globally engaged public institution that prepares leaders for a changing world and equips our students with the skills and knowledge they need to tackle real world challenges. It is our goal to ensure that by the time our students graduate, they have come to recognize themselves as global citizens with the ability to have a global impact. One of the greatest challenges we now face, and will continue to face for the foreseeable future, is how to mitigate and adapt to a world with a changing climate. Therefore, it is our responsibility to ensure that our students not only understand what climate change is, but are aware that each one of them plays a critical role in either exacerbating or mitigating its effects.

In short, the part that CSULB and all educational institutions play in the fight against climate change really begins with our students. The knowledge that they gain during their time on campus is like a drop of water that starts a ripple effect across a pond, creating an ever-widening circle of influence. Thus, CSULB's response to climate change should not be measured by the carbon footprint of our campus alone, but also by our ability to empower our students to improve the world around them.

In recognition of this, the ACUPCC requires signatories to take steps to make climate neutrality and sustainability a part of the curriculum and other educational experience for all students. By doing so, we can create an environment that fosters climate stewardship while also allowing students to connect with these ideas through a range of disciplines and in a variety of contexts.

Climate Action Education/Curriculum

During the initial period of implementing the ACUPCC, we have focused on identifying existing courses concerning sustainability and climate change and the faculty who teach those courses, as well as encouraging the development of new courses. Our next step will be to inform students about these courses and explore approaches to structuring the sustainability curriculum.

The Green Thread

In May 2012, members of the Sustainability Task Force's Curriculum sub-committee, along with other faculty members, conducted a "Green Thread Workshop" to encourage faculty to integrate sustainability in their courses. Rather than rely on faculty to self-designate their courses as sustainability oriented, the Green Thread approach sets the bar high and requires faculty to demonstrate in their Standard Course Outline that specific sustainability learning outcomes are included in their courses. CSULB is now in the third year of the Green Thread project and those leading the effort are currently developing strategies to improve the effectiveness of the approach and increase the number of faculty members involved. In addition to focusing on integrating sustainability in general, future Green Thread efforts will emphasize incorporating concepts specifically related to climate change into new and

existing courses as well as identifying courses that already meet this objective. For a list of courses that have been developed, improved, or identified through the Green Thread project see appendix A.

It is important to keep in mind that the courses listed in appendix A represent only a partial list of the courses that incorporate sustainability concepts and there are many other courses across the university that focus on climate change as a central theme. Because initial assessments have focused on inventorying the number of *sustainability* related courses more generally, further effort is needed to identify all of the courses currently being offered to students which incorporate issues and concepts specifically related to climate change and sustainability.

Campus as a Living Lab

In 2013-14, three CSULB projects were awarded grants through the California State University Chancellor's "Campus as a Living Lab Grant Program." This program was designed to support the development of projects that leverage the campus as a tool for exploring sustainability concepts and theories by encouraging collaboration between faculty and facilities management staff. The three CSULB projects that were selected will focus on integrating sustainability into undergraduate curricula and developing a sustainability "learning community" involving faculty, students, administration, staff, facilities personnel, and practitioners from the university and the greater community. These initiatives will provide new opportunities for students to learn about resource conservation, GHG mitigation strategies, and other sustainability measures by studying challenges and practices right here on our own campus. The projects selected through the grant are listed in appendix B.

Climate Action Research & Activities

In addition to working to integrate climate change concepts into curriculum, the ACUPCC also requires signatories to take actions to expand and support faculty research efforts that contribute to the goal of achieving climate neutrality. CSULB's strategic approach is parallel to the STARS system and focuses on identifying faculty, departments, and programs engaged in climate change and sustainability related or focused research and creative activity. In addition, incentives for and acknowledgement of faculty research related to sustainability and climate change, along with the pursuit of climate change related grant opportunities are a part of this strategic approach. During this first period of implementing the Climate Commitment, we have focused on identifying faculty conducting research related to sustainability and climate change, and seeking resources to support expanded research.

The CSULB Sustainability Task Force Interdisciplinary Research and Grants sub-committee led this effort by developing a research survey that was distributed to all faculty members in 2013 to identify which faculty are engaged in sustainability-related research or creative endeavors. The survey received 170 responses from over 20 departments within 8 colleges. The results of the survey revealed that the proportion of faculty involved in "sustainability focused or related" and "climate change related" research or efforts on campus appears to be relatively small (7-19% sustainability focused or related research, with only a handful of faculty engaged in climate change research). This

survey was the first step toward establishing a base-line understanding of which faculty, departments and programs are engaged in sustainability and climate change-related research on campus. Additional surveys are planned to generate a larger number of responses and a more complete picture of faculty research activities.

As it continues to focus on inventorying existing research activities, the sub-committee will also explore grant opportunities and other incentives to encourage faculty to initiate new sustainability-related research, in particular those which broaden our understanding of climate change and assist us in achieving climate neutrality.

Community Engagement

CSULB provides opportunities to engage our community in the fight against climate change beyond. We provide opportunities for community engagement through the events, programs, services, and resources we provide for our students, faculty, and staff on campus. Earth Week programming, events to promote faculty/staff ridesharing, as well as efforts to establish CSULB's first dedicated sustainability website are just some of the ways we are working to inform and empower our campus community.

We can also have an impact beyond our campus boundaries through our communications, partnerships, and collaborations with local governments, businesses, non-profit organizations, community groups, and the residents of Long Beach and surrounding cities. For example, our Center for Community Engagement connects our students and faculty with service learning and action-oriented research opportunities that match their academic goals, interests and campus resources with specific needs identified by the community. Our Career Development Center helps students find internships on and off campus that allow them to learn important job skills and apply what they are learning in class to real-world situations. These mechanisms could offer valuable opportunities for our students and faculty to engage in professional development, service learning, and research related to climate change and climate action while also potentially leading our students to careers related to moving society closer to a low carbon future.

As a large institution working to drastically reduce GHG emissions, we can share the knowledge and experiences we acquire (including difficulties, practical constraints, and funding limitations). Partnerships with communities in our vicinity will also be necessary to address the greatest challenges of achieving zero GHG emissions and sustainability, which require working together to address problems that cannot be solved separately.

These outreach efforts complement and reinforce the impact of our education and research activities. By making our climate commitment a focal point of all of our interactions and communications both on and off campus, we will begin to create a culture of climate stewardship that will only grow stronger over time.

SECTION 4: CAMPUS GREENHOUSE GAS INVENTORY

The negative effects of climate change can be minimized by reducing greenhouse gas emissions (GHG) from human activities. The first step in mitigating campus greenhouse gas emissions is understanding where these emissions are originating. A greenhouse gas inventory provides the means to identify and measure campus greenhouse gas emissions. Without a comprehensive inventory of our emissions sources, we cannot begin to identify ways to reduce and manage our greenhouse gas emissions.

CSULB's greenhouse gas emissions are reported by organizational boundary. This means the inventory includes emissions by CSULB as an organization which includes all auxiliary operations such as those managed by the 49er Shops, Associated Students, University Foundation, and Student Housing. All together, the footprint of our campus is over 322 acres, which is populated by more than 40,000 students, faculty, and staff.

As a signatory of the ACUPCC, CSULB is required to take ownership and report the following GHG emissions as part of the inventory[1]. These emissions fall under three major categories or scopes as defined by the Cool Air Clean Planet reporting tool:

> Scope 1: Direct emissions from combustion of fossil fuels on campus (i.e. natural gas, diesel, propane, etc.) and from refrigerants
>
> Scope 2: Indirect emissions from purchased energy (i.e. electricity)
>
> Scope 3: Indirect emissions from (a) student, faculty, and staff commuting; and (b) institution-funded travel.

CSULB's GHG emissions are generated from the following sources:

SCOPE 1

Natural Gas – GHG emissions result from the combustion of natural gas and propane as fuels for hot water boilers and heaters which provide heat for campus buildings, swimming pools, kitchens and dining halls, and for other domestic water heating.

Fleet Fuels – the campus owns, operates, and maintains a vehicle fleet to support its operations. Approximately half of the fleet fueled by gasoline or diesel and GHG emissions come from the combustion of these fuels.

[1] The California State University requires all CSU campuses to report GHG emissions according to the AB32 protocol which only considers scope 1 and 2 emissions categories. This is a less stringent approach compared to ACUPCC's reporting requirements which encompass all three scopes.

Refrigerants – these are chemicals used in cooling and air conditioning equipment. GHG emissions from refrigerants come from inevitable leaks associated with the handling and maintenance of cooling and refrigeration equipment such as water chillers, AC units, refrigerators and freezers, and coolers.

SCOPE 2

Electricity – CSULB's electrical supply comes from the local utility. GHG emissions from electricity are primarily attributed to the combustion of fossil fuels such as natural gas. The campus utilizes electricity to power building systems such as lights, heating and air conditioning equipment, elevators, audio and video equipment, office and IT equipment, refrigerators and freezers, and other plug type loads.

SCOPE 3

Commuting – GHG emissions from commuting result from the combustion of fossil fuels such as gasoline and diesel by our vehicles as we travel to and from our homes and the campus. The ACUPCC commitment requires CSULB to report emissions from commuting as part of our Scope 3 indirect emissions.

Solid Waste – GHG emissions from solid waste come from the trash generated on campus that ends up in landfills. GHG emissions result from the breakdown and decomposition of organic material that primarily produces methane gas.

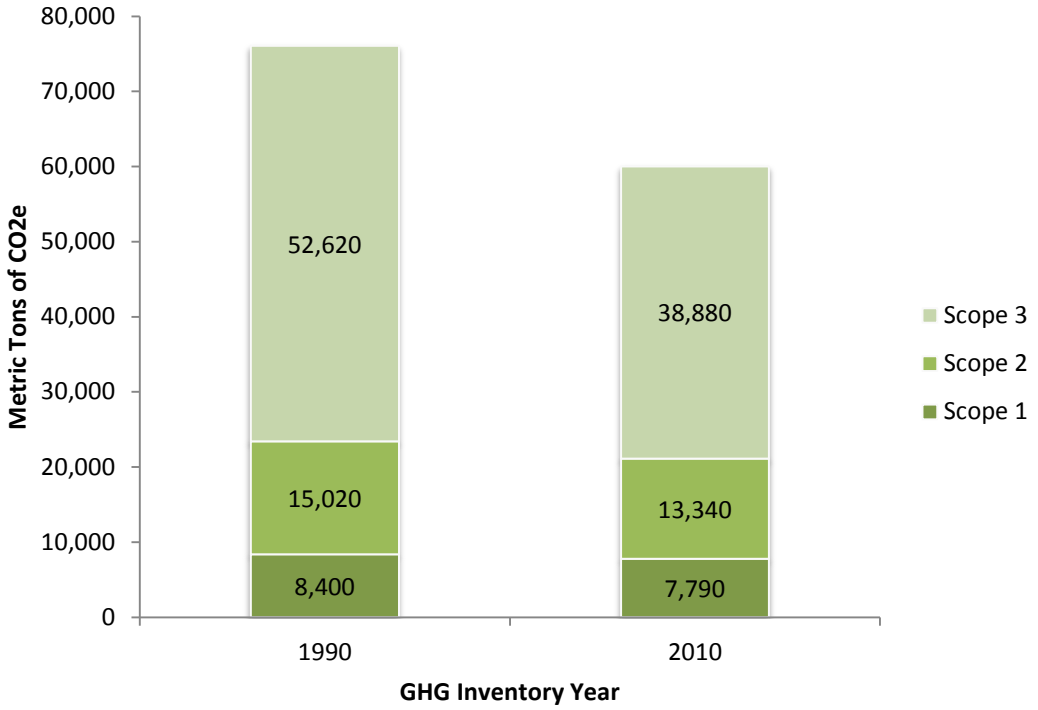
Air and Land Travel – GHG emissions from travel result from the burning of fossil fuels by airplanes, cars, and other vehicles used in university paid and business related travel.

Historical Emissions

CSULB's historical greenhouse gas emissions inventory data consisted of Scope 1 and 2 emissions dating from 1990. Figure 4.0 illustrates CSULB GHG emissions from 1990 as reported by the CSU Chancellor's Office with estimated Scope 3 commuting emissions based on campus population, average vehicle fuel mileage and miles travelled, parking fees, and alternative transportation program in place. The following table illustrates CSULB's 1990 GHG emissions as compared to CSULB's 2010 emissions[2]:

[2] Greenhouse gas emissions are typically reported in metric tons of carbon dioxide equivalent (CO_2e). CO_2e allows many types of greenhouse gases with different heat trapping capacities, also referred to as global warming potential (GWP), to be converted to a standardized unit which can be summed and compared.

Figure 4.0 CSULB Greenhouse Gas Emissions in Metric Tons of CO_2e



Current Emissions

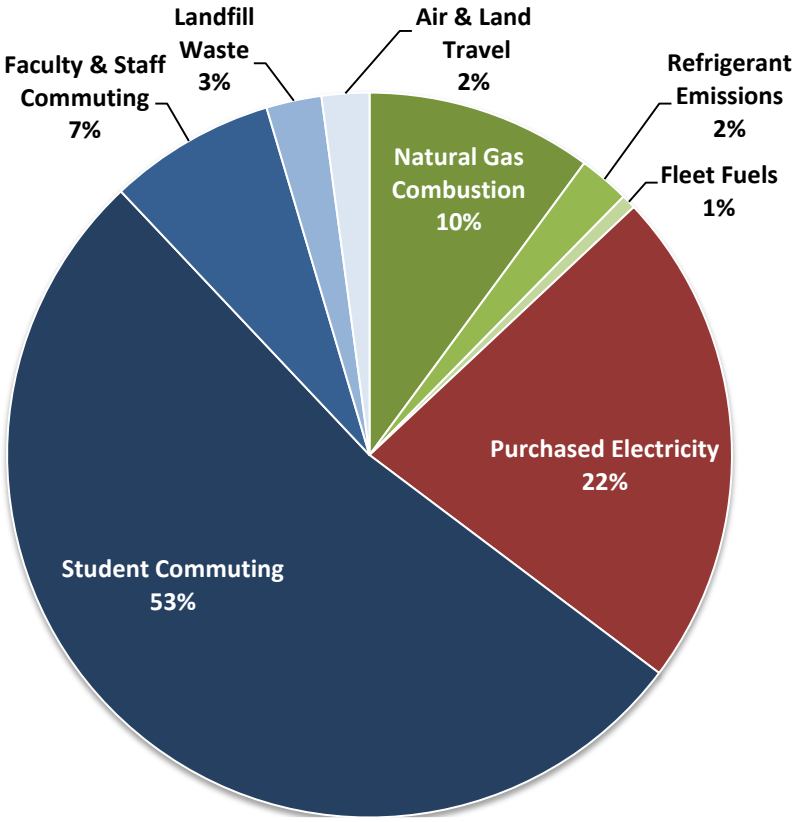
In 2010, a GHG inventory was initiated to fulfill one of the reporting requirements of the ACUPCC. This was CSULB's first attempt to quantify GHG emissions from all scope 1, 2 and 3 sources. Using the ACUPCC approved Campus Carbon Calculator developed by Clean Air Cool Planet, the comprehensive greenhouse gas inventory was completed in 2013, for the first time including emissions associated with student, faculty, and staff commuting[3]. The following graph and table represents CSULB's latest GHG inventory.

[3] Collection, compilation and formatting of raw data related to fiscal year 2009-2010 GHG emissions was primarily led by student volunteers, who received course credit for their contribution to the project. These students worked under the direction of the Energy & Sustainability Manager in the Physical Planning and Facilities Management division, who oversaw the final data analysis and reporting.

Table 4.0: CSULB greenhouse gas emissions source quantities and percentages

CSULB GHG Sources	CO_2e Metric Tons	Percent of total
Student Commuting	31,580	53%
Purchased Electricity	13,340	22%
Natural Gas Combustion	6,050	10%
Faculty and Staff Commuting	4,460	7%
Landfill Waste	1,480	2%
Refrigerant Emissions	1,360	2%
Air Travel	1,270	2%
Fleet Fuels	390	1%
Total 2010 GHG Emissions	59,930	100%
(In Metric Tons of CO_2 Equivalent)		

Figure 4.1: CSULB GHG emissions percentages by source

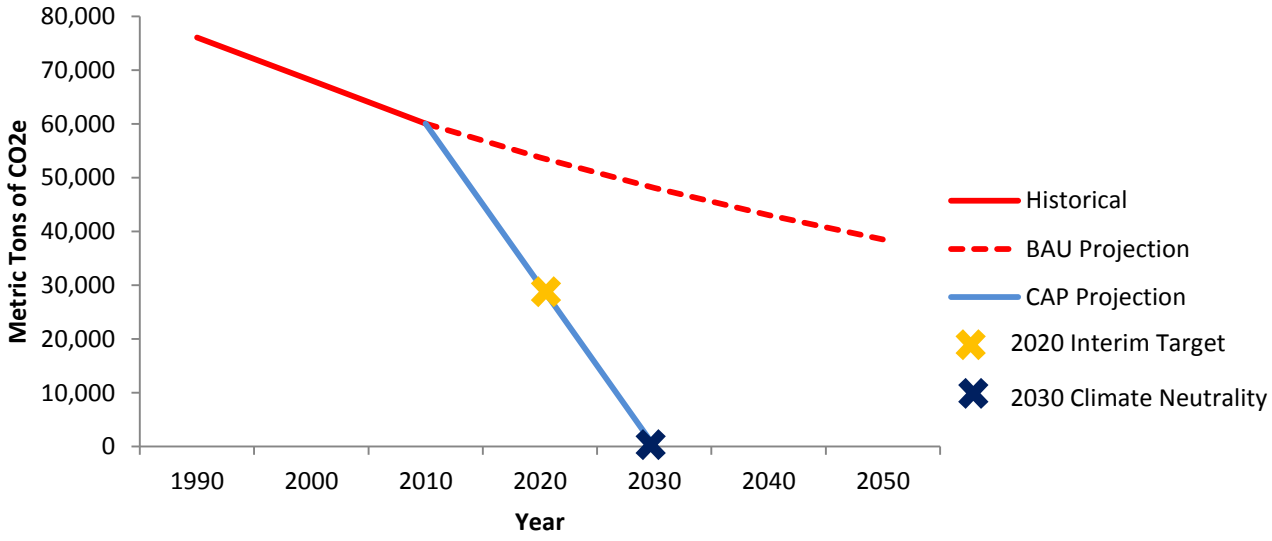


Projected Emissions

CSULB's GHG emissions are projected to decrease slightly over time due to the many great things that the campus is doing to reduce emissions, such as our current Sustainable Transportation Program (see appendix C for details on existing GHG reduction programs). Combined with mandatory measures being taken by entities covered by the California Global Warming Solutions Act of 2006 (AB 32), CSULB will benefit from a cleaner electrical supply with higher renewable content, from vehicles with higher efficiency standards, and from more stringent building energy efficiency standards. Over time, all of these internal and external measures will result in a gradual decline of our overall greenhouse gas emissions. However, simply carrying on with a "business as usual" approach would be insufficient because the anticipated decline in GHG emissions from these existing and mandated measures would be far too slow to have a meaningful effect on climate change. To fulfill our ACUPCC commitment to achieve climate neutrality by 2030, CSULB must do more to reduce emissions in areas within our direct control over a much shorter timeline. CSULB's Climate Action Plan presents a more aggressive and meaningful plan to address climate change.

The following graph illustrates CSULB's historical and projected future GHG emissions based on a "Business as Usual" (BAU) scenario and CSULB's Climate Action Plan implementation scenario.

Figure 4.3: CSULB Historical and Projected GHG Emissions under BAU and CAP scenarios



As illustrated in this graph, CSULB's greenhouse gas emissions are expected to continue to decline incrementally over time. The rate of the projected decrease, however, is far too slow and does not reflect the true spirit of climate leadership. To lead, we must act deliberately and swiftly and stay the course outlined in the Climate Action Plan. To help keep us on track to reach our climate neutrality goal by 2030, a milestone and interim target date of 2020 has been established to reduce campus greenhouse gas emissions down to 30,000 metric tons.

SECTION 5: GHG EMISSION REDUCTION STRATEGIES

The heart and substance of any Climate Action Plan lies within a campus' specific strategies to reduce its greenhouse gas emissions. CSULB's CAP describes not only the ways and means for carbon reductions but also the quantifiable reduction potential and cost effectiveness for each of the action items identified in the plan. CSULB's Climate Action Plan consists of a collection of measures and best practices that have been proven to effectively mitigate campus carbon emissions. Prior to the development of this plan, CSULB developed two key plans that have influenced and informed the GHG reduction measures within the CAP. The Transportation Demand Management Plan (TDM) and the Strategic Energy Plan (SEP) are the result of pre-planning efforts by CSULB knowing the information from these plans would be needed to identify GHG mitigation measures for the CAP. The TDM and SEP identify GHG reduction opportunities from two of our biggest sources of carbon emissions: transportation and energy. CSULB aims to consider the recommendations from these two plans and integrate them into the Climate Action Plan to address related emission sources identified in the Greenhouse Gas Inventory. This section of the CAP describes all the actionable GHG emission reduction measures being considered and organizes them within the following categories:

1. Transportation
2. Energy
3. Operations
4. Carbon Offsets

It is important to keep in mind that this section outlines all of the potential measures that could be implemented to achieve our GHG reduction goal, however, as technology evolves and new best practices emerge, we expect the list of feasible strategies to grow. Therefore, it is difficult to predict at this point in time the exact combination of actions CSULB will chose to take to meet our target.

Transportation

Transportation Related GHG Emissions → 36,040 MTCO$_2$e

Reduction Potential from Strategies → 14,140 MTCO$_2$e

According to the inventory described in the previous section, the biggest source of CSULB's GHG emissions is commuting, accounting for an estimated 36,000 metric tons of GHG emissions per year or 60% of total emissions. This is perhaps not surprising since CSULB is still largely a commuter campus. Therefore, it is to be expected that our biggest source of GHG emissions would be related to the transportation choices we make to travel to and from campus. It is important to note that the amount of annual transportation related emissions would be even higher if not for CSULB's current Alternative Transportation Program, which is responsible for reducing CO_2e

emissions by approximately 7000 metric tons below the levels that could be anticipated each year if the program was not in place. However, the CAP will require us to do more by evaluating additional transportation demand strategies to meet anticipated campus growth and achieve our GHG emission reduction goals and commitment.

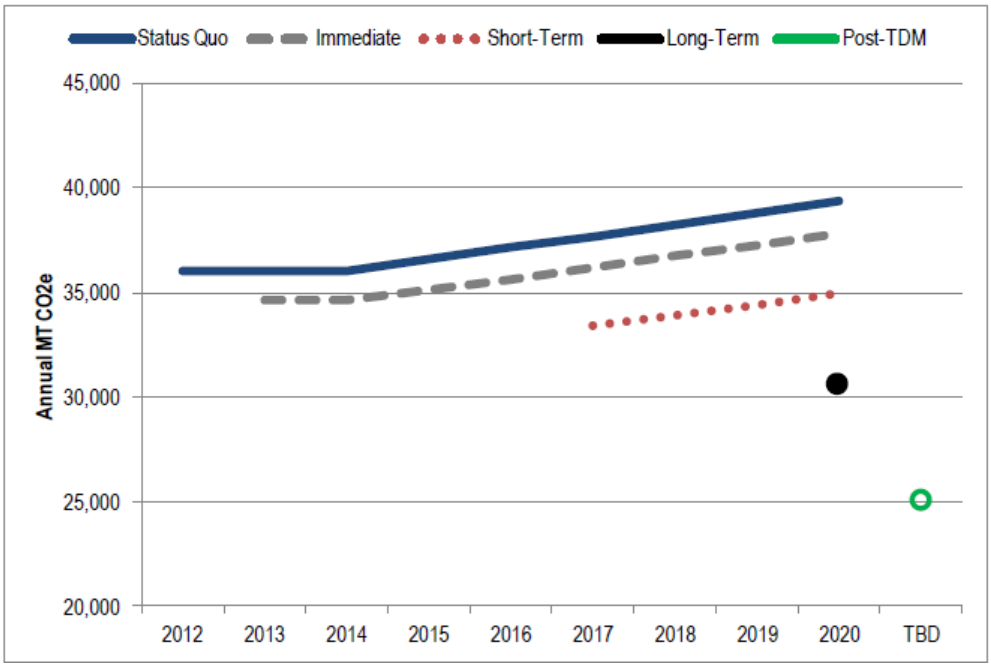
In 2012, CSULB convened a working group consisting of faculty, students, administrators, and staff to develop the Transportation Demand Management (TDM) Plan. Together with a professional transportation consultant, the working group sought to evaluate how it can invest in cost effective strategies for reducing vehicle trips, lowering GHG emissions, managing parking demands, and increasing the use of public transit, bicycling, and walking to and from CSULB. According to the final report, "It is no longer sustainable from an economic, traffic or environmental perspective for CSULB to exist as primarily a commuter campus. The long-term vision calls for a campus in which more students, faculty, and staff have the choice to meet their daily needs on campus. The tangential benefits of such a shift are numerous, including a substantial reduction in the number of vehicle trips and their associated GHG emissions" (Nelson Nygaard with Fehr Peers, 2013, pp. ES-1).

In all, the TDM Plan identifies 26 specific strategies for consideration by CSULB. The TDM plan includes immediate, short, long term, and post-TDM strategies that can be implemented incrementally over time to allow CSULB to achieve its development, transportation, and sustainability goals in a cost-effective and realistic manner. The details of each proposed strategy can be found in appendix D and are listed by categories below:

1. Parking management
2. Transit enhancement
3. Bike and pedestrian infrastructure
4. Expanded car sharing program
5. Expanded marketing efforts
6. Incentives for alternative transportation
7. Other strategies for consideration
8. Evaluation to monitor TDM effectiveness
9. Post-TDM Plan for strategies beyond 2020

As illustrated in figure 5.0, these strategies represent total potential GHG emission reductions of 14,142 metric tons when fully implemented:

Figure 5.0: Campus Emissions by TDM Plan Phase



Source: CSULB Transportation Demand Management Plan Figure ES-23

Energy

Energy Related GHG Emissions → 19,390 MTCO₂e

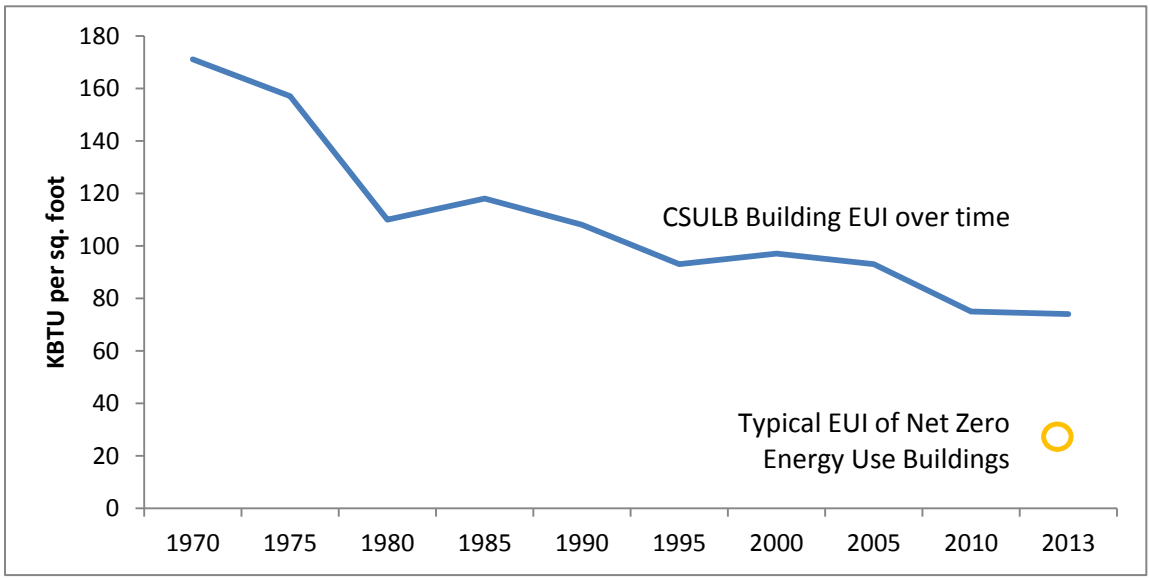
Reduction Potential from Strategies → 12,770 MTCO₂e

Energy is an essential resource that enables a campus to conduct its operations and carry out its mission. Without natural gas to heat our buildings or electricity to power, light, and cool them, CSULB cannot conduct classes nor assume normal business operations. Greenhouse gas emissions from energy sources generally result from the burning of fossil fuels to generate electricity and from combustion of natural gas in a boiler to produce hot water needed to heat our buildings. Additionally, natural gas is used to fuel cooking equipment in our dining hall kitchens and campus restaurants as well as to fuel kilns and Bunsen burners used in our labs. Our reliance on energy is so intrinsic to our day to day campus operations that the resulting greenhouse gas emissions from electricity and natural gas consumption makes up 32% of our total GHG emissions. Although energy consumption is one of our largest sources of GHG emissions, it also provides the greatest opportunities for emission reductions, operation cost savings, and investments with positive financial returns.

CSULB's overall strategy to reduce energy-related GHG emissions will involve eliminating energy waste, improving the efficiency of all energy consuming systems, incorporating net zero energy measures in all new construction, and transitioning to alternative renewable sources of energy as we phase out the use of fossil fuel based energy sources.

Over the last few decades, CSULB has invested and will continue to invest in energy conservation and efficiency. These investments in the campus energy infrastructure, building mechanical, electrical, and envelope systems, and renewable solar power systems have resulted in an overall reduction in energy intensity measured in KBTU per square feet[4] of campus physical space. These improvements translate into reduced operating costs through lower utility bills. In fact, CSULB has reduced its building energy intensity by more than fifty percent since 1974 as illustrated by the following figure:

Figure 5.1: CSULB Facility Energy Use Intensity, 1970 to 2013



CSULB must continue to drive down the energy intensity of campus facilities as an integral part of its Climate Action Plan. To facilitate this effort, new energy efficiency measures and opportunities must be identified, developed, and implemented as part of an integrated plan to reduce GHG emissions and utility costs. Additionally, we must develop our next phase of renewable power systems for the campus and begin to reduce our reliance from the utility electrical grid.

In 2011, CSULB developed the Strategic Energy Plan to identify untapped and innovative energy efficiency and renewable energy opportunities for the campus. This plan will provide the basic measures

[4] A British Thermal Unit (BTU) is the amount of heat energy needed to raise the temperature of one pound of water by one degree Fahrenheit. This is the standard measurement used to state the amount of energy that a fuel has as well as the amount of output of any heat generating device. KBTU per square feet is a metric used to determine the energy use intensity (EUI) of a building relative to its size. EUI is derived by measuring the building total energy use in thousands of BTU (KBTU) and dividing this number by the overall size of the building (square feet)

and action items to reduce facility energy use and will be the primary source of GHG mitigation measures for campus electrical and natural gas consumption. The Executive Summary of the SEP can be found in appendix F. The following table illustrates the categories of energy efficiency and renewable energy measures recommended in the SEP along with their anticipated GHG reduction potential:

Table 5.0: Energy GHG Reduction Potential from Energy Strategies

	GHG Reduction in $MTCO_2e$
Energy Efficiency Strategies	
Building Commissioning[5]	3,070
Plug Load Control[6]	230
Behavior Based Energy Conservation	660
Lighting Upgrade	710
Heating Ventilation/Air Conditioning (HVAC)	1,170
Exterior LED Upgrade	670
Renewable Energy Strategies	
Rooftop Solar PV	830
Parking Canopy Solar PV	3,540
Capital Projects	
Thermal Energy Storage	1270
Data Center Consolidation	620
TOTAL FOR ALL ENERGY STRATEGIES	**12,770 $MTCO_2e$**

[5] Building commissioning particularly retro-commissioning of existing buildings is a process that involves detailed inspection and fine tuning of building energy consuming systems that has been proven to deliver significant energy and operational cost savings.

[6] Plug Load Control is the process of managing and reducing the energy consumption of electrical consuming devices that are normally "plugged in" a building's power outlets.

Operations

CSULB's GHG Inventory not only includes emissions from transportation and energy, but from other campus operations. The following is a list of campus operations that are sources of greenhouse gas emissions:

Operations Related GHG Emissions → 4495 $MTCO_2e$

Reduction Potential from Strategies → 3480 $MTCO_2e$

1. Landfill Waste
2. Fleet Operations
3. Refrigerant Emissions
4. Business Air or Land Travel

Landfill Waste

Landfill waste is trash generated by the campus that is not recycled and which eventually ends up in landfills. Greenhouse gases primarily consisting of methane and carbon dioxide are generated as this trash breaks down and decomposes in the landfill. CSULB currently diverts 70 to 80 percent of its solid waste from the landfill through our campus recycling program. However, to meet our climate commitment goal, the campus must strive to achieve zero waste by finding new ways to effectively recover or recycle campus generated landfill waste. In September 2014, the Sustainability Task Force approved a proposal to form a Zero Waste Working Group that would focus on developing a campus-wide zero waste policy and implementation strategy.

Fleet Operations

CSULB operates and maintains a fleet of motorized vehicles to support campus operations. Greenhouse gas emissions from campus fleet operations results from the burning of fossil based fuels such as gasoline and diesel. To reduce our GHG emissions from our fleet operations, CSULB can transition to cleaner alternative or renewable fuels such as compressed natural gas, hydrogen fuel cell, or electric powered vehicles. The Sustainability Task Force approved a proposal in September 2014 to establish a Clean Fleet Policy for the university, which would require all departments to purchase the cleanest vehicle available according to the intended use of the vehicle.

Refrigerant Emissions

Greenhouse gas emissions from fluorinated gases such as refrigerants are produced from the handling and operation of cooling equipment such as liquid chillers, refrigerators, and freezers that utilize chemicals called refrigerants which contribute to the depletion of atmospheric ozone or promote global warming when release into the atmosphere. Some of these refrigerants are still in use in campus

mechanical machinery and appliances, however, many of these older machines are slated to be retired or decommissioned and replaced with new equipment that utilizes environmentally friendly refrigerants. The CAP seeks to accelerate the early retirement of these equipment and replace them with non- fluorinated gas dependent and more energy efficient equipment.

Business Air and Land Travel

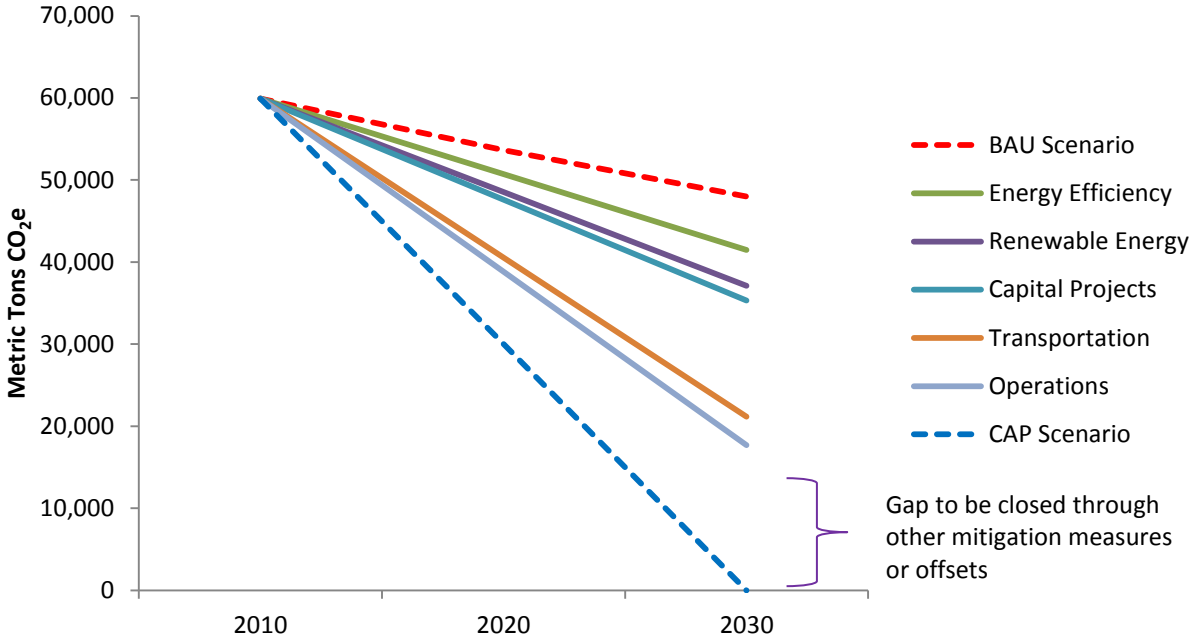
Business air and land travel emissions are part of CSULB's scope 3 emissions. These emissions are generated when faculty, staff, or students travel on official campus business by plane or automobile. Planes and automobiles generate GHG emissions from the combustion of fossil based fuels such as aviation fuel, gasoline, or diesel. It is highly unlikely that CSULB will be able to eliminate travel related to university business, however, we anticipate that modest reductions can be achieved by encouraging alternatives such as online meetings and collaborations, webinars, online instruction, or through voluntary purchase of GHG offsets. For the purposes of the CAP, we estimate that business related air and land travel can be reduced by 20%.

Carbon Offsets

Carbon offsets are GHG emission reduction measures that are implemented in one place to offset GHG emissions elsewhere. The purchase of carbon offsets which are available in the open carbon market help fund greenhouse gas emission reduction projects that otherwise do not have other sources of funding for implementation. Carbon offsets are recognized by the ACUPCC as part of a signatory campus' GHG reduction portfolio. CSULB must give priority to on-site GHG reduction measures before contemplating purchasing carbon offsets as part of the CAP. If carbon offsets are ever considered to meet the campus climate commitment, CSULB must evaluate the quality and cost effectiveness of selected carbon offsets before investing in such instruments. Alternatively, CSULB can consider creating its own carbon offset projects in nearby financially distressed communities as part of its climate action plan outreach activities.

The following figure illustrates the reduction effect of each category of mitigation measures represented by individual lines. The wedges created by these lines represent the quantities of GHG emission reduction associated with each category of measures, which combined will help us reach our climate neutrality goal.

Figure 5.2: GHG Reduction Potential from Proposed Climate Action Plan Reduction Strategies



Summary

The CAP mitigation strategies discussed here are by no means exhaustive nor do they reflect a finite set of mitigation measures for consideration. They do, however, represent examples of GHG emission mitigation best practices and ideas meant to spur innovations that can lead to solutions that remain to be uncovered. This can be the perfect challenge for CSULB students with aspirations of influencing and addressing global problems such as climate change.

SECTION 6: FUNDING THE CAP

To meet the aggressive timeline established in this Climate Action Plan for CSULB to be carbon-neutral by 2030 will require the commitment of significant resources to fund the necessary projects. The university has identified numerous projects necessary to achieve this goal in the Strategic Energy Plan (2012) and the Transportation Demand Management Program (2013) as discussed in the previous section. Although there will be financial costs associated with implementing the projects needed to reduce our GHG emissions, it is important to consider these in relation to the very real costs that would result from failing to act. Adopting a less ambitious GHG reduction target, or worse, simply choosing to maintain the status quo, would not only incur financial costs, but also costs to the environment, public health, and CSULB's reputation for leadership. While these costs are more difficult to estimate, they must not be ignored.

Still, the critical question is 'where will the funds come from?' The good news is that there are a range of potential funding sources and finance mechanisms, many of which the university is already tapping, that will allow us to leverage our limited resources in ways that can have a big impact. Potential funding sources can be divided into two categories – internal sources and external sources. Examples of each of these sources will be discussed.

Internal Sources

Leveraging internal sources of funds will be critical to the success of the CAP. The CSU system has experienced a decline in state support for a number of years and funding is unlikely to increase in the foreseeable future. Given this scenario, it is important that the priorities for the campus be reconsidered in order to determine the importance to the campus community of meeting our goal of carbon-neutrality as set out in the University President's commitment. Examples of internal funding sources include:

Green Revolving Fund

A Green Revolving Fund (GRF) is an internal fund that provides financing for projects that will generate cost savings. The cost savings are then tracked and used to replenish the fund. The seed money to establish a GRF can originate from a variety of sources, several of which are discussed in this section. Creating a GRF would provide a predictable source of funds to finance projects in the future.[7]

[7] An excellent guide for establishing a GRF is Indvik, Foley and Orlowski, 2013.

Parking Permit fees/Parking Citation fees

This is an important source of funds for several reasons. First, transportation is a critical source of carbon emissions for the campus. The allocation of parking fees to address demand management options provides a direct link to the behavior that is generating the emissions. In this way, increased parking fees can serve as both a mitigation measure and a CAP implementation funding mechanism.

Capital Improvement Budget

The Strategic Energy Plan identifies a number of capital improvement projects that will achieve reduced emissions as well as increased efficiencies in power generation, fuel use and fuel substitution to more renewable sources. These projects could be prioritized in the ranking of projects based upon their contribution to achieving the mitigation targets identified in the CAP.

Auxiliary Organizations

The university receives funds from a variety of sources including the 49er Shops[8], two Foundations, and Student Housing. The university receives payments from these sources and they are categorized for budgeting as auxiliary funds. Targeting some percentage of these funds to help support the mitigation efforts identified in the CAP could also provide a direct link between the behavior that is generating the emissions and the reduction in such emissions. For example, reducing the waste stream that is diverted to landfills could be an investment targeted with funds from the 49er Shops and student housing.

General Operating Budget

As spending priorities are reevaluated, resources from the general operating budget could be reallocated to meet the educational objectives of the CAP and to fund projects that will help reduce the carbon footprint of the campus.

Student/Faculty/Staff Fees

Many campuses have used student fees to fund various aspects of their CAP. These funds were committed to this priority based upon a vote of the students. For example, the students at the University of California, Riverside voted to fund a Green Campus Action Plan using a fee of $2.50 per quarter. As this is an issue that affects all of the campus community such an approach could also be implemented by faculty and staff.

[8] The 49er Shops operate the Student Bookstore, food court, convenience stores, among other enterprises.

External Sources

Rebates/Incentives

The SEP (2012) identifies a variety of rebates and incentives available to the university, particularly in the area of solar projects. Although these programs are not predictable, they are currently available and should be leveraged to obtain significant gains in the near term. The SEP recommends the installation of Solar PV as the most cost-effective and energy efficient solution currently available to CSULB to move toward carbon neutrality.

Foundation Grants

There are a number of private foundations that are allocating resources to aid universities in meeting the carbon reduction strategies. For example, Chevrolet has dedicated funds to a program targeted to universities that have an established climate commitment.

Gifts & Donations

As CSULB embarks on the Capital Campaign, Declare, fund raising appeals related to the CAP projects should be integrated into the effort. The alumni network and friends of the university are an important source that can provide significant resources to meet the CAP goal. This is also a common approach used to provide seed funding for the establishment of a Green Revolving Fund.

Federal & State Grants

Another source of funding is government grant programs. Such programs are generally available for a specific project or on an unpredictable schedule. A systematic effort needs to be established to identify such programs when they are offered and support to complete the grant proposal necessary to compete for the available resources.

Corporate Partnerships

A growing area of support for energy savings projects is through corporate partnerships. There are two common partnerships that are currently utilized by campuses to fund their climate action plan energy measures: Power Purchase Agreement (PPA) and Energy Performance Contracts (EPC). A PPA arrangement involves a private sector firm developing a power generation project (for example, a solar project) and then entering into an agreement with the client to purchase the power generated from that project for a specific time horizon. An EPC is a vehicle for procuring energy-related equipment and services through an energy services company (ESCO) with guaranteed cost savings. Both PPA and EPC

provide an opportunity to move forward with projects without committing large capital investment funds up front.

Cap and Trade Funds

The Global Warming Solutions Act (AB32) in California created the Greenhouse Gas Reduction fund that is financed through the sale of carbon allowances. These funds are available on a competitive basis to fund projects that will obtain emission reductions. The university is eligible to compete for these funds.

To attain climate neutrality by 2030, CSULB must reduce its GHG emissions by 60,000 metric tons based on current conditions or by 48,000 metric tons compared to the BAU case in year 2030. Determining the optimal strategy for funding the projects necessary to meet the CAP target of carbon neutrality is a complex undertaking. The above discussion lists potential sources of funds. It is also important to understand how the funds will be used to achieve the CAP targets. Section 5 discussed the projects that have been identified to help meet the goal. Tables 6.0 and 6.1 below provide two possible ranges of cost estimates based on available sources of funds and financing mechanism.

Table 6.0: GHG reduction potential and cost estimate

	Potential GHG Reduction $MTCO_2e$	**Estimated Cost**
Energy Strategies[9]	12,770	$63,361,000
Transportation Strategies[10]	14,140	$3,173,000[11]
Operations Strategies	3,480	TBD
Offsets	17,690	$232,100[12]
TOTAL	48,080	$66,766,100

[9] Energy strategies cost estimate only reflects unfunded projects.
[10] Transportation strategies cost is based on only those estimated costs to CSULB which would not be shared by the City of Long Beach as described in Figure 1-22 Summary of TDM Strategies and Phases in the CSULB TDM Program Final
[11] Cost estimate does not include potential cost of adding campus housing for students as a TDM strategy because such costs are TBD
[12] Carbon offset cost estimate is from Terrapass (www.terrapass.com) based on offset price for business at $13.12 per mT as of 10/23/2014

Table 6.1 illustrates an alternative project financing scenario that can significantly reduce the up-front cost required to implement CAP mitigation measures utilizing third party financing mechanisms such as Energy Performance Contracts (EPC) or Power Purchase Agreements (PPA) that leverage internal funds with utility incentives, operational savings, and private partnerships to finance mitigation projects over time. The table also shows a reduced costs associated with transportation strategies based on the assumption that these costs could be partially offset using the anticipated $1.8 million in increased revenue that could be generated between 2014 and 2020 through the implementation of Demand Based Pricing.

The following table represents one of many possible scenarios of innovative project financing mechanism that can reduce overall project cost and reduce up-front capital funds by combining internal funds with external funds, private partnership funds, operational savings, and energy rebates.

Table 6.1: Sample Cost Scenario Utilizing Innovative Funding Mechanisms (EPC/PPA model & parking revenue scenario)

	Potential GHG Reduction $MTCO_2e$	**Estimated Cost**
Energy Strategies[13, 14]	12,770	$6,037,600
Transportation Strategies[15]	14,140	$1,373,000
Operations Strategies	3,480	TBD
Offsets	17,690	$232,100
TOTAL	48,080	$7,642,700

It's important to note that energy related GHG reduction strategies generate cost savings and utility incentives and these can be leveraged to reduce the total cost of these measures. Energy strategies included in the CAP have potential cost avoidance of **$4 million** annually and can qualify for incentives of up to **$6 million** as a one-time payment.

[13] EPC financing utilizes cost savings, incentives, and tax credits to cover debt service of the project.
[14] PPA financed projects are owned and operated by third party developers on customer site and the developer recovers project cost and profits from the sales of renewable energy to the customer.
[15] Based on revenue earned via TDM Strategy #1 by 2020 in the Estimated Cost Impact as described in Figure 1-22 Summary of TDM Strategies and Phases in the CSULB TDM Program Final Report

SECTION 7: MONITORING PROGRESS

The Climate Action Plan is designed to be used as a roadmap for guiding university policies, capital investments, curriculum development, faculty, staff and student engagement, community outreach and communications that will help us achieve our goal of climate neutrality. Establishing a consistent and predictable system for evaluating the effectiveness of each GHG reduction and mitigation strategy will allow us to adapt to new opportunities and challenges, and ensure that the CAP remains a useful decision making tool and a dynamic planning document.

As a signatory of the ACUPCC and a participant in the AASHE STARS[16] program, CSULB is required to regularly report on a variety of indicators. Having these "built-in" reporting expectations will help to ensure that we are continually gathering the data needed to analyze the overall impact of CAP implementation at regular intervals. It will also help keep us focused on integrating climate change and sustainability concepts into our curriculum and supporting faculty research in these areas.

The following section outlines the existing and proposed mechanisms for regularly tracking and disclosing various indicators and recommends responsible entities to lead each effort.

Greenhouse Gas Emissions Inventories

The ACUPCC requires member institutions to submit a comprehensive GHG emissions inventory (including scope 1, 2 and 3 emissions) every other year. As discussed in Section 4, the first comprehensive GHG emissions inventory was completed by CSULB in 2013. The next GHG emissions inventory is therefore due to be submitted to the ACUPCC in January 2015. The next inventory will allow us to evaluate progress made to reduce GHG emissions since the previous inventory period and provide a useful baseline against which to measure the effectiveness of future emissions reduction strategies implemented as a result of the CAP.

We recommend that the Sustainability Task Force's existing GHG Emissions and Climate Action Planning sub-committee, which oversaw the previous GHG inventory, continue to take responsibility for managing the ongoing inventory process. The previous inventory was led by the Energy and Sustainability Manager and supported by student interns who assisted with data collection and analysis. Engaging students in the inventory process provides valuable opportunities for students to build new skills while increasing their climate literacy. We recommend that the sub-committee continue to involve students in this important work going forward.

[16] The Sustainability Tracking, Assessment and Rating System (STARS) is a voluntary self-reporting framework and certification program designed to help colleges and universities track and measure their sustainability progress. The program is administered by the Association for the Advancement of Sustainability in Higher Education (AASHE).

Transportation Related Emissions

In conjunction with the development of CSULB's Transportation Demand Management Plan (TDM Plan), an extensive campus-wide "travel preferences survey" was conducted in spring 2013. The data collected through this survey helped establish a baseline estimate of the transportation mode share of the campus community (delineated by faculty, staff/administrators, freshmen, undergraduate students, and graduate students). The mode share data was then used to calculate an estimate of annual vehicle miles traveled (VMT). The annual VMT was in turn multiplied by industry recognized emissions factors to arrive at a baseline estimate of transportation-related GHG emissions (see appendix E for complete description of methodology). This number was incorporated into the 2010 GHG emissions inventory.

To ensure that transportation related GHG emissions data is available for future GHG emissions inventories and reporting, it will be necessary to repeat the travel preference survey and analysis bi-annually. The previous survey was conducted by the consultant group that developed the TDM Plan. Going forward, it may be preferable to conduct the survey and analysis using internal staff and resources, however, more discussions are needed to identify which department can take the lead on this effort. If possible, students should be provided with opportunities to engage in data collection and monitoring so that they can learn about the impacts of transportation emissions in the context of climate mitigation efforts.

Curriculum Assessments

In addition to monitoring the effectiveness of our GHG emissions reduction strategies, the impact of the CAP will also be evaluated based on the strides we make to integrate climate change literacy into our curriculum and support climate related faculty research. As described in Section 3, the STF's Curriculum sub-committee has established resources to support the development of courses that incorporate sustainability principles and concepts, including those related to climate change.

As an increasing number of sustainability and climate change related courses are developed through the faculty Green Thread Workshops, it will be essential to track these courses and assess the benefits they provide to our students and campus community. Therefore, the STF's Curriculum sub-committee should continue to provide ongoing curriculum development support in order to expand the number of courses that can be reasonably designated as "sustainability courses" as well those that address climate change in ways that help us realize the vision of the CAP. The sub-committee should also conduct regular assessments of the number of existing and newly created courses and establish mechanisms for students and faculty to provide feedback about the quality of these courses.

Research Assessments

We must place a similar emphasis on our efforts to support, incentivize, and recognize faculty research that contributes to our understanding of climate change and its impacts, as well as potential solutions. The STF's Interdisciplinary Research and Grants subcommittee has taken the first steps toward identifying CSULB faculty engaged in sustainability related research, however, further assessments will be needed to discover what proportion of this research is related to climate change issues and solutions.

Integration with STARS

These curriculum and research tracking efforts will be reinforced by CSULB's participation the AASHE STARS certification program. As a STARS reporting institution, CSULB is expected to inventory sustainability curriculum and research programs, as well as track and report data on all aspects of campus operations, planning, administration, and student/community engagement that in any way contribute to the institution's overall sustainability. Once the initial certification process has been completed and the STARS rating has been achieved[17], CSULB must update all required data and inventories every three years in order to maintain (or improve) our STARS rating. The STARS assessment will, therefore, provide an additional motivation to maintain ongoing data collection and analysis.

Table 7.0 presents a general reporting and data collection schedule for 2014 through 2020. As shown, in order for CSULB to meet our ACUPCC and STARS reporting schedule requirements we will need to submit one or more report/update every year.

[17] Data gathering for the STARS certification is currently underway and initial certification is anticipated by spring 2015.

Table 7.0: Reporting and Data Collection Schedule and Proposed Responsible Entity

Responsible Entity	2014	2015*	2016	2017	2018*	2019	2020
	ACUPCC Reporting Schedule						
GHG & CAP Sub-committee	Climate Action Plan		CAP Update /Progress report		CAP Update /Progress report		CAP Update /Progress report
GHG & CAP Sub-committee		GHG Inventory Report		GHG Inventory Report		GHG Inventory Report	
	Ongoing Data Collection Schedule						
GHG & CAP Sub-committee		GHG Inventory		GHG Inventory		GHG Inventory	
TBD		Transportation Preferences Survey & VMT/CO_2e Analysis		Transportation Preferences Survey & VMT/CO_2e Analysis		Transportation Preferences Survey & VMT/CO_2e Analysis	
Curriculum Sub-committee		Sustainability & Climate Change Curriculum Assessment		Sustainability & Climate Change Curriculum Assessment		Sustainability & Climate Change Curriculum Assessment	
Research & Grants Sub-committee		Sustainability & Climate Change Research Assessment		Sustainability & Climate Change Research Assessment		Sustainability & Climate Change Research Assessment	

*Signifies STARS reporting year

In addition to the ACUPCC and STARS reports, beginning in 2014, we intend to create an Annual Sustainability Report for the benefit of our own campus community, other CSU campuses, and the community at large. These annual reports will be crafted through a collaborative process involving most, if not all, of the STF sub-committees as well as other campus and community partners such as the Associated Students, Inc., student clubs and organizations, and the City of Long Beach. The purpose of the Annual Sustainability Reports will be to highlight our accomplishments and challenges across a range of campus sustainability areas and communicate our goals for the year ahead.

Monitoring and Course Correction

In order for any plan to be more than a static document, it must clearly describe a problem, recommend specific problem-solving strategies, and outline practical procedures for monitoring and reporting progress along the way. Planning for both incremental GHG reductions in the short-term as well as a longer term climate neutrality goal is inherently challenging, and building in feedback loops and mechanisms for course correction are essential. This CAP reflects our current scientific knowledge about climate change and recommends current best practices in campus GHG reduction and mitigation strategies. However, as new studies emerge and new technologies are developed, our approach to achieving climate neutrality will inevitably evolve. By adhering to established, continuous monitoring processes, we will have the information we need to know whether we are on track to meet our 2030 neutrality goal.

SECTION 8: THE WAY FORWARD

Climate change is real, it's happening now and, if left unchecked, it will continue to unfold in the future with devastating consequences to people, the environment, and the economy. As a leading educational institution, we have two options: We can ignore it and continue about our business as usual, or we can face it head on and turn this draconian challenge into the biggest opportunity to improve the lives of generations of people, including our own students, by protecting the planet they will inherit from us. This Climate Action Plan represents an important step toward achieving CSULB's climate neutrality goal and fulfilling the American Colleges and University Presidents' Climate Commitment. With the support of President Conoley and the entire campus community, we are confident that we can achieve our goals.

To be successful, we will approach the problem from multiple angles, employ a range of solutions, and partner with a diverse group of stakeholders both on and off campus. The commitments outlined in this CAP are as follows:

1. We will implement solutions to reduce GHG emissions related to our campus operations, energy use, transportation, waste management, and other areas to achieve climate neutrality by 2030.
2. We will work to promote climate and sustainability literacy through our curriculum, programs, and services so that our faculty, staff, and especially, our students, will become emissaries for climate action, both here on campus and in the lives they lead beyond CSULB.
3. We will endeavor to find new ways to support and incentivize faculty and student research activities aimed at advancing our knowledge of climate issues and discovering new strategies for achieving climate neutrality.

Through all of these efforts, we will work to instill a sense of responsibility and a culture of climate stewardship at CSULB so that our institution's role as a leader in the climate change fight will be taken as a given.

Our plan for funding the CAP is to employ a wide variety of mechanisms, focusing especially on those which will allow us to minimize (or eliminate) up-front costs or leverage limited campus resources to secure outside support. At the same time, we will be mindful that any costs associated with implementing CAP strategies should be viewed in relation to the financial, environmental, and social costs that would come if we fail to act. Although these costs are much more difficult to quantify, they are no less real and must be taken into consideration.

To ensure that we remain on track to meet our GHG reduction, educational, and research goals, we will establish consistent monitoring processes led by designated campus entities made up of students, faculty, and staff from across campus. These groups will provide the structure for tracking our progress, recommending corrections and improvements to the CAP, and engaging the campus community in the efforts. Although the challenges are great, so is our capacity to achieve greatness. CSULB has been given this opportunity to lead and we have no doubt that working together we can and will rise to overcome this global challenge.

ACKNOWLEDGEMENTS

The Climate Action Plan was drafted by the members of the Sustainability Task Force's Greenhouse Gas Inventory and Climate Action Planning Sub-Committee with input from other STF Sub-committee members and student contributors.

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The draft Climate Action Plan was distributed to all Sustainability Task Force and Sub-Committee members and posted online for public review and feedback. We thank and acknowledge the members of our campus community and CSU Chancellor's Office who took the time to review the draft and share their input and suggestions for improving the plan.

CSULB CLIMATE ACTION PLAN

CAP logo created by CSULB Graphic Design student, Gabriella Toledo

APPENDICES

Appendix A: Green Thread Sustainability Course List

- Hospitality Management - HFHM 370: Exploring a Sustainable Food System**
- Marketing – MKTG 495: Green Marketing
- American Indian Studies - AIS 336: Indigenous Philosophies of Sustainability
- Public Policy & Administration – PPA 590:Urban Environmental Governance
- Design – DESN 268: Sustainability by Design
- Health Care Administration- HCA 422: Global Issues in Health Services*
- Comparative World Literature – CWL 412: Art & Literature: Myths of Pygmalion & Prometheus*
- Asian American Studies - ASAM 350: Environmental Justice*
- Geography – GEOG 355: International Environmental Issues**
- Engineering - ENGR 302: Energy and Environment: Global Perspective*
- Biology – BIOL 459: Conservation Biology
- Business Administration - CBA 600: Sustainability and the Business Organization
- Business Administration - CBA 601. Sustainability and the Business Organization II
- University Honors - UHP 201: Sustainability and Technology in Los Angeles

*denotes capstone GE course

**denotes capstone and writing intensive GE

Appendix B: Campus as Living Lab Grant Recipients

"Developing a Learning Community in Sustainability & Sustainable Development," by Professor Wade Martin & Mr. David Salazar (Associate Vice President, Physical Planning & Facilities Management).

Co-Principle Investigators: Heather Barker, Ingrid Martin, Christine Whitcraft, Reza Toossi, Wesley Woelfel White paper available from Wade Martin (Wade.Martin@csulb.edu).

"Development of a Hybrid Module-Based Introductory Course in Environmental Engineering with Focus on Water Resources, Sustainability, and Renewable Energy," by Professor Antonella Sciortino & Mr. David Salazar.

"Integrating Students into CSULB's Sustainability Mission," by Professor Dean Toji & Mr. David Salazar.

Appendix C: Existing Greenhouse Gas Reduction Programs

Sustainable Transportation Program:

- U-PASS offers free boardings 7 days a week on Long Beach Transit
- Zipcar car-share provides cars on campus for hourly / daily use with all gas and insurance included
- Traffic Skills 101 is a free bike class that teaches how to ride safely & confidently on city streets
- JAX bike mechanics offer free bike repair clinics & 12-point safety inspections on campus
- Zimride helps form CSULB carpools for 1-time or daily rides
- Vanpools help our long distance commuters save time, money & environment
- $1 / Day Points encourage employees to walk, bike, carpool or motorcycle to CSULB

Existing and ongoing Energy Program strategies:

- 350 KW of onsite solar photovoltaic systems in 3 campus buildings
- Campus-wide energy efficient lighting retrofits
- LED lighting in parking structures
- Retro-commissioning projects
- IT server consolidation and switch replacement project
- LED street lighting replacement
- Parking lot LED lighting and controls
- Corridor lighting control project
- Motion-controlled stairwell lighting
- Energy savings by design in major campus renovation projects
- Wireless smart fan control for LA5
- Multi-building LED indoor lighting retrofit
- PowerSave Campus program dorm energy competitions
- Green Building design and LEED certification
- Smart laboratory indoor air monitoring and control system
- Rooftop AC Unit upgrade project
- Windows, doors, and fan replacement project for ED1
- High performance chiller and variable speed pumps for CPAC

Appendix D: Executive Summary of Transportation Demand Management Plan including list of Recommended Strategies

EXECUTIVE SUMMARY

Each day, thousands of students, faculty, staff, and visitors travel to, from, and around California State University Long Beach (CSULB). With campus facilities and student enrollment expected to equal or exceed current levels in order to meet increased demands for higher education, it is important to weigh the effects of growth on the transportation system. In the context of increasing costs and declining resources, the University has sought to evaluate how it can invest in cost-effective strategies for reducing vehicle trips, lowering greenhouse gas (GHG) emissions, managing parking demand, and increasing the use of transit, bicycling, and walking at CSULB.

This report is the culmination of a series of tasks including an in-depth transportation and parking existing conditions analysis, the development of a financial and parking demand model, a screening process for potential transportation demand management (TDM) strategies, and the development of a multi-phase implementation plan. Ultimately, this TDM Program seeks to assist and guide CSULB in its efforts to improve environmental sustainability, shift the fundamental nature of the campus away from a "commuter" school, maximize its transportation resources, and provide specific strategies to enable the University to invest in a transportation system that supports all modes of travel.

PROGRAM BACKGROUND

CSULB was established in 1949 with 169 students in a converted apartment building east of downtown Long Beach. By 1950, construction had begun on the new permanent campus at its current location. Since that time, CSULB has grown into one of the largest universities in California, occupying over 300 acres in the eastern portion of the City Long Beach. CSULB is now a key center of economic, academic, cultural, and social activity for both the City of Long Beach and the surrounding region.

As part of its dramatic growth and evolution, CSULB emerged primarily as a "commuter" campus, in which most of the 30,000 plus students and faculty live off-campus and commute each day for classes or work. While this framework for campus growth has served CSULB well until now, the University faces several issues that will challenge its long-term viability as a commuter campus.

It is no longer sustainable from an economic, traffic, or environmental perspective for CSULB to exist as primarily a commuter campus. The long-term vision calls for a campus in which more CSULB students, faculty, and staff have the choice to meet their daily needs on campus. The tangential benefits of such a shift are numerous, including a substantial reduction in the number of vehicle trips and their associated GHG emissions.

First, and foremost, the demand for higher education in California will only continue to grow, along with demand for access to CSULB. This may be tempered by the increasing popularity and use of online courses

that reduce campus vehicle trips, parking demand, and greenhouse gases, but at this point the degree of change is uncertain. Second, CSULB's physical footprint is established and the surrounding residential communities will largely inhibit additional growth of that footprint. Third, CSULB has made a strong commitment to long-term environmental sustainability and has pledged to reduce its carbon emissions and eventually become climate "neutral" as part of the American College & University Presidents' Climate Commitment (ACUPCC). Finally, all of these changes will take place in an environment of reduced financial resources, thereby requiring cost-effective investments.

CSULB recognizes that these factors necessitate a shift in its fundamental approach to campus growth and transportation access. It is no longer sustainable from an economic, traffic, or environmental perspective for CSULB to exist as primarily a commuter campus. While some students and faculty/staff will always continue to live off-campus, CSULB has begun to prioritize investments that will provide more housing, social, retail, commercial, and recreational opportunities directly on-campus. The long-term vision calls for a campus in which more CSULB students, faculty, and staff have the choice to meet their daily needs on campus. The tangential benefits of such a shift are numerous, including a substantial reduction in the number of vehicle trips and their associated GHG emissions.

CSULB's transition away from a commuter campus will not be immediate, but will happen over several years and decades of changes. This TDM Plan recognizes this vision, establishes a strong foundation for such change, and offers an incremental approach. The Plan has been developed with both short- and long-term goals in mind, with proposed strategies designed for CSULB to achieve all of its development, transportation, and sustainability goals in a cost-effective and realistic manner.

PROPOSED TDM STRATEGIES

In consultation with CSULB staff, this TDM Program includes a series of 26 strategies. The strategies are organized and presented according to category of improvement, as well as by proposed timeline for implementation. Implementation would occur under one of four different phases or TDM "packages" – immediate, short-term, long-term, and post-TDM – based on consideration of several factors, including total school population, campus parking utilization rates, and potential transportation-related impacts attributable to campus growth.

Figure ES-1 provides a summary of the proposed strategies and their implementation timelines. Following is a brief description of each strategy and how it would be utilized at CSULB.

Figure ES-1 List of Proposed TDM Strategies

Category	Number	Strategy	Phase
Parking	1	Implement demand-based pricing for students in CSULB parking facilities to reduce parking demand, adjust parking behavior, and increase user convenience	Immediate
	2	Work with the City to implement demand-based pricing for all on-street spaces, including on those streets adjacent to the CSULB campus	Short-term
	3	Improve parking wayfinding to enhance user experience and ensure efficient use of parking facilities	Short-term
Transit	4	Enhance transit amenities	Long-term
Bike / Pedestrian	5	Provide additional short-term and long-term bicycle parking	Immediate
	6	Partner with the City of Long Beach to ensure ongoing maintenance of pedestrian/bicycle/transit facilities	Immediate
	7	Develop a coordinated bicycle/pedestrian wayfinding system	Immediate
	8	Implement a bike sharing program	Immediate
	9	Address safety "hot spots" as identified in CSULB Bicycle and Pedestrian Plan	Long-term
	10	Implement an on-campus bicycle service and information station	Long-term
	11	Explore street network improvements	Long-term
Car sharing	12	Expand and diversify on-campus car sharing	Short-term
Marketing	13	Hire or appoint a TDM coordinator to implement and manage TDM measures	Immediate
	14	Expand the use of technology	Immediate
	15	Enhance on-campus marketing and social media	Immediate
Incentives	16	Extend pre-tax benefits to bicyclists	Immediate
	17	Reduce parking costs for carpools/vanpools as a means to incentivize ridesharing	Immediate
	18	Maximize use of Guaranteed Ride Home (GRH) program	Immediate
	19	Expand eligibility of rewards program to CSULB students	Short-term
	20	Evaluate additional incentives as part the rewards program	Short-term
	21	Evaluate the use of congestion pricing to manage demand in the peak periods	Long-term
Other	22	Evaluate the use of alternative schedules for classes and work shifts	Short-term
	23	Explore the use of vehicle parking restrictions	Long-term
Evaluation	24	Implement an annual monitoring and evaluation program	Immediate
Post-TDM Plan	25	Continue to invest in on-campus housing and amenities	Post-TDM
	26	Shift from monthly/semester/annual commuter permits to daily parking permits	Post-TDM

Appendix E: Methodology used in Transportation Demand Management Plan Environmental Analysis

METHODOLOGY

Outlined below is the methodology by which the environmental analysis was calculated:

1. Identify campus population[12] by campus group (faculty, staff/admin, freshman[13], other undergrad students[14], and graduate students[15]).
2. Analyze travel preferences survey to identify mode share to campus by campus group.
3. Using mode share, extrapolate number of people travelling by each mode by campus group.
4. Analyze travel preferences survey to calculate average one-way trip distance by mode and by campus group. This analysis was based on home location[16] and was conducted using ArcGIS Network Analyst to provide as accurate a trip distance as possible based on the existing road and transit network.
5. Analyze travel preferences survey to calculate average number of trips to campus by campus group.
6. Calculate baseline annual vehicle miles traveled (VMT)[17] =
    a. Drive alone, motorcycle/scooter, and drop off: Number of people x Average roundtrip trip distance x Average number of trips per week x Number of weeks per school year[18]
    b. Carpools: (Number of people carpooling / average carpool size) x Average roundtrip trip distance x Average number of trips per week x Number of weeks per school year
    c. Transit: Number of people x Average roundtrip trip distance x Average number of trips per week x Number of weeks per school year
7. Calculate total baseline annual CO_2e by multiplying annual VMT by appropriate EMFAC[19] emission factors (MT eCO_2 per mile) for the South Coast AQMD. Baseline transit CO_2e emissions were adjusted by an average passenger mile per vehicle mile factor based on 2011 service data[20] for LBT, MTA, and OCTA.
8. Calculate estimated emissions reduced by current strategies by adjusting baseline VMT and CO_2e by estimated cumulative impact from existing TDM program.
9. Calculate projected emissions reduced by proposed strategies by adjusting baseline VMT and CO_2e by estimated cumulative impact from proposed TDM program phases.

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[12] http://daf.csulb.edu/offices/univ_svcs/institutionalresearch/students/enrollment_registration.html

[13] Combined Fall 2012 and Spring 2013 Freshman totals.

[14] Factored out Fall 2012 Freshman from Spring 2013 Other Undergrad and then averaged Fall 2012 and Spring 2013 Other Undergrad totals.

[15] Averaged Fall 2012 and Spring 2013 totals.

[16] Respondents were asked to indicate the closest intersection to their home and zip code.

[17] Bike and walk trips were assumed to have no GHG emissions. No survey respondents indicated that they arrive by taxi.

[18] Based on 2013/2014 Payroll Calendar. Assumes 35 weeks for students, 37 for faculty, and 49 for staff/admin.

[19] http://www.arb.ca.gov/emfac/

[20] http://www.ntdprogram.gov/ntdprogram/profiles.htm

APPENDIX F: Executive Summary of Strategic Energy Plan

1 Executive Summary

1.1 Background and Scope

California State University, Long Beach currently has 96 buildings on its campus spread over 323 acres with a total approximate square footage of 4,400,000. The Campus has executed numerous energy retrofit projects in the past, ranging from lighting retrofits to DDC, VAV conversions and VFD Conversions and installation of high efficiency motors. P2S Engineers Inc. was retained by California State University, Long Beach (CSULB) to develop a Strategic Energy Plan for the campus that identifies energy efficiency projects, evaluates provision of alternative energy sources at the campus and analyzes their contribution to helping the campus reduce energy consumption and associated greenhouse gas emissions.

The scope of this plan involved:

- Evaluating existing mechanical systems and their related control configurations in existing buildings,
- Evaluating existing Central Plant , analysis of piping distribution and control configurations,
- Evaluating existing lighting systems, their efficiencies and their controls,
- Identifying potential energy conservation measures for lighting and mechanical systems,
- Evaluating sites suitable for providing photovoltaic panels to generate solar power,
- Establishing Rough Order of Magnitude Construction Cost Estimates for the identified potential energy conservation measures,
- Estimating simple energy paybacks.
- Establishing existing and proposed greenhouse gas emissions projections

1.2 Campus Sustainable Policies

Executive Order No. 987 put forth by the Chancellors office delegates to each president or his/her designee at the campus, the implementation of the California State University Board of Trustees' energy conservation, sustainable building practices, and physical plant management policy. This executive order reaffirms the need to conserve energy in order to achieve the goal originally set in 2001 and reevaluated in 2005. The new goal is to reduce consumption by 15% by the end of FY 2009/10, as compared to 2003/04. The trustee policy is consistent with Governor Arnold Schwarzenegger's Executive Order S-12-04, which requests the CSU's active participation in statewide energy conservation and reduced electrical demand.

This executive order retains general operational provisions and sustainable building practices while adding the CSU Sustainable Measurement Checklist process. It encourages campuses to continue to adopt an integrated design approach that includes sustainable materials and practices. It also requires new goals for energy conservation, and the purchase and generation of renewable power.

In addition, the campus signed the ACUPCC Presidential Climate Commitment on May 31, 2011 to reduce greenhouse gas emissions and pursue the goal of reducing greenhouse gas (GHG) emissions to 1990 levels by 2020, following the California Global Warming Solutions Act of 2006 (AB32) directive on GHG emissions. This target is not growth adjusted.

The new campus energy and sustainable policy currently in review and in draft form now mandates stricter reductions in greenhouse gas emissions compared to AB 32. All campuses are required to reduce greenhouse gas emissions to 80% below 1990 level by 2040 as compared to 2050 stipulated under the AB 32 Act.

The policy also indicates that each CSU will endeavor to meet or exceed the State of California and California Public Utilities Commission Renewable Portfolio Standard (RPS) that sets a goal of procuring 20 percent of its electricity needs from renewable sources, by 2010 subject to the constraints of program needs and standard budget parameters.

In addition, all major capital projects starting design beginning in the FY 2011-2012 shall meet the following requirements: new construction projects shall at a minimum outperform the 2010 Title 24 Standards (California Energy Code) by at least 15 percent. Major capital renovations projects shall at a minimum outperform the Title 24 Standard by at least 10 percent if connected to a campus central plant, or 7.5 percent if a standalone project. These efforts will help to reduce the BTU/square foot consumption of the projects.

The campus over the years has aggressively pursued reduction of energy consumption by executing a number of energy retrofit projects involving both mechanical and electrical systems within the buildings and making the existing central plant efficient. A list of these projects executed by the campus in the past are provided at the end of the chapter. The campus has also pursued the provision of renewable power sources at the campus and currently produces approximately 500,000kWh of energy from renewable per year.

Electricity and gas purchases represent 45% of campus GHG emissions so energy conservation and GHG reduction goals are closely linked. Accordingly, it is expected that the Strategic Energy Plan projects will be one of the main tools the campus uses to meet its GHG targets.

1.3 Energy Use and Greenhouse Gas Reduction Targets

The campus energy use and associated greenhouse gas emissions for the years 1990, 2004 and 2009 are documented in Table 1-1. The total energy consumption (both electric and gas) were provided by the campus. The greenhouse gas emissions are calculated based on published US Emission Factors by eGRID for each sub-region.

The campus has embraced the AB32 and the chancellor's policy targets for reducing their greenhouse gas emissions. The past efficiency projects executed by the campus and the proposed potential SEP projects contributing to the reduction in greenhouse gas emissions are provided in tables 1.1C.

Table 1-1 shows energy usage and GHG emissions for the campus, starting with the baseline year 1990. Table 1-2 shows the impacts of all potential projects identified in the SEP.

1.4 Strategic Energy Plan Projects

This Strategic Energy Plan identifies potential energy efficiency retrofit projects at the campus and are summarized in Table 1-2. The projects include primarily lighting, HVAC and commissioning measures. A number of other measures are included that apply to all evaluated buildings, regardless of size. The Plan also addresses the potential for energy efficiency in new construction and renovated buildings based on the projected campus 5-year state and non-state funded capital programs (new construction, renovation and deferred maintenance/capital renewal) A separate line item shows the potential from addition of photovoltaic power to roof areas on campus. All projects were evaluated using the campus energy rates.

The Strategic Energy Plan is comprehensive in its identification of potential energy projects. As a result the total potential energy savings is significant and the payback periods for some of the measures are fairly long. During implementation the campus will select measures to implement which meet its investment and physical plant needs.

The efficiency measures will be implemented through the UC/CSU Investor Owned Utility Partnership Program in the 2009-11 and 2012-14 funding cycles. Utility incentives are projected to be similar to those that have been used in past cycles at the rate of $0.24/kWh. Energy savings have been calculated on a project by project basis, with incentives based on the building level savings. This report does not represent an investment grade audit so the financial and energy reduction numbers are expected to be refined in project-specific engineering that will be undertaken before the campus submits proposals for individual project initiatives or funding. The photovoltaic projects would be implemented using the California Solar Initiative incentives.

The effect of these potential projects on meeting the efficiency and GHG targets is illustrated in Table 1-2. In these tables the energy savings are reported as they would be measured at the utility meters, taking into account the effect TES at the central plant. The indication is that the SEP projects will play a significant role in helping the campus reach its GHG emissions reduction goal, with the estimated emissions reductions being around 35-40% of that needed to reach 1990 levels.

The economics of the projects are described in Table 1-2, which lists the potential projects by each building. Table 1-3 also lists the Solar Projects along with projected California Solar Initiative incentives and the net simple paybacks to the site, factoring in the incentives.

The list of potential projects will be continuously tuned and updated as projects are built, savings are measured, new technologies become commercially available, and campus loads change over the course of the coming years.

1.5 Report Overview

A review of the existing state owned buildings on campus and discussions had with CSULB staff revealed that majority of the buildings on campus have implemented energy saving strategies in the past years. The campus identified a total of 49 state owned buildings and 17 non-state owned buildings for our investigation and are included as part of this report. An investigation of these buildings identified potential mechanical energy saving measures and potential lighting retrofit opportunities. A campus map identifying these buildings that have potential mechanical energy saving opportunities and lighting retrofit opportunities is provided at the end of this Chapter.

The cost of electricity for the purposes of pay back calculations has been assumed to be $0.089/kWh. The cost of natural gas is calculated to be $0.90/therm. Both values were obtained after discussions with the campus.

Chapter 2 provides an Introduction to our report. Chapter 3 and 4 discuss the historical energy usage and associated greenhouse gas emissions and existing metering at the campus. Chapter 5 and 6 discuss the current utilities and their procurement options and the electrical and gas infrastructure at the campus.

Chapter 7 provides details on the alternative technologies evaluated as part of our report, identifies current renewable generation at the campus and provides locations of proposed renewable power generation.

Chapter 8 provides a description of energy efficiency measures evaluated as part of our effort that are applicable to the buildings surveyed and analyzed.

Chapter 9, 10 and 11 provide building and project summaries with their associated energy conservation measures for all buildings evaluated as part of our effort.

Chapter 12 and 13 provide current greenhouse gas emissions, current legislations and their goals and future goals of the campus in reducing the same

Appendix A provides photographs of existing systems, and their descriptions along with details of existing equipment.

Appendix B provides details of calculations of conservation measures.

Over all, an estimated $11,344,332 projects with an estimated savings of 13,858,803 kWh which includes estimated $484,739 of lighting projects with an estimated savings of 2,183,501 kWh were identified. The overall yearly demand of the campus is currently estimated approximately at 50,000,000kWh. These are summarized in Table 1-2.

Figure 1.1 shown in the next page shows CO_2 equivalent emissions trends and trajectories for business as usual and state target as dictated by the AB 32 ordinance.

Figure 1.2 shown in the next page shows CO_2 equivalent emissions trends and trajectories for business as usual and potential reductions in the emissions after implementation of the various energy conservation measures recommended in the report. These include energy conservation measures projects in HVAC, and Lighting, MBCx projects, reduction in plug loads, and behavioral based load reductions.

FIGURE 1-1—CO_2 EQUIVALENT EMISSIONS TRENDS AND TRAJECTORIES

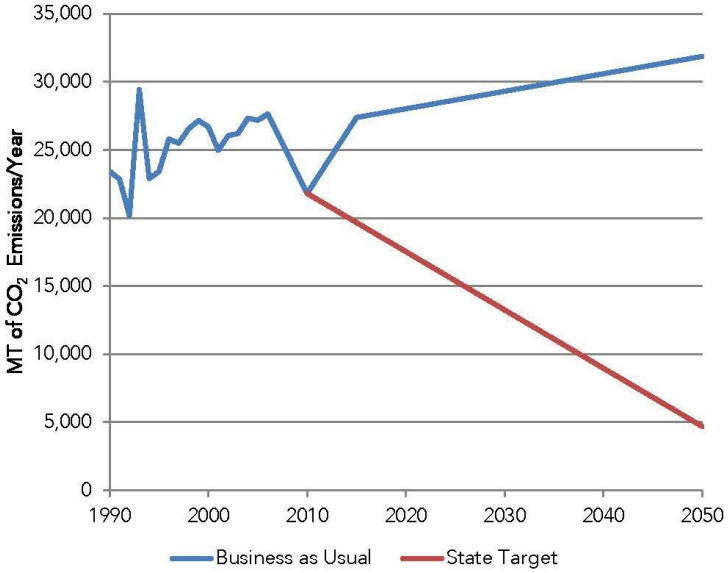

FIGURE 1-2—BUSINESS AS USUAL VS. POTENTIAL EMISSION REDUCTION INITIATIVES

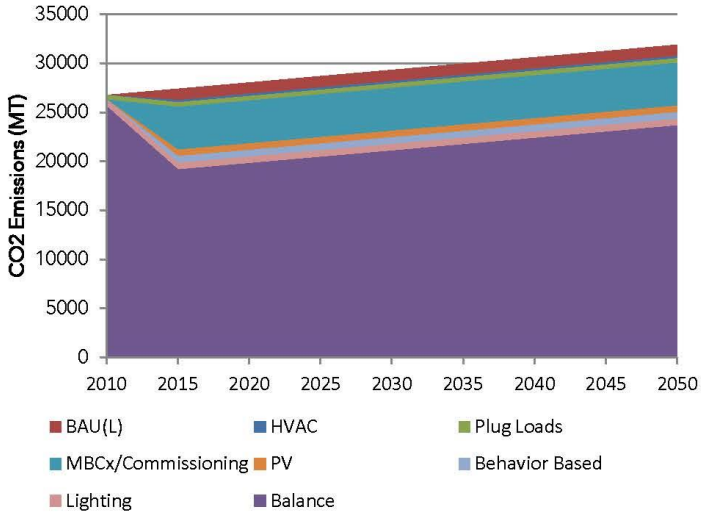

TABLE 1-1

Year	Annual Electrical Energy Usage (kWh/Yr)	Annual Thermal Energy Usage (Therms/Yr)	Total Energy Usage (kBtu/Yr)	Approximate, ft^2	$kBtu/ft^2/Yr$	Total Campus GHG Emissions (MT/Yr)	GHG Emissions vs. 1990 Baseline
1990	48,531,845	1,664,834	332,122,631	2,850,000	116.53	23,424	100.00%
2004	61,275,291	1,656,991	374,831,664	3,450,000	108.65	27,336	116.70%
2009	50,223,070	1,218,983	293,309,638	3,682,423	79.65	21,641	92.39%
2015	28,542,192	1,154,727	212,887,242	3,682,423	57.81	14,609	62.37%

TABLE 1-2

Savings Measure	Electric kWh/Yr	Peak Demand kW	Gas Therms/ Yr	GHG (CO_2) MT/Yr	Total Cost Savings ($/Yr)	Project Cost	Incentive	Net Cost	Simple Payback (Years)
HVAC	3,653,978	724	6,688	1,165	$351,490	$7,031,099	$845,691	$6,185,408	17.60
Plug Loads	639,563	73	5,640	226	$50,556	$362,472	$128,667	$233,805	4.62
MBCx/ Commissioning	4,103,279	468	46,069	1,501	$410,757	$1,565,918	$886,624	$679,293	1.65
PV	13,274,848	8,428	0	4,369	$1,181,461	$55,787,345	$9,956,136	$45,831,209	39.00
Behaviour Based	2,143,804	0	0	664	$-	$-	$-	$-	0.00
Llighting	2,286,577	694	0	708	$249,462	$3,421,270	$548,779	$2,872,491	11.51
Totals	26,102,048	10,388	58,398	8,632	$2,243,726	$68,168,103	$12,365,897	$55,802,207	24.87

TABLE 1-3

# of Bldgs	Technology	Approx. Roof SF	PV Size KW	kWh Generation	System Cost*	Incentives	Annual Savings**	Simple Payback (Years)	GHG Emissions Reduction MT/yr
14	Roof Mounted PV	321,198	1,606	2,529,434	$8,029,950	$1,897,076	$225,120	27	832
7	Canopy Mounted PV	1,364,497	6,822	10,745,414	$47,757,395	$8,059,060	$956,342	42	3,536
21	Totals	1,685,695	8,428	13,274,848	$55,787,345	$9,956,136	$1,181,461	39	4,369

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