Climate Action Plan
2014

UCSB
Utility & Energy Services

UCSB Sustainability




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In March 2007, University of California (UC) President Robert C. Dynes signed the American College and Universities Presidents Climate Commitment (ACUPCC) on behalf of all UC Chancellors. ACUPCC membership requires development of a Climate Action Plan to establish strategic Greenhouse Gas (GHG) reduction measures, as well as to set a target date for climate neutrality.

The UC Policy on Sustainable Practices sets system-wide policy guidelines and implementation procedures for environmental impact minimization and operational sustainability, including the following provisions regarding Climate Protection Practices:

- With an overall goal of reducing GHG emissions while maintaining enrollment accessibility for every eligible student, enhancing research, promoting community service, and operating campus facilities more efficiently, the University will develop a long term strategy for voluntarily meeting the State of California's goal, pursuant to California Assembly Bill 32 (AB32), The California Global Warming Solutions Act of 2006, that is to reduce GHG emissions to 1990 levels by 2020.

- The University will pursue the goal of reducing GHG emissions to 2000 levels by 2014.

- The University will pursue the goal of reducing GHG emissions to 1990 levels by 2020.

- The University will develop an action plan for becoming climate neutral which will include: a feasibility study for meeting the 2014 and 2020 goals (and) a target date for achieving climate neutrality as soon as possible, while concurrently maintaining the University's overall mission. Climate neutrality means that the University will have a net zero impact on the Earth's climate, and it will be achieved by minimizing GHG emissions as much as possible and by using carbon offsets or other measures to mitigate the remaining GHG emissions.

In accordance with these initiatives, the University of California, Santa Barbara (UCSB) created a Climate Action Plan (CAP), approved by the Chancellor's Campus Sustainability Committee in August 2009. The 2009 CAP was drafted with the best available data and methodology. It was intended to establish an institutional framework for the inventorying, annual tracking, and strategic reduction of GHG emissions, to be updated on a biennial basis. The 2012 CAP included revised GHG emissions baselines and reduction goals, as well as updated GHG emissions inventory results through calendar year 2010. Additionally, it included GHG emissions from commuting and University-funded air travel. This 2014 CAP supersedes the 2012 document.

GHG emissions resulting from activities under UCSB's operational control were inventoried and reported annually to the California Climate Action Registry (CCAR) for years 2004 through 2009. In 2010, UCSB began reporting to The Climate Registry (TCR), which has replaced CCAR. The 2014 CAP includes GHG emissions inventory results through calendar year 2012 and mitigation strategies as well as revised emissions forecasts. The total 2011 GHG emissions were 90,959 metric tons of carbon dioxide equivalents (MT CO_2e), and total 2012 GHG emissions were 91,596 MT CO_2e.

The 2014 CAP details the following GHG emissions reduction targets:

- 2014: 2000 Emissions Level – 99,699 MT CO_2e
- 2020: 1990 Emissions Level – 90, 736 MT CO_2e
- 2025: Scope 1 & 2 Carbon Neutrality (Set by UC President Janet Napolitano)

- 2050: Complete Carbon Neutrality (Includes scope 3 emissions)

These reduction targets are estimates based on the methodology used to inventory 2012 emissions. Where data was not available for 2000 and 1990, emissions have been scaled for campus population. UCSB's ability to achieve its stated GHG emissions reduction targets depends on the growth of the campus, the level of available state/utility sponsored energy efficiency programs, the build-out of renewable energy generation capacity on campus, and reductions in carbon intensity of transportation fuels and purchased electricity consumed by the campus and its population.

UCSB has achieved the 2014 reduction target two years early and is projected to meet the 2020 emissions reduction target, primarily through a $17 million investment in energy efficiency projects funded through the continuation of the Strategic Energy Partnership, a 5% reduction in business air travel through encouraging remote conferencing, reduced commuter emissions by moving students, faculty, and staff on campus, and by developing on-site renewable energy. The mitigation efforts discussed in section 5 will save the campus $3.7 Million annually in avoided energy costs.

After forecasting for planned reduction measures in energy conservation, on-site renewable energy production, energy efficiency projects, and commuter and air travel reductions, UCSB's 2020 projected emission level with mitigation is 86,519 MT CO2e (Table 1). This represents a 12% reduction from the 2020 BAU projections, and a 5% reduction from 1990 levels.

Table 1: Summary of major mitigation strategies

Mitigation Strategies	Energy Savings (KWH/Year)(2020)	GHG Savings (MT CO2e/Year) (2020)	Energy Cost Savings ($/Year)	Program Costs	Payback period (years)
SEP Projects (2012 - 2013) savings	7,206,797	1,485	520,967	$4,562,021	9
SEP Projects (2014) savings estimates *	4,471,899	849	193,881	$5,347,637	28
SEP Projects savings projections(2015 -2019)	19,570,308	3,938	1,651,890	$13,081,907	8
Energy Conservation	12,480,700	2,374	983,000	695,325	<1
On-site Renewable Energy	2,228,000	498	65,940	6,000,000	30 (Large parking structure) 17 (Ground level)

Virtual Travel	NA	1,724	298,600	180,000	<1
Commuting Reduction	NA	1,016	NA	0	0

* Project costs are more expensive in 2014 because they address not only GHG emissions but regulatory issues and help us meet the NEI requirements.

Table 2: Costs of entering into the CAP and Trade Program

Participation Under CAP and Trade						
Year	2015	2016	2017	2018	2019	Total
Cost ($/Yr)	$388,952	$441,237	$459,818	$500,154	$2,214,475	$2,214,475
Potential GHG savings (MT CO_2e/yr)	141	150	160	171	182	804

Note: Not included in projections because it is Contingent on whether CARB decides to give the UC-System Allowances and whether UCSB decides to opt into Cap and Trade program

UC President Napolitano's Carbon Neutrality in its operations by 2025 goal, while a laudable goal which will inspire creative ways of reducing our GHG emissions, will only be achievable through financial partnerships with the UC-system and the State of California. UCSB will have to reduce scope 1 and 2 emissions by 54,000 MT CO2e from 2025 projected BAU emissions levels and by 44,824 MT CO2e from projected emissions levels with mitigation (mitigation strategies outlined in section 5 of this CAP) in order to meet the 2025 carbon neutrality goal of zero net operating emissions. In addition to the $17 million (table 1) investment needed to meet the 2020 target (mitigation strategies outlined in section 5 of this CAP), UCSB will need to invest $14.5 million in energy efficiency and conservation projects (Table 3).

Table 3: Investment needed to reach 2025 Carbon neutrality goal

Mitigation strategies	Reduction (GHG)	$/CO2e	Cost	Annual Cost savings (2025)	Payback Period (Years)
Efficiency	4,359	$3,322	$14,481,315	$3,566,030	4

While large reductions can be made through energy efficiency and conservation, which have a considerable return on investment and payback period, at some point, emissions must be further reduced by increasing the use of renewable energy or by obtaining offsets.

Table 4: Offsets required to reach 2025 Carbon Neutrality

Offsets	Reduction (CO_2e/Year)	Annual Cost (2025 $)	Annual energy Cost savings

Conservation program	1,917	700,000	1.2 Million
Carbon free Electricity*	16,634	$ 4.36 Million	0
Carbon Free Gas	15,532	$ 2.65 Million	0
Offset Credits	1,729	$ 21,000	0

* Carbon free electricity cost estimates were derived from a proposed rate structure that SCE may be offered starting in 2015. SCE is planning to offer Carbon free electricity to us at a 5 cent per KWH premium.

UCSB will need to spend an additional 7 million dollars in 2025 for the purchase of carbon free energy and offsets (Table 4). However the estimated $8 Million dollars UCSB will save on the campuses annual energy utility bill from planned improvements in Efficiency and conservation (2012 through 2019), and recommended investment in efficiency and conservation (2020 through 2025) will negate most of the increases the campuses annual utility bill due to growth, increases in energy costs, and the high costs of renewable energy (Table 5).

Table 5: Utility Cost Projections

2025 Campus energy cost projections	Business as usual costs	With recommended investments in efficiency and conservation costs	Completely Carbon Free*
Natural Gas	$ 6,014,470	$ 4,537,446	$ 7,190,397
Electricity	$ 20,674,064	$ 15,670,057	$ 20,032,894
Total	$ 26,688,534	$ 20,207,503	$ 27,223,291

* Utility cost projections include reductions form recommended investments in efficiency and conservation as well as cost increases from purchasing carbon free energy.

2 INTRODUCTION

2.1 BACKGROUND

The University of California, Santa Barbara (UCSB) has long been a leader in the advancement of environmental issues, education, and research. In 1990, then-Chancellor Barbara Uehling was one of the first chancellors in the US to sign the Talloires Declaration. This document, originally signed by 22 university presidents, declares that institutions of higher learning will be world leaders in developing, creating, supporting, and maintaining sustainability on their campuses.

In September 2006, Governor Arnold Schwarzenegger signed into law AB 32 – the Global Warming Solutions Act of 2006. In March 2007, the University of California President, Robert Dynes, approved the Policy on Sustainable Practices – guidelines for the UC system to minimize its impact on the environment and decrease its dependence on non-renewable energy. Within this policy is a section on Climate Protection Practices that mandates each campus to develop, by December 2008, a long-term plan for (1) achieving 2000 emissions levels by 2014, (2) achieving 1990 levels by 2020, and (3) eventual climate neutrality. An update to these policies was adopted in summer 2011, raising the bar higher for sustainable operations and continuing to require all campuses to create Climate Action Plans and to update them on a biennial basis.

In 2007, President Robert Dynes signed the American College and University Presidents' Climate Commitment (ACUPCC), and UCSB Chancellor Henry T. Yang was appointed to the ACUPCC advisory board. As part of this commitment and ongoing development of sustainability initiatives, in October 2008, Chancellor Yang appointed a high-level campus-wide sustainability committee consisting of staff, faculty, and students. This committee reviews and prioritizes sustainability projects and initiatives and submits recommendations to the Chancellor for project approval and funding.

In 2013, UC President Napolitano announced that the UC system will be carbon neutral in its operations by 2025 through changing the fundamental profile of our energy sources. This initiative proposes four efforts that will enable us to become the first major university system to achieve carbon neutrality:

- **Wholesale Electricity**
- **Campus Energy Efficiency and Renewable Energy**
- **Natural Gas and Biogas Procurement**
- **Management of Environmental Attributes**

As UCSB moves forward in planning new efforts to reduce emissions, this ambitious goal of neutrality will guide our strategies for improving energy efficiency and renewable energy supplies.

2.2 REGULATORY CONTEXT

Climate change will have significant impacts on California's coastal environments and communities. Potential impacts of climate change along the California Coast include increased storm surges and flooding, increased coastal erosion and inundation, loss of coastal habitat, and threats to marine ecosystems. Recognizing the potential impacts of climate change, the state of California, as well as local governments, has passed several laws aimed at reducing greenhouse gas emissions and protecting local communities and ecosystems.

AB32

- In 2006, the Legislature passed, and Governor Schwarzenegger signed, AB 32, the Global Warming Solutions Act of 2006, which set the 2020 greenhouse gas emissions reduction goal into law. It directed the California Air Resources Board (CARB or Board) to begin developing discrete early actions to reduce greenhouse gases while also preparing a scoping plan to identify how best to reach the 2020 limit. Under AB 32, the University is required to report stationary sources of CO_2e emissions to CARB. UCSB reported 21,662.55 tons of CO_2e emissions for 2012 to CARB. If UCSB exceeds 25,000 tons CO_2e, it will be required to purchase emission credits and develop a GHG reduction plan. However CARB may approve the proposed regulatory amendments allowing the UC-system to receive an allocation of allowances for 2013-2020. Each applicable UC must report to CARB on how it spent the money it otherwise would have had to spend on Cap and Trade compliance, and the University must invest an amount at least equal to the value of the allocated allowances in a manner consistent with the goals of AB 32.
- As part of the California Global Warming Solutions Act, CARB also adopted a regulation in 2009 to reduce greenhouse gas (GHG) emissions from stationary sources of Ozone Depleting Substances (ODS) through refrigerant leak detection and monitoring, leak repair, system retirement and retrofitting, reporting, and recordkeeping, as well as through proper refrigerant cylinder use, sale, and disposal. ODS used as refrigerants such as chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC), hydrofluorocarbons (HFC), and perfluorocarbons (PFC) have a high global warming potential. UCSB reports sulfur hexafluoride (SF_6) in gas insulated switchgears and will soon implement a refrigerant tracking database.

New Source Review

- The Santa Barbara County Air Pollution Control District (APCD) regulates emissions at the local level and gains its authority from CARB and the EPA to ensure compliance with the Federal Clean Air Act. The APCD is the regulating agency for all permitted equipment and processes that produce emissions at UCSB. All of UCSB's contiguous properties are regulated as one stationary source and contain over 130 permitted emissions sources through the local, state, and federal regulating agencies. When UCSB proposes to install a new piece of equipment requiring a permit, the APCD conducts a New Source Review (NSR). The purpose of this NSR is to calculate the additional Net Emissions Increase (NEI) that will result from adding the potential emissions from the new source to UCSB's total emissions inventory. The total emissions inventory for all UCSB permitted sources is based on the sum of the potential emissions from each source rather than actual emissions. Likewise, the NEI calculated for each new source is also based on potential rather than actual emissions. If the NEI resulting from a NSR is calculated to raise UCSB's total emissions past the established threshold for any particular criteria pollutant, the APCD will either deny the permit application or require that UCSB purchase emission offsets. UCSB is currently working on reducing emissions from our existing permitted sources through retrofits of existing boilers and the installation of efficient boilers with lower emissions.

Assembly Bill 2588

- Assembly Bill 2588, the Air Toxics "Hot Spots" Information and Assessment Act, requires facilities to evaluate the potential public health risks resulting from emissions generated during routine operation. A health risk assessment is conducted by modeling the exposure to potential health risks resulting from various emissions sources within a facility. In order to conduct this assessment, UCSB developed a comprehensive emissions database containing data on each emissions source and, using a computer model, calculated the potential health risks to the UCSB population as well as the surrounding community. A current inventory of all emissions sources on campus is also maintained for use in any future health risk assessments. UCSB is making every effort to ensure that students, staff, and faculty as well as the surrounding community are not exposed to any potential adverse health effects as a result of campus operation.

University of California, Office of the President Mandate

In March 2007, President Robert C. Dynes signed the American College and Universities Presidents' Climate Commitment (ACUPCC) on behalf of all UC Chancellors. ACUPCC membership requires development of a Climate Action Plan to establish strategic GHG reduction measures, as well as to set a target date for climate neutrality.

- The UC Policy on Sustainable Practices sets system-wide policy guidelines and implementation procedures for environmental impact minimization and operational sustainability, including the following provisions regarding Climate Protection Practices:
  - With an overall goal of reducing GHG emissions while maintaining enrollment accessibility for every eligible student, enhancing research, promoting community service, and operating campus facilities more efficiently, the University will develop a long term strategy for voluntarily meeting the State of California's goal to reduce GHG emissions to 1990 levels by 2020, pursuant to AB32, The California Global Warming Solutions Act of 2006.
  - The University will pursue the goal of reducing GHG emissions to 2000 levels by 2014.
  - The University will pursue the goal of carbon neutrality by 2025.
  - The University will develop an action plan for becoming climate neutral, which will include a feasibility study for meeting the 2014 and 2020 goals (and) a target date for achieving climate neutrality as soon as possible, while maintaining the University's overall mission. Climate neutrality means that the University will have a net zero impact on the Earth's climate that will be achieved by minimizing GHG emissions as much as possible and by using carbon offsets or other measures to mitigate the remaining GHG emissions.

UC Presidential Initiative

In November 2013 President Janet Napolitano announced an initiative to make UC the first research University to achieve carbon neutrality in its operations by 2025.

2.3 SCOPE OF THE CLIMATE ACTION PLAN

Greenhouse Gas Emissions and the UCSB Campus

UCSB has long recognized the importance of addressing climate change issues and is proactively implementing solutions. Current campus emissions are 91,703 MT CO_2e, which is 8% below 2000 emissions levels. However, population increase, combined with the anticipated growth of on-campus housing to accommodate a larger number of faculty and staff, will raise UCSB´s demand for energy. Acknowledging the need for reducing Greenhouse Gas emissions, UCSB has taken steps to reduce energy consumption. Looking forward, the University seeks to continue decreasing overall Greenhouse Gas emissions while meeting the needs of the current and future campus population.

UCSB Physical Scope

The 1055 acre UCSB Campus is located in Santa Barbara County on the Pacific coastline where it is highly susceptible to the effects of sea level rise. UCSB is made up of four principal campuses: the 422 acre Main Campus, acquired in 1948; the 184 acre Storke Campus, purchased in 1962; the 273 acre West Campus, purchased partly in 1967 and partly in 2007; and the 174 acre North Campus, purchased in 1994. The University also owns two apartment buildings in Isla Vista (El Dorado and Westgate). Including all of its land holdings, UCSB currently occupies nearly 8 million California-Adjusted Gross Square Feet (CAGSF) of built-out space.

SCOPE OF UCSB EMISSON SOURCES

Each year, UCSB performs an audit of its emissions sources through the Climate Registry (formerly the California Climate Action Registry). From 2004-2006, it only looked at CO_2 emissions. Starting in calendar year (CY) 2007, it began auditing all six Kyoto Protocol gases. UCSB's annual GHG emissions inventory quantifies emissions in three categories: Scope 1 – Direct Emissions: on-site natural gas, diesel, and propane combustion; campus fleet emissions; marine vessel emissions; and fugitive emissions. Scope 2 – Indirect Emissions: purchased electricity and gas. Scope 3 – Indirect Emissions (Other): University-funded business air travel and student, staff, and faculty commuting.

2.4 CLIMATE ACTION PLAN UPDATES: A LIVING DOCUMENT UPDATE

In the summer of 2009, the UCSB campus approved its first Climate Action Plan (CAP), based on GHG emissions data gathered during calendar year 2007. The 2009 CAP included emissions data and addressed mitigation strategies for scope 1 (on-site combustion and campus fleet GHG emissions) and scope 2 (purchased electricity consumption). In addition to scopes 1 and 2, the 2012 CAP also included emissions data and mitigation strategies for scope 3 (university-funded business air travel and student, staff, and faculty commuting).

The 2014 Climate Action Plan quantifies and analyzes UCSB's current, historical, and projected emissions and evaluates the campus' progress toward meeting reduction targets in years 2020 and 2050. Planned and conceptual climate change mitigation strategies outlined in this document demonstrate UCSB's ability to achieve a 1990 GHG emission level by 2020 as the campus' building stock and population continue to grow.

The 2014 Climate Action Plan includes:

- Historical emissions reduction efforts
- 2011 and 2012 GHG emissions inventory methodology and results
- Historical and projected GHG emissions
- Mitigation strategies and projected reductions
- Curriculum and Research efforts related to Climate Change
- Community Outreach efforts regarding Climate Change
- Student Life Initiatives: The Division of Student Affairs Zero-Net Energy Strategic Plan

Continuing engagement and evaluation of this plan by the Chancellor's Campus Sustainability Committee and The Academic Senate Sustainability Workgroup will help in ensuring that UCSB meets its commitments to reducing campus climate impacts. The Climate Action Plan is intended to assist in this process by documenting progress, identifying unknowns, and framing next steps.

3 HISTORICAL MITIGATION STRATEGIES

3.1 HIGHLIGHTED HISTORICAL MITIGATION EFFORTS

Energy Efficiency

In the late 1990s, UCSB Energy Services began implementing aggressive energy efficiency measures, such as de-lamping, HVAC upgrades, lighting retrofits, metering, building commissioning, and installation of chilled water loops. Over the last decade, the campus has made tremendous efforts to reduce GHG emissions. Low hanging fruit such as lighting retrofits were targeted early on by the campus and have played a major role in reducing emissions. Between 2001 - 2003, the campus upgraded 50+ buildings with T8 lamps and program start electronic ballasts. High Pressure Sodium (HPS) lights on building exteriors were also replaced with compact fluorescent and metal halide lights, reducing GHG emissions 1,110 MT CO_2e annually and saving almost $400,000 annually in electricity costs. Since the last Climate Action Plan Update, UCSB Energy services has completed more than 20 major energy projects, saving the campus millions of dollars annually in electricity costs and reducing GHG emissions (Table 6).

Table 6: 2010 – 2011 Energy Efficiency Improvements

Period	Cost	Electricity Saved (kWH/yr)	Natural Gas Saved (therms/yr)
2009	432,778	650,461	3,223
2010	1,242,925	2,046,639	55,236
2011	3,329,519	2,937,785	121,963

Buildings

UCSB has historically been a leader in green building. In 2002, Bren Hall was the first laboratory building in the US to achieve Platinum-level certification in Leadership in Energy and Environmental Design (LEED) for New Construction (NC), a rating system developed by the US Green Building Council. Subsequently in 2009, Bren Hall was awarded a second LEED Platinum certification for its ongoing maintenance and operational practices, making it the only facility in the world to have achieved such a distinction.

The University has maintained this leadership position in green building design, construction, and operation with the first LEED for Homes certification in the UC system completed in 2011. Between 2010 - 2011, UCSB LEED certified all of Phase 1 of North Campus Housing and 12 buildings (Table 7).

Table 7: 2010 -2011 LEED certificated Buildings

LEED Rating System	Building Name	Building Function	Certification Level	Certification Year	Year Built
NCv2.2	Education	Academic	Silver	2010	2010
NCv2.2	Social Science & Media Studies	Academic	Silver	2010	2010
NCv2.2	Pollock Theater	Theater	Silver	2010	2010
NCv2.2	Engineering II Addition	Academic	Gold	2010	2010

NCv2.1	Tipton Meeting House	Academic/Administrative	Platinum	2011	2011
HOMESv3.0	North Campus Faculty Housing Phase I	Residential	Gold (MF)/Silver(SF)	2011	2011
EBv2.0	Life Sciences Building	Laboratory	Silver	2010	2003
EBv2.0	Marine Science Research Building	Laboratory	Gold	2011	2006
EBv2.0	Harder Stadium Office Annex	Academic	Silver	2011	2004
EBv2.0	Kohn Hall	Academic	Silver	2011	1994
EBv2.0	Materials Research Laboratory	Laboratory	Certified	2011	1997
EBv2.0	Ellison Hall	Academic	Gold	2012	1967
EBv2.0	San Clemente Villages	Housing	Gold	2012	2008

Conservation through Administrative and Behavioral Changes

The campus as a whole has been dedicated to conserving energy, with a wide range of groups and organizations within the campus community working to reduce energy use.

PowerSave Campus

The PowerSave Campus Program is a student-driven energy efficiency program that works to save energy, promotes careers in the field, and increases awareness of the importance of energy efficiency. Projects include energy audits and assessments, energy efficiency technology retrofits, intern-led and faculty-sponsored academic courses, and green career fairs. Every year, PowerSave Campus also hosts an energy conservation competition in the Residential Halls during the month of February. The competition encourages energy savings by offering prizes to the Residential Hall that reduces their energy use by the greatest amount. During the 2012 – 2013 term, 611 freshman students living in the Residential Halls participated in the competition and saved an estimated 15,059 lbs. of CO_2e.

The Green Initiative Fund

The Green Initiative Fund (TGIF) was created by students in the spring of 2006 with a mission to "reduce the University's impact on the environment." It has provided support to a number of projects that promote energy conservation through efficiency and behavior change. Since the last Climate Action Plan update, TGIF grant has provided more than $256,000 in funding to 16 projects aimed at reducing GHG emissions, including several solar projects.

The Transportation Alternatives Program (TAP)

The Transportation Alternatives Program (TAP) at UCSB has also made enormous efforts to reduce commuter emissions by equipping students, staff, and faculty with the resources they need to reduce their GHG emissions by choosing alternative means of transportation. TAP offers options such as free and unlimited local MTD bus use to students, complimentary on-campus parking for a reduced amount of hours per month, access to the carpool match program, and complimentary emergency rides home. The Program is heavily used by staff and faculty, as well as by students that do not live on or around campus. Currently, 92% of students commuting to campus use alternative modes of transportation.

In addition, UCSB supports 15 vanpools that run throughout Santa Barbara and Ventura Counties to reduce commuter miles, gasoline consumption, and GHG emissions. Alternative campus commuters can also benefit from bike lockers, showers, and clothes lockers, as well as access to a car share program on campus.

All of the efforts made by the staff, students, and faculty on campus have enabled the campus to reduce GHG emissions 8% below the 2014 climate reduction target.

4 CAMPUS EMISSIONS

The following summarizes UCSB's approach to inventorying emissions. UCSB's GHG emissions inventory includes emissions of the six Kyoto Protocol gases – carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) – resulting from fossil fuel consumption and refrigerant use at facilities under operational control of the University, including the main campus and off-campus housing and auxiliary facilities, as well as emissions associated with the commuting patterns and business air travel of the UCSB population.

UCSB's annual GHG emissions inventory quantifies emissions in three categories:

Scope 1 – Direct Emissions: on-site natural gas, diesel and propane combustion; campus fleet emissions; marine vessel and fugitive emissions

Scope 2 – Indirect Emissions: purchased electricity

Scope 3 – Indirect Emissions (Other): University-funded business air travel and student, staff, and faculty commuting

4.1 GHG EMISSIONS REPORTING HISTORY

In 2005, UCSB began voluntary reporting its GHG emissions to the California Climate Action Registry (CCAR). To date, emissions inventories have been submitted and verified for CY 2004 through 2012. In the first three years, the inventory specifically examined CO_2 emissions. Beginning in CY 2007, the inventory included all six Kyoto Protocol gases for scope 1 and 2 emissions.

4.2 CURRENT EMISSIONS – CALENDAR YEAR 2012

For 2012, UCSB reported scope 3, in addition to scope 1 and 2 GHG emissions, to The Climate Registry (TCR). 2012 GHG emissions and sources as reported to TCR in Metric Tons Carbon Dioxide Equivalent (MT CO_2e) are presented in the table and figure below.

Table 8: 2012 GHG Emissions Reported to TCR [MT CO_2e]

GHG Emission Scope and Source	MT CO_2e	Percent of Total
Scope 1 - Stationary Combustion (Campus)	18902	20.61%
Scope 1 - Stationary Combustion (Other)	2301	2.51%
Scope 1 - Mobile Combustion	1422	1.55%
Scope 1 - Fugitive Emissions	10	0.01%
Scope 2 - Purchased Electricity (Campus)	27398	29.88%
Scope 2 - Purchased Electricity (Other)	1348	1.47%
Scope 3 - Air Travel	27419	29.90%
Scope 3 - Commuting	12903	14.07%

TOTAL	91,703	100.00%

Scope 1 emissions reported to TCR are calculated following a thorough analysis of current and historical fuel and refrigerant consumption data for all UCSB operations and by applying fuel-specific emissions factors as prescribed by the TCR General Reporting Protocol (GRP) version 1.1.

Scope 2 emissions reported to TCR are calculated by applying the Southern California Edison emissions factor. During calendar year 2012, UCSB's primary electricity transmission provider was Southern California Edison (SCE). The California Investor Owned Utilities do not maintain an accurate database on emissions factors inclusive of the 1990 and 2000 baseline years. The UC Climate Change Working Group has developed guidelines, referencing the August 2002 Lawrence Berkeley National Laboratory study "Estimating Carbon Dioxide Emissions Factors for the California Electric Power Sector". The Southern California Edison factors calculated by LBNL are applied to baseline years in calculating Scope 2 GHG emissions.

Scope 3 emissions reported to TCR include emissions resulting from University-paid business air travel and staff, faculty, and student commuting to and from campus. Air travel emissions calculations are based on mileage calculations derived from a subset of total amount spent on air travel. The Connexxus travel system tracks air miles, and from this data, a campus-specific cost factor can be applied to derive air miles traveled. It is noted that UCSB's average cost per mile is 25% higher than the national average, as reported by the Air Transport Association (ATA). Miles are converted to resultant GHG emissions using air travel emissions factors from the Clean Air Cool Planet Calculator version 6.7-2010. The UC Transportation Working Group and Climate Change Working Group expect to refine and standardize this calculation method for inclusion in further iterations of UC Climate Action Plans. Commuter emissions are based on accurate mode-split data derived from comprehensive campus surveys administered annually during spring quarter. Using guidance developed by the UC Transportation working group, GHG emissions for the entire population of the campus are calculated and updated annually. GHG-emitting transportation modes include single-occupancy vehicles, carpooling, vanpools, motorcycles, and bus commuting. These figures are adjusted for average ridership.

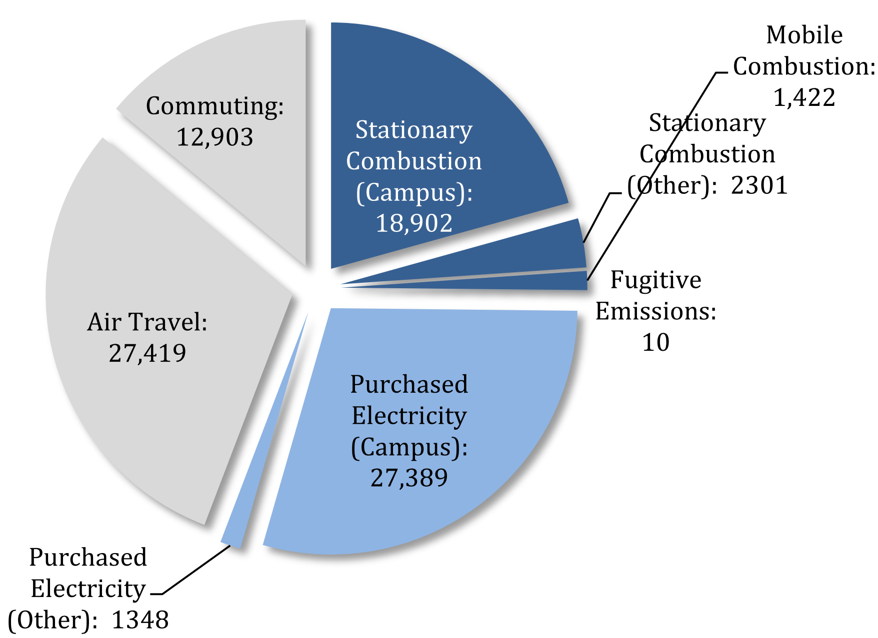

Figure 1: 2012 GHG Emissions by Source [MT CO_2e]

4.3 HISTORICAL EMISSIONS

Figure 2 below depicts the trend in GHG emissions levels between 1990 and 2012. While the majority of scope 1 and 2 historical electricity and fuel consumption data is available, this analysis relies on extrapolated usage data for years 1990-1995. Scope 3 commuter emissions are based on historical mode-split survey data and are normalized for population.

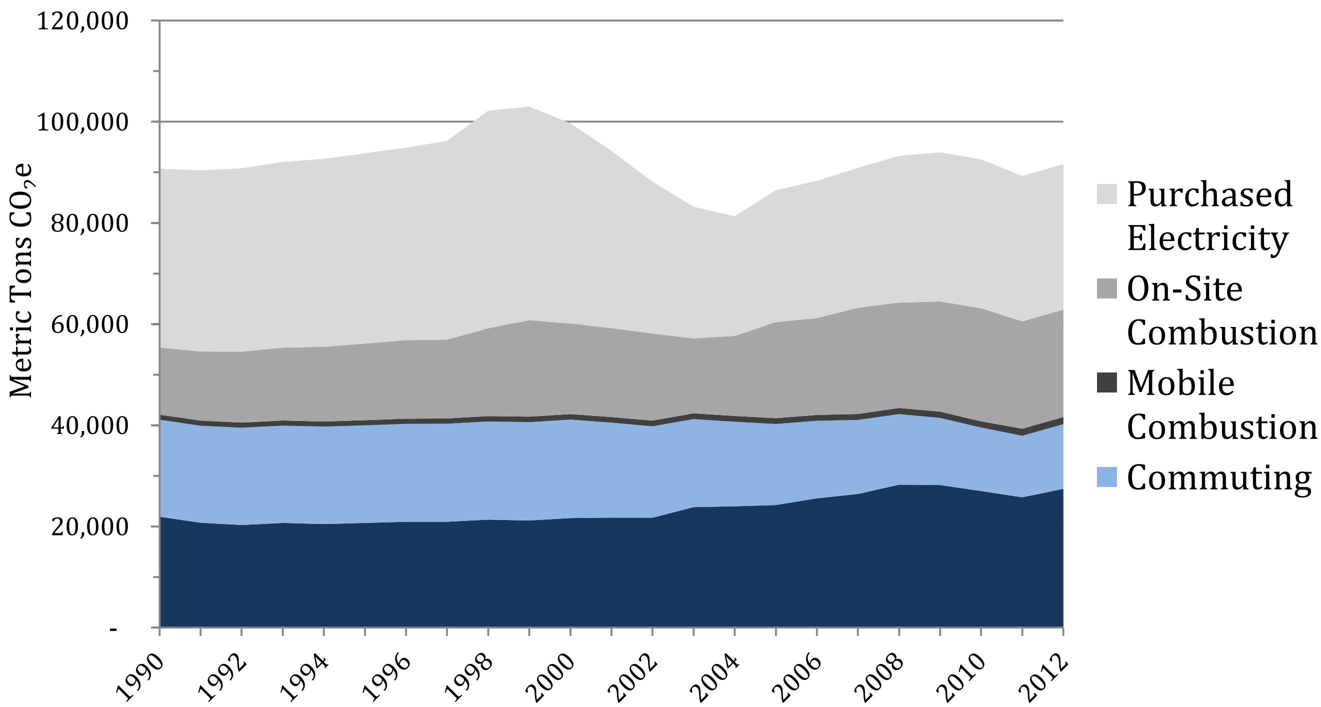

Figure 2: Historical GHG Emissions – 1990 to 2012

Emissions increased relatively steadily from 1990 to 1999, followed by a decline in emissions from 1999 to 2004 and an increase in emissions from 2004 to 2009. The decrease in emissions from 1998 to 2004 was due to the implementation of a number of energy efficiency projects which reduced campus electricity usage intensity considerably, while the increase from 2004 to 2009 is due to the increase in square footage resulting from new building construction and from an increase in associated natural gas consumption. Examination of the GHG intensity factors for electricity and natural gas, based on gross square footage (GSF), show that electricity-related GHG emissions per GSF have decreased from 1998 through 2012. The campus natural gas usage intensity has fluctuated over the years, which is partly due to winter weather conditions. Although natural gas intensity appears to have increased in recent years, it is within the range of variability.

Commuting and air travel data to 1990 has been normalized for population, based on 2010 calculation methods. Although some data is available on commuting and air travel in the past, it was largely incomplete. This CAP presents the best estimation for consistent back casting, given limited or absent data. It is worth noting that this method does not capture reduction trends in commuting or air travel and likely under-represents commuting and travel emissions in 1990. Current accounting systems do not track air miles or resulting GHG emissions. Mechanisms to capture this data will be incorporated into new accounting systems in the future.

During the period of 1990 to 2012, the total student, faculty, and staff counts have increased from 22,261 to 26,321, for an increase of 18%, and building GSF has increased from 4,385,989 to 8,335,240, for an increase of 90%. The increase in students, faculty, and staff has been fairly steady through 2009 and dropped slightly in 2010 and 2011. UCSB experienced its most rapid build-out during the time period 2004 through 2008, resulting in a recent increase in GSF per capita.

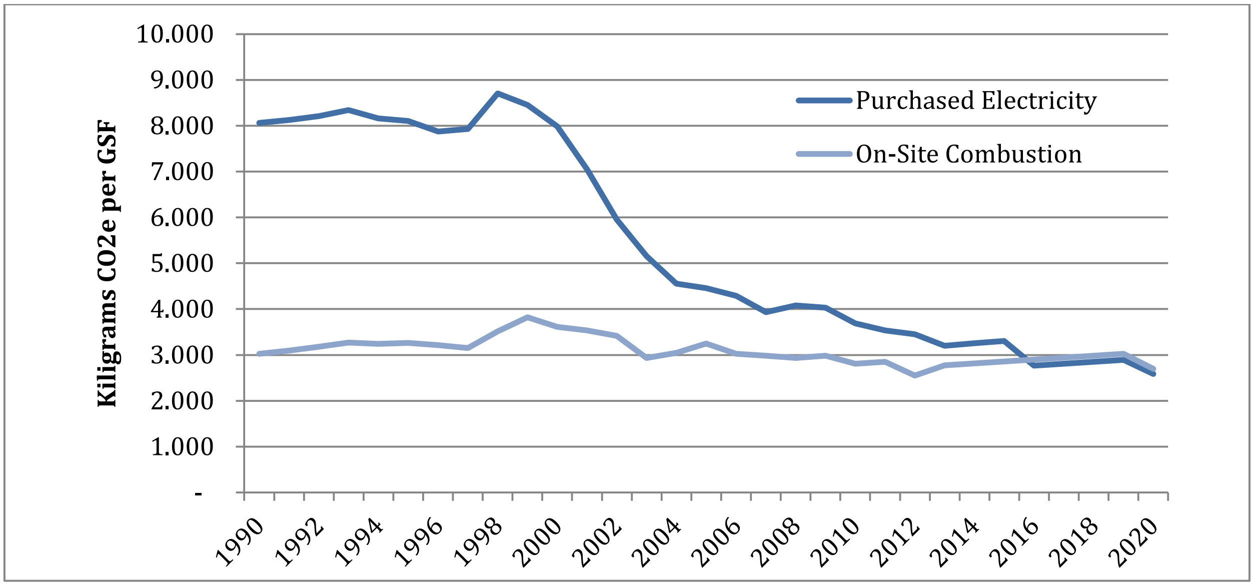

Figure 3: Historical Electricity and Onsite Combustion GHG Intensity – 1990 to 2012

4.4 PROJECTED EMISSIONS

The 2010 Long Range Development Plan (LRDP) and accompanying Environmental Impact Report (EIR) were originally circulated in Spring 2008, recirculated in 2009, and recirculated most recently in 2010. The LRDP and EIR were approved by the UC Board of Regents in September 2010, followed by submission to the California Coastal Commission in May of 2011, and are still pending final approval. These documents describe future campus growth. The 2010 version describes development through 2025. The following LRDP projections informed CAP projections through 2020:

- Increase in undergraduate and graduate student population of 1% per year, for a total of approximately 25,000 in 2025.
- Increase in faculty and staff population to a total of 6,431 in 2025.
- Addition of sufficient housing to accommodate each new student, faculty member, and staff employee.
- Addition of an estimated 3,000,000 GSF for general uses.

The draft LRDP implements principles of sustainability in urban planning. Specifically, the LRDP adds housing for each new individual without increasing the carbon footprint of the campus. Thus, development that will occur is considered in-fill, and many new commuting trips that would otherwise have been in a vehicle will be made by alternative means (e.g., cycling, walking, and public transit).

4.5 BUSINESS AS USUAL

While UCSB is prepared for the projected growth approved by the UC Regents and detailed in the LRDP by 2025, this CAP assumes roughly a two-thirds build-out of the LRDP by 2025, representing the addition of approximately 2,000,000 GSF. The 2014 CAP projections are based in large part on the 2011-21 Capital Financial Plan (CFP) to predict future growth. Based on the most current version of the CFP, the CAP projections assume that approximately 670,000 ASF and 1,500,000 GSF will be built out by 2020 and 2,000,000 GSF by 2025 and will be within the scope of our campus GHG emissions inventory. Several for-sale housing projects for faculty and staff are not included in these projections since UCSB does not maintain operational control or ownership of these housing units.

Business As Usual (BAU) emissions for future years, 2013 through 2020, are calculated, based on conditions described in the current CFP and forecasted GHG energy intensities. Emissions assume an average annual campus growth rate of 1%. Intermediate year emissions are interpolated, assuming linear growth. Energy use will increase stepwise as each new building is commissioned.

The Campus procured the generation component of its purchased electricity through Direct Access contracts for years 2010 and 2011. For this reason, campus emissions for 2010 and 2011 are based on the Environmental Protection Agency (EPA) statewide E-GRID emissions factors for the WECC region. However, projected scope 2 emissions from 2012-2020 are based on Renewable Portfolio Standard (RPS)-adjusted Southern California Edison (SCE) utility-specific power generation. The California RPS mandates that SCE must increase procurement from eligible renewable energy resources to 33% of total procurement by 2020.

BAU emissions from UCSB's fleet of mobile sources (i.e., on-road and marine fleets) are estimated by scaling the 2012 mobile source emissions by the increase in faculty and staff. Backup generator, gas cylinder, and refrigerant emissions are each scaled by the increase in square footage of the main campus buildings. Similarly, scope 3 emissions from commuting and air travel have been scaled for population increases in faculty.

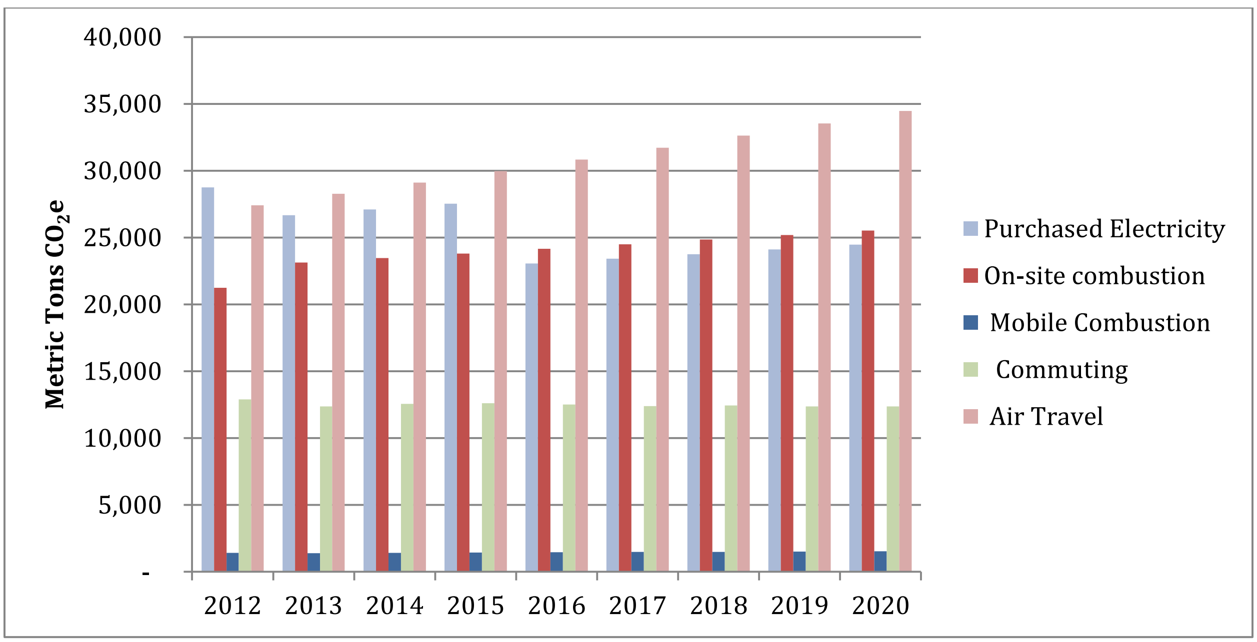

Figure 4: Projected Business as Usual Emissions 2012-2020

Table 9: Projected Business as Usual Emissions

	Metric Tons Emitted Annually (CO_2e)

GHG Emission Scope and Source	2012	2014	2020	2025
Scope 1 - Stationary Combustion (Campus)	18,902	20,752	22,804	24,008
Scope 1 - Stationary Combustion (Other)	2,301	2,714	2,730	2,740
Scope 1 - Mobile Combustion	1,422	1,395	1,480	1,557
Scope 1 - Fugitive Emissions	10	10	10	10
Scope 2 - Purchased Electricity (Campus)	27,398	25,846	23,408	24,644
Scope 2 - Purchased Electricity (Other)	1,348	1,266	1,064	1,075
Scope 3 - Air Travel	27,419	29,109	34,478	39,371
Scope 3 - Commuting	12,903	12,560	12,368	12,715
TOTAL CO_2e	91,703	93,652	98,343	106,118

Table 10: Projected Campus Growth 2012-2020

Growth Comparisons	2012	2014	2020	
Total Bldgs	408	412	424	-
Calif OGSF	8,335,240	8,619,378	9,471,792	9,971,792
Students	21,927	22,368	23,744	24,955
Faculty/Staff	4394	4,805	6,039	6,431
Total Population	26,321	27,173	29,783	31,386

4.6 FORECASTED FUTURE GHG EMISSIONS

Forecasted future GHG emissions take into account campus growth, currently planned mitigations, and projected changes in SCE percent renewable. These estimates are discussed in more detail in Section IV-Mitigation Strategies.

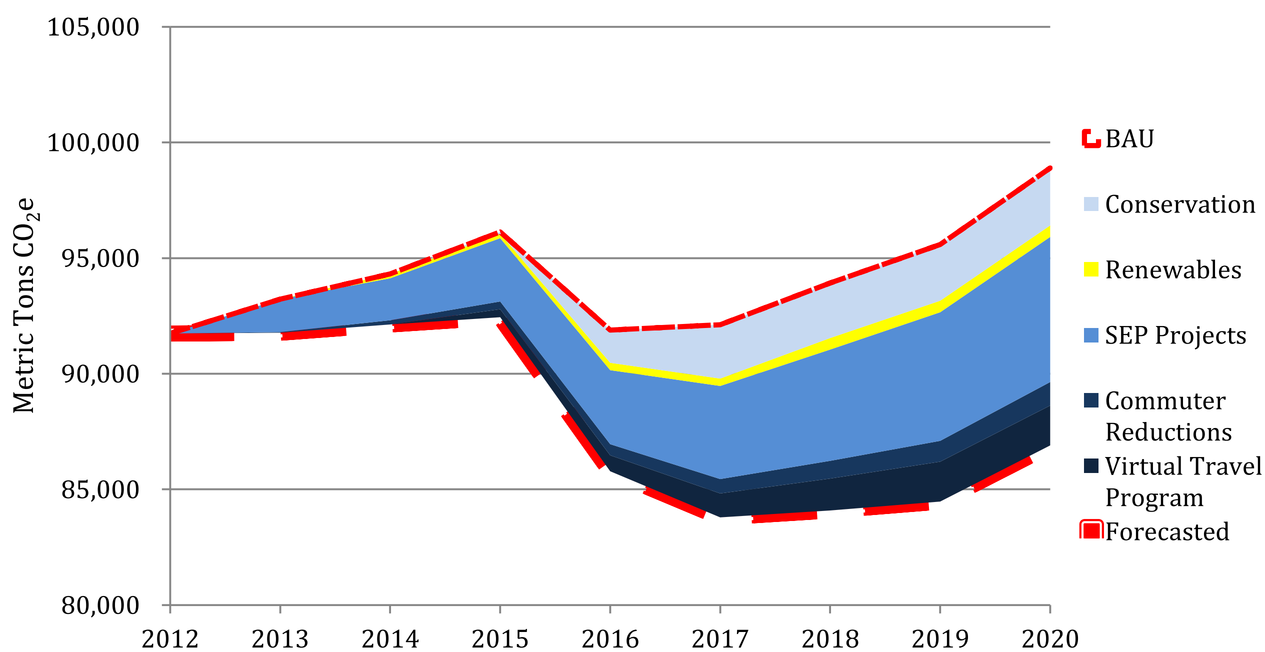

Figure 5: Forecasted Future GHG Emissions

4.7 EMISSION REDUCTION TARGETS (2014, 2020 AND 2025)

The interim emissions reduction goals are CY 2000 emissions levels by 2014 and CY 1990 emissions by 2020. Emissions for 1990 and 2000 have been calculated, based on current and historical information, and are presented in Figure 2. For comparison, 2012 emissions and projected BAU emissions for each of the target years are presented in Table 12.

The UC system has committed to achieving carbon neutrality in its operations by 2025. The first step in achieving this will be avoiding and reducing emissions as much as possible, using mitigation strategies described in Section V. The second step will be to provide offsets for any remaining emissions, as covered in Section VI.

Table 11: Mitigation Measure and Associated Reductions

	Metric Tons Mitigated Annually (CO_2e)	
Mitigation Measure and Associated Reduction	**2014**	**2020**
SEP	1,814	6,272
Onsite Renewables	188	498
Conservation (UCIP)	-	2,374
Commuter Reductions	182	1,016
Virtual Travel	-	1,724
TOTAL CO_2e	2185	11,884

Table 12: Emission with Mitigation compared to Targets

	Metric Tons Mitigated Annually (CO_2e)		
	2014	**2020**	**2025**
Emission Reduction Targets	99,699	90,736	0 (scope 1 & 2)
Projected emissions (mitigation)	91,482	86,519	44,824 (scope 1 & 2)

5 MITIGATION STRATEGIES

5.1 MITIGATIONS IN ENERGY USE AND EFFICIENCY

This CAP also forecasts **6,770** MT CO_2e in annual emissions reductions, resulting from changes in energy use and efficiency. Mitigation strategies that are considered energy measures in this CAP include: energy efficiency projects (e.g. SEP), installation of on-site renewable energy generation capacity, and procurement of off-site green power.

1 | THE STRATEGIC ENERGY PARTNERSHIP (SEP) PROGRAM

The Strategic Energy Partnership (SEP) program has been in place at the University of California since 2009, and since its inception, UCSB has implemented $10 million worth of energy conservation projects. The SEP is the most effective mitigation strategy, facilitating the achievement of UCSB's 2020 GHG reduction target. SEP projects finished between 2012 -2020 will reduce emissions by an estimated 6,272 MT CO_2e annually (Table 13) and will save an estimated $2.4 million annually in utility costs.

Table 13: 2012 – 2016 GHG reductions through SEP projects

Period	Net Program Cost	Energy Cost Savings ($/Year)	Payback (years)	Electricity Saved (kWH/yr)	Natural Gas Saved (therms/yr)	GHG Reduction MT CO_2e/year
2012 -2013	4,562,000	520,967		4,300,469	99,168	1,485
2014 (estimate)*	5,347,637	193,881		959,588	119,845	849
2015 -2019 (estimate)	13,081,907	1,651,890		9,433,880	345,869	3,938

*Project costs are more expensive in 2014 because they address not only GHG emissions but regulatory issues and help us meet the NEI requirements.

SEP projects for the current funding cycle fall into three main categories:

Lighting fixture and controls retrofits have remained consistently successful projects at academic, residential, and athletic facilities, yielding simple paybacks of three to four years.

HVAC equipment replacement has been a focus of major investment on campus. Installation of high-efficiency chiller and boiler systems, extension of the campus hot and chilled water loop, and optimization of chiller staging yield longer returns on investment but provide a mechanism for deep energy savings, in addition to financing of necessary deferred maintenance.

Monitoring Based Commissioning (MBCx) projects at various campus buildings allow campus engineering staff to optimize building systems operation and to identify inefficient or malfunctioning equipment. UCSB has achieved a high degree of success with MBCx projects, generating typical returns on investment for these projects in one year or less.

SEP is the primary mitigation strategy to reduce campus GHG emissions in this CAP and is essential to the University meeting the 2020 target. The Strategic Energy Partnership (SEP) program was developed by the UC

Office of the President as a formal partnership with the state's investor-owned utility companies. In March 2009, the Regents approved external financing for all campuses to participate in the program. The SEP is only formally approved through 2014; however we anticipate that the program will continue through 2020.

Efficiency projects are currently the most cost effective methods for reducing GHG emissions because of the return on investment. Financing will be needed so that the campus can undertake additional building energy efficiency projects that reduce our campuses GHG emissions and our annual energy utility bill costs.

2 | RENEWABLE ENERGY

The on-site renewable energy emission reduction estimate is **498** MT CO_2e, resulting from the build-out of renewable energy generation capacity on campus. Renewable energy generation capacity will contribute increasingly to GHG emission mitigation efforts on the main campus, as well as at auxiliary facilities and campus-adjacent housing development. UCSB owns nine installed on-site solar PV systems, ranging in size from 2kW to 155 kW; the aggregate capacity of these systems is 247 kW DC. The campus is currently installing photovoltaic arrays (426 kW DC) in Parking Lot 22, and the project is expected to be completed by June 2014. It is expected to generate about 628,000 kWh per year.

Table 14: Lot 22, Multi storage parking garage

Project Cost (Bid)	Payback (years)	Electricity Saved (kWH/yr)	Electricity Cost Savings ($$/yr)	SCE Customer Rebate 5 Year rebate	GHG Reduction MT CO_2e/year
$2.5 Million	30	628,000	65,940	440,000	140

The campus also plans on adding two large photovoltaic arrays (approximately 500 kilowatts each) before 2020, resulting in a build-out of an additional 1000 kilowatts of on-site solar production, yielding an additional reduction in annual GHG emissions of 498 MT CO_2e by 2020.

Table 15: Cost and savings estimates for ground, carport or roof mount on-site solar

Total cost (2 - 500 kW systems)	Payback (Years)	Electricity Saved (kWH/yr)	Electricity Cost Savings ($$/yr)*	GHG Reduction MT CO_2e/year
3.5 Million	17	1,800,000	373,887	358

*Savings estimates based on projected electricity costs in 2020

The Campus should explore possible sites for future solar projects. This would be the most cost effective means available of acquiring electricity, as illustrated in Table 16.

Table 16: Cost comparison of purchased electricity vs. onsite solar

Purchased standard Electricity costs ($/kWh)	Purchased Carbon Free Electricity costs ($/kWh)	Onsite Solar ($/kWH)* (30 year life Span)	Onsite Solar ($/kWH)* (50 year life Span)
$0.105	$ 0.155	$0.110	$0.066

- Cost analysis of onsite solar includes the assumption that we would be loaned the upfront money needed to install the solar at a 3% interest rate.

The lifespan of high quality modules is on the order of 50 years with relatively low loss of output. With electricity rates projected to increase 5% annually, investing in solar in suitable locations will help ensure that UCSB has a source of affordable electricity well into the future. However, because the campus plans to expand (grow) primarily through redevelopment as indicated in the LRDP, it will not be feasible to install solar in most of the currently suitable locations on Campus. For this reason, the Campus should explore possible off-site locations for new solar projects, given the cost benefits.

5.2 MITIGATIONS IN TRANSPORTATION

This CAP forecasts 3,407 MT CO_2e in annual emissions reductions resulting from decreases in business air travel and commuter emissions declines due to new campus population growth largely housed close to the main campus. Emissions from transportation account for 46% of UCSB's total emissions, making targeted mitigation efforts essential in meeting the campus' 2020 emissions target.

1 | REDUCING EMISSIONS FROM BUSINESS AIR TRAVEL

Emissions from business air travel account for 30% of UCSB's total emissions, making it the single largest source of emissions for the University. Business air travel needs to be reduced drastically in order for the University to meet 2020 campus emissions targets. Reducing air travel 5% from BAU by 2020 will reduce emissions by 2,126 MT CO_2e annually and save the campus $298,618 annually in avoided travel costs.

Table 14: Reduction in Business Air Travel

	Emissions reductions (MT CO_2e/ yr)	Air Travel Cost savings ($/yr)	Costs estimates ($/yr)	Payback Period (years)
5% reduction in air travel	2,126	$298,600	180,000	<1

While a higher level of reduction would have greater impacts on emissions, this is seen as a hindrance to research, which is one of the University's Fundamental Missions. However, a significant amount of faculty air travel can be reduced, without hindering research, through teleconferencing.

The following recommendations will help the campus meet the goal of reducing business air travel by 5%:

- Create and implement an outreach program aimed at educating faculty and staff on the importance of reducing air-travel. Most faculty and staff are unaware that business air travel accounts for 30% of our campus' total emissions. Information should be disseminated throughout the campus departments regarding the impacts of air travel, alternative options available, and the time and cost savings associated with teleconferencing and telecommuting.

- Increase the availability and use of teleconferencing tools and facilities. The current fiscal situation creates an incentive to reduce costs through substituting teleconferencing tools for travel where appropriate. The Alternative Transportation Subcommittee of the Chancellor's Sustainability Committee should focus on identifying and implementing opportunities to reduce these emissions during the 2014/15 academic year.[1]
  - Departments constituting a large proportion of the campus' total air travel should be identified. Conference facilities should be upgraded to meet the needs of the departments. Possible sources of funding that could go towards upgrading conference rooms with teleconferencing capability include the following: the return on overhead from research grants, the office of research, and from the Dean. (add cost estimates)

- Promote campus-wide site licensing, so that individual faculty and staff members may use web-based software in place of travel and establish and track the effects of a dedicated, multi-user teleconferencing system for campus use.[2]

- Institute a financial system that includes a mileage component of all air travel and incentivizes reducing air travel. Below are possible programs that could be developed by the University:
  - Department Air Travel Cap Program
    - Set a cap on air travel mileage for each department that gets lowered each year until departments reach a 5% reduction in Air Travel.
    - Require any departments that exceed the cap to purchase carbon offsets.
    - If the department's air travel is below the cap, allow the credits to be carried over into the next year.
  - A GHG fee that tagged onto the cost of air travel that would then be used to purchase offsets.
    - This would need to be incorporated into guidelines for new grant proposals but would first need to be cleared with the grantor.
- The Alternative Transportation Subcommittee of the Chancellor's Sustainability Committee should undertake the following tasks:
  - Estimate the portion of air travel that can be reduced by using teleconferencing based on the current year's travel data.
  - Assess the effectiveness of teleconferencing by having one academic council meeting annually face to face, and substitute additional meetings virtually throughout the year.

2 | REDUCING COMMUTER EMISSIONS

This CAP forecasts 1,016 MT CO_2e reductions in annual commuter emissions, resulting from new campus population growth, largely housed close to the main campus, by 2020. As outlined in the LRDP, transportation emissions will be substantially reduced in the future through housing all new student growth adjacent to campus and adding additional housing for faculty and staff nearby, thus reducing the demand for parking and motorized transportation.

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[1] 1 2013 Annual Transportation Report. University of California, Santa Barbara, Web.

[2] IBID

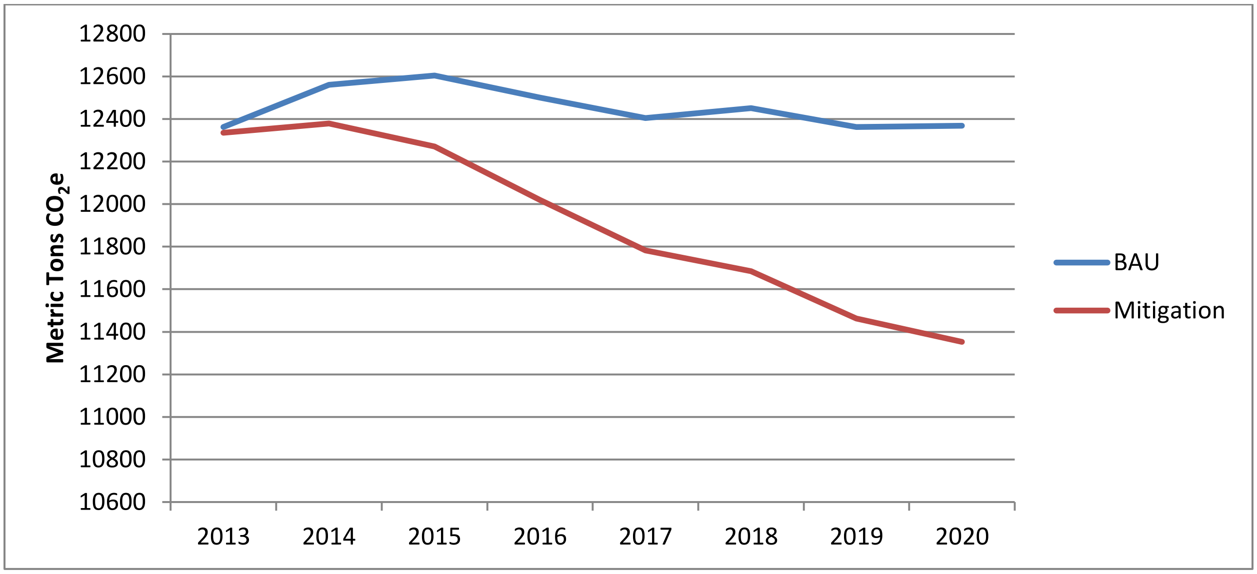

Figure 6: 2013 -2020 Projected Commuter Emissions

The Alternative Transportation subcommittee is also working to improve bicycle circulation in order to accommodate additional population growth. Improved North-South circulation for bicycles, in particular, could greatly increase the number of potential bike users living within three miles north of campus.

Additionally, the campus will work more closely with the Santa Barbara Metropolitan Transit District(SB MTD) to improve service in an effective manner through options that include:

- Supporting the MTD in taking a national leadership role in addressing ridership.
- In February of 2014 UCSB reached an agreement with MTD to provide additional transit enhancement that promotes ridership at UCSB by offering increased capacity and additional routes free to students. This agreement will help mitigate the impact of increases in Campus growth outlined in the LRDP.
    - MTD will increase service level capacity on two existing lines, paid for by UCSB: (1) line 24x, which provides express service between UCSB and downtown Santa Barbara, as well as service along El Colegio Road and to Camino Real Marketplace; and (2) Line 12x, which provides service between the Hollister Avenue corridor and downtown Santa Barbara.
    - MTD will also add a new transit line, identified as Line 38, paid for by UCSB. Line 38 will provide service in both directions between the North Hall traffic circle at UCSB and Camino Real Marketplace

Currently, the campus has not approved tiered parking rates. The Transportation subcommittee will urge the campus to explore developing tiered rates that truly reflect the cost of parking on a daily basis. The subcommittee feels that the current low monthly cost of parking does not incentivize the use of available alternative transportation enough.

We estimate that the successful implementation of the above recommendations could reduce emissions by 3,142 MT CO_2e annually from air travel and commuting to the campus.

5.3 MITIGATIONS IN BUILDINGS

Buildings account for a large portion of campus energy use and GHG emissions. For the most part, building measures in the CAP are a result of sustainability efforts that may or may not reduce GHG emissions, while energy efficiency projects that can be quantified are considered energy measures. The Campus Sustainability Plan seeks to "create superior places to study, work, and live that enhance the health and performance of building occupants through sustainable planning, design, construction, operations, retrofits, and biomimicry." Many of the sustainability principles that are applied under this category will result in avoidance or reduction of GHG emissions, but the amount of reductions is not known. Nevertheless, sustainable building initiatives will be important in minimizing campus impacts on the environment. Building mitigation measures include: development of strategic plans for energy efficiency in existing buildings and operation of buildings according to LEED guidelines, certification of existing campus facilities through LEED-EBO&M, and LEED certification of all new buildings. Table 18 shows the buildings that the campus plans to certify over the next four years.

Table 15: Planned LEED Certification of UCSB Buildings

LEED Rating System	Building Name	Building Function	Certification Level	Certification Year	Year Built
NCv2.2	OSEB	Academic/ Administrative	Registered	2013	2012
NCv2.2	Bioengineering	Laboratory	Silver	TBD	2015
CIv3.0	Santa Rosa Residence Hall	Housing	Gold	2013	1954
CIv3.0	Anacapa Residence Hall	Housing	Gold	2014	1958
CIv3.0	Santa Cruz Residence Hall	Housing	Gold	2015	1958
NCv3.0	Davidson Library Addition & Renewal	Academic	Gold	2015	2015
NCv3.0	Sierra Madre Multipurpose Building	Housing/Gathering	Gold	2015	2015
NCv3.0	Faculty Club Renovation & Guest House Addition	Housing/Dining	Gold	2015	2015
NCv3.0	Sierra Nevada Aquatics Research Lab Classroom	Academic	Gold	2014	2015
NCv3.0	Portola Dining Commons	Housing/Dining	Gold	2017	2017
NCv3.0	Institute for Energy Efficiency	Academic	Gold	TBD	TBD
HOMESv3.0	North Campus Faculty Housing Phase II	Residential		2014	2014
HOMESv3.0	North Campus Faculty Housing Phase III	Residential		2017	2017

HOMESv3.0	Sierra Madre Apartments	Residential	2015	2015
HOMESv3.0	San Joaquin Apartments - North Village	Residential	2017	2017
HOMESv3.0	San Joaquin Apartments - Storke Gateway	Residential	2017	2017

The campus' robust building program emphasizes energy efficiency and reduced environmental impact across all building types, and, thus, will significantly reduce GHG emissions associated with future build-out. In August of 2011, The University of California approved a revised Sustainable Practices Policy that established goals in eight areas of sustainable practice: green building, clean energy, transportation, climate protection, sustainable operations, waste reduction and recycling, environmentally preferable purchasing, and sustainable foodservice. All new and renovation building projects shall outperform the California Building Code CBC energy-efficiency standards by at least 20% and should strive for 30% or more. All new and renovation buildings projects will achieve a minimum LEED certification of "Silver" and strive to achieve "Gold."

System-wide, UC has committed to provide up to 10 megawatts of on-site renewable power by 2014 and will reduce consumption of non-renewable energy by using a portfolio approach that includes a combination of energy efficiency projects, the incorporation of local renewable power measures for existing and new facilities, green power purchases from the electrical grid, and other energy measures to reduce fossil fuel usage in buildings.

5.4 MITIGATIONS THROUGH ADMINISTRATIVE AND BEHAVIORAL CHANGES

This CAP forecasts **2,408** MT CO_2e in annual emissions reductions resulting from energy conservation though administrative and behavioral changes in both academic buildings and residential halls. Energy conservation through behavioral change is an important component in any plan to reduce GHG emissions from building energy use. In order to achieve energy conservation, it is essential that a program inform energy consumers of their present and historical energy use, provide them with examples of energy-saving measures and activities, and give frequent, even real-time, feedback on how their energy use compares to social norms. In addition, a successful program builds on making users "energy aware" by motivating individuals to get involved, identifying and supporting committed individuals, and rewarding users for reducing energy waste. A number of programs on campus induce behavioral change and reduce energy waste, such as PowerSave Campus, LabRATS, and The Green Initiative Fund. However, more aggressive efforts will need to be taken in order to meet the emissions reduction goals the campus has set. The following recommendations will help the campus meet these goals:

1 | IMPLEMENTING AN ENERGY INCENTIVE PROGRAM (EIP)

One option to increase energy conservation through behavioral change is to decentralize the campus utility budget. The campus is evaluating models in place at Stanford University and UC Berkeley, although their specific program details are still under consideration. By decentralizing the campus-wide utility budgets, the campus could incentivize energy conservation in the future.

Faculty and staff on campus are currently developing an Energy Incentive Program at UCSB in which energy use will be monitored, and 50% of savings or reductions from the buildings' baseline will be directed toward high-visibility building enhancement projects. The campus plans to start with a pilot phase, focused on two buildings that will run from 2014 – 2016. The program will reduce building electricity usage by shifting the responsibility for academic electricity expenses “down" in the organization. This provides individuals with an opportunity to benefit directly from reducing electricity use. Berkeley estimates that they will see a persistent electricity consumption reduction of 3-5% through their energy incentive program,[3] and evidence from campus residence halls indicates that even higher reductions are potentially achievable. UCSB forecasts a conservative 5% reduction in total building energy use through the EIP, which would reduce CO_2 (e) emissions by 2,349 MT CO_2e annually by 2020.

Table 16: Energy Incentive Program (EIP) 2020 savings estimates

Reduction	Electricity savings (KHW/ Year)	Natural Gas Savings (therms/yr)	Energy cost savings ($/year)	GHG Savings (MT CO_2E/yr)	Program costs	Payback
5%	5,654,429	232,095	983,000	2,349	$625,800	<1

Studies show that a 5% reduction in total building energy use is well within reach. As part of the University of Cambridge’s energy and Carbon Reduction Project, a laboratory pilot program at the University’s Gurdon Institute utilized strategies focusing on influencing behavior that successfully changed the way people used energy throughout a department.[4] The pilot program had a 76% participation rate across the department and achieved an overall reduction of 19% in energy usage over a 5-month period.[5]

2 | CREATING A GREEN REVOLVING FUND

A Green Revolving Fund is a key additional component to a successful EIP because it will make the funds available to departments, essentially serving as an internal SEP funding mechanism. The Green Revolving fund would be an internal fund that provides financing to parties within an organization to implement energy efficiency, renewable energy, water conservation, and other sustainability projects that generate cost-savings. Ideally, an allocation of money would be distributed into the Green Revolving fund each year, thus establishing a sustainable funding cycle while cutting operating costs and reducing environmental impact. As time goes on and the campus grows, it will be more difficult to realize important energy reductions. This new budget will allow the campus to invest the upfront capital that is required to fund energy projects that have an acceptable rate of return and, ultimately, save the campus money. Between 2010 and 2012, the number of GRFs established at college and university campuses across the nation grew by 60 percent. The Association for the Advancement of Sustainability in Higher Education’s (AASHE) database includes information from 76 institutions of higher education whose GRFs collectively contain $111,000,000. These funds regularly achieve high financial returns, with a median return on investment of 28% annually.

Green Revolving funds are usually established through one-time budget allocations, thus establishing that a source of the initial fund is important.

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[3] Energy Incentive Program Design. Rep. University Of California, Berkeley, 1 Apr. 2012. Web. 3 Dec. 2013.
[4] University of Cambridge Energy and Carbon Reduction Project. (2012). Introducing Behavioral Change Towards Energy Use. Retrieved from http://www.gurdon.cam.ac.uk/downloads_public/green/Gurdon-behavioural-change.pdf
[5] University of Cambridge Energy and Carbon Reduction Project. (2012). Introducing Behavioral Change Towards Energy Use. Retrieved from http://www.gurdon.cam.ac.uk/downloads_public/green/Gurdon-behavioural-change.pdf

Ideally, a Carbon Fund at UC Santa Barbara would be initiated with seed capital in the amount of $2,500,000. UCSB's Carbon Fund would be established for energy and water efficiency projects and renewable energy procurement to meet critical campus emissions targets and objectives, as well as improve economic efficiency. There are several potential sources of capital that we have identified as viable options for the creation of the Carbon Fund:

1. **Campus Carbon Tax: Integrate a fee into the energy bills of campus departments:** The tax will generate money for the campus that can then be reinvested into the campus in the form of sustainability projects. The discussion of this tax would need to happen in parallel with a discussion regarding the decentralization of our energy utilities. In addition to funding larger energy efficiency retrofits, renewable energy installations, and water conservation projects, a portion of this money could be used to pay for allowances that will be required when UCSB reaches the emissions threshold for participation in California's Cap and Trade Program. Within the next few years, UCSB's Scope 1 emissions from combustion will exceed 25,000 tons. When this happens, the campus will be forced to pay the state for allowances (estimated to be over $15/ton). We must have a plan to deal with this imminent expense.

2. **Student Lock in fee matched by the Office of the Chancellor**: UCSB Students may be willing to tax themselves if the fee were to go towards seed money for a GRF. However, should an increase go on a student ballot asking for seed money for a Campus GRF, a commitment from the Office of the Chancellor will be essential in soliciting campus-wide student buy-in and in providing the amount of funding needed to establish an effective GRF.

3 | IMPLEMENTING A RESIDENTIAL HALL ENERGY CONSERVATION PROGRAM

An estimated 69 MT CO_2e can be reduced annually through behavioral changes that incentivize emissions reductions in residential halls (Table 20). Currently, PowerSave Campus holds an annual dorm energy conservation competition that incentivizes students to reduce their energy use in residential halls and encourages behavioral change. In February of 2012, during the competition, an estimated 15,059 kWh were reduced at a total savings of approximately $1,506. The table below estimates the potential annual energy savings and CO_2 reductions that could be achieved if the behavioral changes achieved during the competition could be maintained year round. Savings will be dependent on the participation rate among residential halls. Currently, the dorm competitions only have a participation rate of around 14%.

Table 17: 2020 Energy Savings and Costs

Participation Rate	Energy Savings (kWh/Year)	Energy Savings ($/Year)	CO_2€ Reductions (MT CO2E/Year)	Program costs	Payback
25%	310,530	42,387	69	28,788	<1

In order to achieve these annual energy reductions, we recommend developing a Residential Hall Energy Conservation Program, which would include a reward system that incentivizes students to conserve energy year-round, as well as an energy awareness and education campaign focused on students living in residential halls that is part of a larger campus Energy Awareness and Education Campaign.

Possible reward systems should reflect and be funded by a portion of the energy cost savings achieved by students and could include monthly events, like pizza or ice cream parties, for participants in Residence Halls with the greatest energy reductions. Currently, participants in the residential hall competitions with the greatest energy reductions are entered into a raffle and have the opportunity to win prizes, such as a camping trip to Catalina Island or recreational equipment. This incentive system could be extended throughout the year to encourage savings year-round.

4 | CREATING AN ENERGY AWARENESS AND EDUCATION CAMPAIGN

Incentive programs in both academic and residential halls will need to include an Energy Awareness and Education campaign. As previously mentioned, in order to achieve energy savings through behavioral changes, it is essential that consumers: 1) are informed of their present and historical energy use, 2) are provided the knowledge needed to reduce use, such as examples of energy-saving measures and activities, and 3) are given frequent, and when possible, real-time feedback on how their energy use compares to social norms. Educating the campus community on the importance of energy conservation is the first step in encouraging thoughtful use of energy on-campus.

The energy awareness and education campaign should include the following components:

1. Implementation of a mandatory seminar on energy use for incoming students. This education program should be included during freshman or transfer student orientations that both undergraduate and graduate students attend.
    a. Currently, PowerSave Campus is working on creating a syllabus for a one-unit class that covers sustainability, including energy conservation. The University should consider partnering with PowerSave Campus to host the seminar.
2. Implementation of the following annual training sessions on how to reduce energy use:
    a. For all incoming freshman living in campus housing: energy conservation in residential halls
    b. For all incoming laboratory researchers: energy conservation in the laboratory
    c. For all faculty and staff: reducing office energy use
3. Easy access to tips on individual actions to save energy targeted to specific campus settings
4. Posters and stickers to draw attention to the campaign, with specific energy-saving steps
5. Development of a volunteer program of staff who receive support and training to serve as a resource for their buildings and departments
6. Real-time energy use should be displayed on dashboards in all residence halls, academic buildings, and public spaces.
    a. Example: During a residential hall competition at Dartmouth College, information on energy use was displayed on dashboards, along with a polar bear that responded positively when students were conserving and negatively when students were not. They saw a 10% energy usage reduction during the semester, and 67% of the students in the competition said that the real-time information system encouraged them to adopt energy savings habits.[6]
7. Ask all incoming freshmen to sign a pledge to conserve energy and follow up with repeated reminders of the pledge and tips for conserving energy..

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[6] Tice, Evan, Tim Tregubov, Craig Slagel, Giulia Siccardo, Lorie Loeb . "GreenLite Dartmouth: Unplug or theBear Gets It". *Dartmouth College*. 18 Feb. 2009. Web. 21 Jan. 2013.

8. Provide students with contact information for questions or concerns regarding energy use and conservation; this information could be included on the "Important Contacts" pamphlets that students receive when they move into Residential Halls.
9. Residential Assistants (RA's) should receive training on energy conservation so that they can serve as a resource to students.

A comparable energy incentive program at UC Berkeley is coupled with an extensive public education and outreach campaign. The multi-faceted outreach campaign combines campus commitment, communications strategies based on the latest research on behavior change, and expert design to achieve energy reductions. Individual behavior is a key component of efforts to reduce energy use. UC Berkeley attributes a large portion of its success to how well they communicate with the campus and convince people to modify their behavior.[7]

5.5 MITIGATION IN LANDSCAPE AND VEGATATION

Landscape and vegetation can be important sinks for carbon dioxide through carbon sequestration. Trees, in particular, sequester large amounts of carbon in their wood. In addition, vegetation reduces the urban heat island effect, a phenomenon which results in higher overall temperatures in urban areas in comparison to rural areas due to the heat-absorbing effects of impermeable materials like concrete and asphalt. Vegetation counteracts the urban heat island effect by reducing heat-absorbing impermeable area and by providing cooling shade. Subsequently, energy use of buildings near trees and vegetation is reduced because less energy is needed for cooling. In fact, strategic placement of trees can reduce a building's energy needs for cooling by providing shade and for heating by blocking winter winds and insulating buildings.

Use of landscapes for mitigation is complicated by the fact that vegetated landscapes both absorb carbon through photosynthesis and emit CO_2 through respiration and decomposition. Consequently, the sequestration potential of landscapes differ, depending on the vegetation or ecosystems present and the energy used to maintain them. Landscapes, particularly lawns and turf, can be significant sources of GHG emissions, depending on the energy and practices used to maintain them. GHG emissions related to landscape have a number of sources:

- Use of lawn and garden equipment
- Water-related electricity use (pumps, etc.)
- Decomposition of plant material
- Fertilizer and irrigation practices
- Disturbance and erosion of soils
- Transportation emissions related to vehicular travel of maintenance crews

UCSB owns and maintains nearly 300 acres of open space on campus, including 90 acres of turf, 86 acres of irrigated vegetation, and 122 acres of unirrigated vegetation. As of 2012, landscape maintenance required about 453,880 gallons of fuel (gasoline and natural gas) and approximately 77,862 gallons or approximately 0.24 acre feet of reclaimed water per year (90% of total campus irrigation). Energy is embedded in supplying water and, depending on the source, can vary greatly. In 2012, approximately 202.7 kWh were required to source water for

[7] "Energy Management Initiative Annual Report." UC Berkeley, Nov. 2013.

landscape irrigation. A study by the UCSB Cheadle Center for Biodiversity and Ecological Restoration demonstrates that restored, native landscapes require less fuel, water, and herbicide for maintenance in comparison to conventional landscapes, such as turf and lawn (2006).

In addition, UCSB recently finished a comprehensive tree inventory in which 10,271 trees were identified in the "campus urban forest." The vast majority of trees on the core campus lie within 60 feet of buildings and provide cooling and heating energy reduction benefits. Trees modify climate and conserve building energy use in three ways: (1) shading reduces heat absorption and storage in buildings, (2) evapotranspiration cools the air by using solar energy to convert water from liquid to vapor and reducing the amount of solar energy available to heat the air, and (3) tree canopies insulate buildings from wind and reduce the amount of heat lost from buildings, especially in buildings with a lot of glass windows where conductivity is high.

As an example of the energy savings trees represent, we calculated the energy reduction effects of 43 trees lying within 60 feet of Ellison Hall, using the National Tree Benefit Calculator. We estimate that trees provide an annual energy savings of 2133 kWh of electricity by cooling buildings and 16 therms of oil or natural gas by reducing heating costs (see Appendix). If Ellison Hall is an example of an average building on campus, then, with 182 buildings on the core campus (151 general buildings and 31 residential buildings), the University could be realizing energy savings of approximately 388,205 kWh or annual CO_2e reductions of approximately 116 metric tons from vegetation alone. Loss of these trees could lead to significant loss in savings, while an increase in the number of trees on campus, particularly if strategically planted, could lead to additional savings. On average, UCSB removes approximately 30 trees per year due to disease, death, structural failure, new construction, and utility or root-pavement conflicts. According to Jon Cook, Associate Director of Physical Facilities, Landscape, Environmental, & Custodial Services currently, tree replacement efforts on campus average between 50-60 tree plantings per year.

Recommendations

- **Afforestation.** UCSB can increase carbon sequestration by planting additional trees in its campus urban forest. For example, if the University set a goal of strategically planting an additional 500 medium, broadleaf evergreens on campus, it could reduce emissions from energy consumption by 25,000 kWh per year, resulting in a 7 MT CO_2e reduction in emissions annually once the trees reach 10 inches in diameter. Strategically placed trees can increase building energy efficiency. In summer, trees shading east and west walls cool buildings. In winter, allowing the sun to strike the southern side of a building can warm interior spaces, whereas if southern walls are shaded by dense evergreen trees, winter heating costs could rise. A tool like MyTreeKeeper helps managers strategically plant trees for the greatest energy savings.

- **MyTreeKeeper Funding.** Funding of MyTreeKeeper, an extension of the tree inventory produced for the University by Davey Tree Expert Company, would facilitate better management of UCSB's tree resource by tracking greenhouse gas and energy benefits of trees (as well as the water, air quality, and property benefits) and guiding afforestation efforts to maximize the sequestration and emission reduction potential of tree plantings.

- **Fertilizer and pesticide electronic record-keeping.** Fertilizer and pesticide application should be electronically recorded to enable better management and to build sufficient data for emission reduction calculations. Performance of soil tests can be used to assess the nutrient use efficiency of fertilizers applied to plants.

- **Development of a landscape management plan.** This would enable identification of the most resource-consumptive landscapes on campus that can be converted to more water-conserving, slower growth plants that require less maintenance in order to quantify potential energy savings and emission reduction potential.

- **Quantification of historical emissions from landscape.** Historical emissions from landscape activities should be quantified and included in the campus' emissions inventory. As described above, vegetation plays an important role in reducing the urban heat island effect and in sequestering carbon, and it is important that it be included in emissions inventories in order to encourage and account for the benefits of better management practices.

Best Management Practices

- Tree protection and replacement. The campus urban forest could be helping buildings save as much as 388,205 kWh or 116 metric tons of CO_2e from reductions in cooling and heating costs. In order to maintain these emission reductions, UCSB should protect established trees, where feasible, and replace trees when unfeasible.

- Protect and promote native, low-input landscapes. Protect and maintain native landscapes and promote the use of native and Mediterranean, drought-tolerant species in landscaping to save energy and water.

- Decrease impermeable surfaces and lawn area. Reducing the amount of impermeable surfaces and lawn area and replacing them with natively landscaped areas reduces the heat island effect and energy use for maintenance activities.

- Decrease fertilizer application. In order to avoid high nitrous oxide release, areas that irrigate with reclaimed water should decrease fertilizer application.

If the University strategically planted trees on campus, it could reduce emissions from energy consumption by 25,000 kWh per year. It should be noted that this reduction isn't included in the mitigation projections because of uncertainty of the adopted recommendation taking place and the time frame for the reductions. This would result in a relatively small reduction in CO_2e emissions; however, if the University were to account for the complete carbon cycle of the campus' landscapes in its emissions inventory, further savings could be realized through landscape mitigation efforts.

5.6 MITIGATION THROUGH CURRICULUM AND RESEARCH

In addition to addressing the immediate climate impacts of the campus, the University of California, Santa Barbara is also concerned with addressing the global and long term impacts of climate change. UCSB recognizes that our most significant impact on the world is a result of the service that our students provide to society and the innovative new ideas that we develop through our research. UCSB has established a leadership role in research and curriculum related to Climate Change. At least twelve departments offer courses related to or including climate change, and at least ten departments house a minimum of 44 researchers working specifically on climate change. In accordance with this commitment, UCSB's Academic Senate established a Sustainability Working Group (SWG) in Fall 2008 to develop programs and policies related to sustainability in our curriculum and to further promote research. The SWG is charged with the development and updating of the curriculum and research sections of both the Climate Action Plan and the Campus Sustainability Plan.

Table 18: Summary of Goals

	Short-Term (2012-2014)	Mid-Term (2014-2020)	Long Term (2020-2050)
Research	A fellowship program will be implemented to support student researchers working on climate change.	Develop and implement an interdisciplinary research symposium on climate change which is managed by an interdepartmental committee.	
Undergraduate Curriculum	Courses on climate change will be identified in the course catalog.	Funds will be set aside to encourage the development of courses related to climate change, especially in departments that do not usually address this issue. 15% of students will take at least one course that touches on climate change before they graduate.	Climate change curriculum will be documented and shared with other universities globally. 25% of students will take at least one course related to climate change before they graduate.
Co-Curricular Activities	UCSB will offer a peer educators program focused on climate change.	UCSB's campus will be a living laboratory where researchers can use the physical campus as their lab and where teaching faculty can use the physical campus as a demonstration of their lessons. Opportunities to fulfill this vision will be identified.	There will be 2-3 new large scale demonstration projects that will engage campus researchers, link to curriculum, and set UCSB in a leadership position beyond peer institutions.
Outreach	UCSB will have a speaker's bureau of faculty willing to speak on climate change. UCSB Sustainability will promote climate change related events and media already available.	UCSB will have a program which encourages and supports faculty to engage in local climate change projects where their expertise can be used effectively.	UCSB will be involved in local community-based research projects on climate change issues that engage multi-disciplinary teams of researchers.

1 | RESEARCH

Climate change will continue to have profound effects on how our society operates and interacts with the natural environment. In order to both address the existing effects and reduce future impacts, we will need new technologies and approaches. As a premier research institution, UCSB has a responsibility to provide a better understanding of climate change and to help create innovations that will sustain our society in light of it.

Seventeen percent of the departments which conduct research at UCSB host at least one researcher who studies climate change. Given that we already have a substantial interdisciplinary team of researchers working on climate change, our focus is two-fold: a) we aim to encourage more young researchers (undergraduate and graduate students) to pursue climate change related research and b) we also aim to promote better communication and collaboration amongst climate change researchers.

The following recommendations will assist in this mission:

- A fellowship program to support student researchers working on climate change; and
- An interdisciplinary research symposium on climate change which is managed by an interdepartmental committee.

In addition, numerous research centers and institutes on campus conduct leading edge research in renewable energy and energy efficiency. New material systems for solar energy, more efficient solid-state lighting, new electrochemical storage technologies, and theoretical models of grid stability are only a few of the exciting topics our faculty and students are pursuing

2 | CURRICULUM

Climate change will have effects on most careers that our students may choose to pursue, and as such, it is our responsibility to ensure that our students have the opportunity to learn about climate change. Currently, 20.7% of academic departments at UCSB offer at least one course related to climate change. We aim to better promote existing courses and to expand our offerings to more departments, making it more likely that a diversity of students will take advantage of these courses. Lastly, we hope to share our best practices with instructors at other colleges and universities.

The following recommendations will assist in this mission:

- Courses on climate change will be identified in the course catalog;
- 15% of students will take at least one course that touches on climate change before they graduate (currently our estimation is that between 8-10% of students take a course related to sustainability before they graduate);
- 25% of students will take at least one course related to climate change before they graduate;
- Funds will be set aside to encourage the development of courses related to climate change, especially in departments that do not usually address this issue; and
- Climate change curriculum will be documented and shared with other universities, globally.

3 | CO-CURRICULAR ACTIVITIES

UCSB Sustainability aims to create a bridge between campus operations, the community, and academics. Via this bridge, we can match the brightest minds of today with practitioners who understand the day-to-day real-world challenges of implementing sustainability projects. We can also create a learning environment for our students, which does not stop at the walls of the classroom, but instead continues throughout the campus landscape.

The following recommendations will assist in this mission:

- UCSB will offer a peer educators program focused on climate change;
- UCSB's campus will be a living laboratory where researchers can use the physical campus as their lab, and where teaching faculty can use the physical campus as a demonstration of their lessons. Opportunities to fulfill this vision will be identified; and
- There will be 2-3 new large scale demonstration projects that will engage campus researchers, link to curriculum, and set UCSB in a leadership position beyond peer institutions.

4 | OUTREACH

As a knowledge leader and repository of expertise, the University has an important role to play in the global dialogue regarding climate change policy and mitigation. As we discover new information regarding climate change and develop new solutions, it is important to share these insights with the public.

The following recommendations will assist in this mission:

- UCSB will have a speaker's bureau of faculty willing to speak to the public on climate change;
- UCSB Sustainability will promote climate change-related events and media already available;

- UCSB will have a program which encourages and supports faculty to engage in local climate change projects where their expertise can be used effectively; and
- UCSB will be involved in local community-based research projects on climate change issues that engage multi-disciplinary teams of researchers.

5.7 MITIGATION THROUGH GOVERNMENT REGULATION AND PROGRAM

State and local governments are developing programs that will result in GHG emissions reductions related to external sources. These reductions will flow through to UCSB indirectly. These include:

- 20% renewables by 2010 for Independently Owned Utilities (IOU) – California Renewable Portfolio Standard (RPS), SB 1078 and SB 107, in effect.
- 33% renewables by 2020 for IOUs – When analyzing the effect of increasing renewables on emissions reduction for the campus, it is necessary to take into account the fact that electricity supplied by SCE currently includes power from 20% renewables and approximately 26% non-GHG emitting sources. Therefore, only the incremental change may be counted.
- Low carbon fuel standard to reduce the carbon content of transportation fuels by 10% by 2020 – AB 32 Scoping Plan and SB 1007.
- California Clean Car Law estimated to reduce emissions from passenger vehicles by 18% by 2020 and 27% by 2030 – AB 1493 Vehicular Emissions; Greenhouse Gases.

Additionally, as required by California Senate Bill 375, the Santa Barbara County Association of Governments (SBCAG) is preparing a new, long-range plan, called a Sustainable Communities Strategy (SCS), which will evaluate future land use, housing, and transportation scenarios in the Santa Barbara County region. The SCS must consider a range of land use and transportation scenarios, measures, and policies which would reduce GHG emissions from automobiles and light trucks to achieve the GHG emission reduction target set by the State. The SCS will be part of the Regional Transportation Plan (RTP), a long-range planning document simultaneously being updated by SBCAG that defines how the region will invest available funding over the next 20 years to meet the region's transportation needs. SBCAG is in the early stages of crafting this plan and is partnering with our campus for input goals and options for GHG emissions reductions.

Under AB32, if UCSB exceeds 25,000 tons CO_2e of stationary source emissions it will be required to purchase emissions credits and develop a GHG reduction plan. While the Universities emissions are currently under the threshold UCSB can choose to acquire allowances and opt into the Cap and Trade program. CARB may approve the proposed regulatory amendments allowing the UC-system to receive an allocation of allowances for 2013-2020. If this is approved the University will likely participate in the Cap and Trade program. If the University chooses to receive allowances for 2015 -2019, it will be required to report to CARB on how it spent the money that it otherwise would have had to spend on Cap and Trade compliance, and the University must invest an amount at least equal to the value of the allocated allowances in a manner consistent with the goals of AB 32. Over the five year period the University would be required to invest an estimated 2.2 Million dollars into emissions reductions (Table 22)

Table 19: CAP and Trade Participation

CAP and Trade Participation						
Year	2015	2016	2017	2018	2019	Total
Cost ($/Yr)	$388,952	$441,237	$459,818	$500,154	$2,214,475	$2,214,475
Potential GHG savings (MT CO_2e/yr)	141	150	160	171	182	804

Note: Not included in projections because it is contingent on whether CARB decides to give the UC-System Allowances and whether UCSB decides to opt into Cap and Trade program

5.8 ROAD MAP TO CLIMATE NEUTRALITY: FUTURE MITIGATION STRATEGIES

As shown in Figure 7, to stay under the 2020 target, the University will need to continue its efforts to improve energy efficiency, promote efficiency, and expand its renewable energy supply in order to counteract emissions increases from campus growth. Additionally, the University will need to find new ways to reduce emissions to meet the UC Presidents' 2025 Carbon Neutrality in its operations by 2025 goal. Campus scope 1 and 2 emissions will have to be reduced 54,000 MT CO_2e from 2025 projected BAU emissions levels, and 44,824 MT CO_2e with planned mitigation strategies, to achieve carbon neutrality.

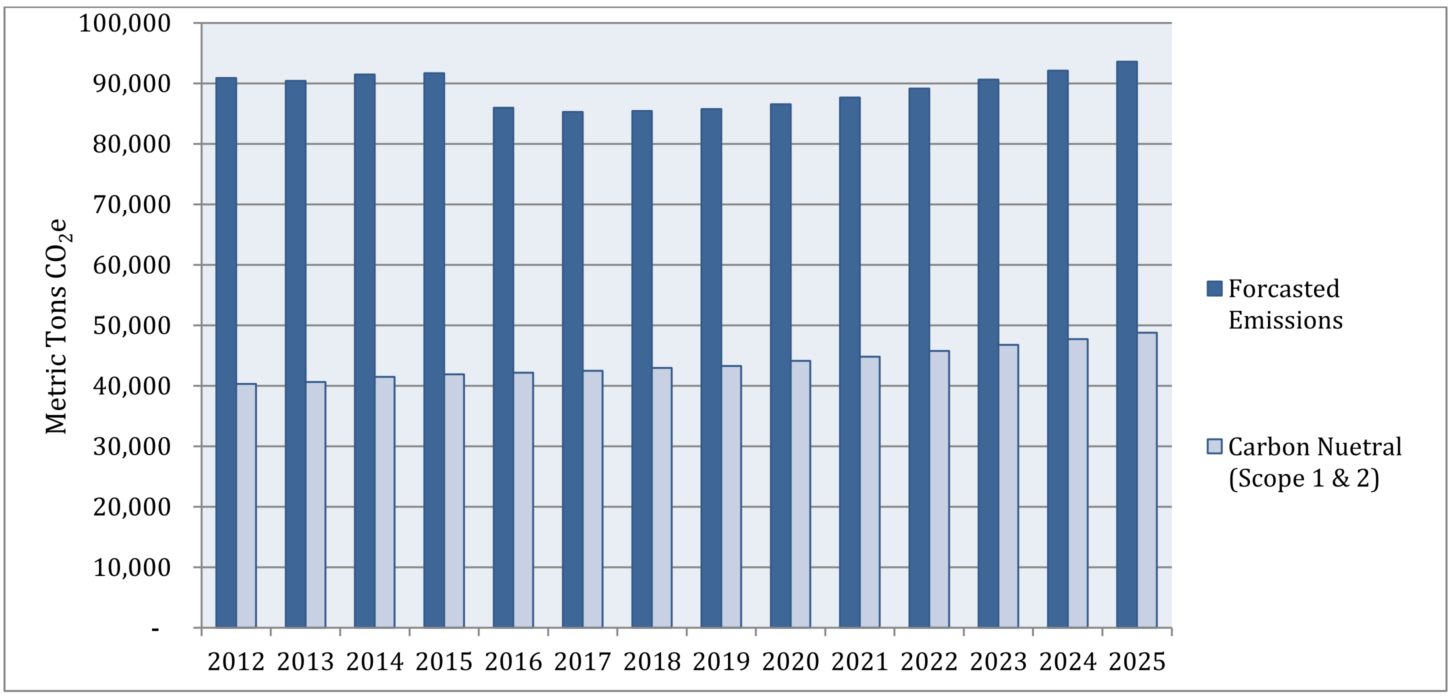

Figure 7: 2012 – 2025 Emissions Projections (doesn't include mitigation efforts made past 2020)

Investing another $14.5 million in energy efficiency and 700,000 annually in conservation between 2020 and 2025 will reduce the Campus' scope 1 and 2 emissions by an additional 15% (Tables 23 & 24). This will save the campus over $4.7 million annually in energy costs, however UCSB will still need to reduce scope 1 and 2 emissions by an estimated 38,000 MT CO_2e to meet the carbon neutral goal through the purchase of offsets, which will have significant costs to the University.

Table 20: Investment needed in energy efficiency to meet 2025 Carbon Neutral goal

Mitigation strategies	Reduction (GHG)	$/$CO_2e$	Cost	Cost savings annual in 2025	Payback Period (Years)
Efficiency & Conservation	4,359	$3,322	$14,481,315	$3,566,030	4

UCSB will need to spend an additional 7 million dollars annually to purchase carbon free electricity, natural gas, and offsets to cover scope 1 emissions in areas were carbon neutral energy substitutes do not exist (Table 25).

Table 21: Offsets required to reach 2025 Carbon Neutrality

	Reduction (CO_2e/Year)	Annual Cost (2025 $)	Energy Cost savings ($/Year)
Conservation program	1,917	700,000	1.2 Million
Carbon free Electricity	16,634	$ 4.36 Million	0
Carbon Free Gas	15,532	$ 2.65 Million	0
Offset Credits	1,729	$ 21,000	0

Recommendation

1 | Form a System-Wide Committee

Reaching Carbon Neutrality by 2025 will require coordinated efforts within the UC-System. Therefore a multi-campus committee should be formed to explore what mitigation strategies are needed to meet the carbon neutrality target. Committee Members should include representatives from the UC Office of the President, Sustainability Office and UC Office of the President, Facilities Management Services, Energy/Utilities group, and key faculty involved in energy efficiency research, and the main goal of the committee should be to find shared resources that will allow all campuses to reach the Carbon Neutral goal.

Some of the strategies our campus could explore include but are not limited to the following:

1. | Reducing Energy Demand

- Complete a campus-wide energy audit – Over the last decade, the campus has made tremendous efforts to reduce GHG emissions through energy efficiency measures, and most of the low hanging fruit has already been targeted. A complete campus building audit will help to identify where efficiency efforts are still needed and what projects will have the greatest energy savings.

- Extend funding for future energy efficiency projects - The SEP has been the most effective mitigation strategy for the campus. Continued funding for energy efficiency projects either through the continuation of the SEP or a similar program will be crucial in helping to meet the carbon neutral goal.

- Increase energy savings behavior – Energy savings behavior will need to be increased through education and outreach, as well as by energy incentive programs that penalize energy wasting behavior (see sections 5.4).

2 | Increasing Renewable Energy Supplies

- Advocate more renewable options from SCE – Emissions from purchased electricity account for just over 30% of campus' total emissions. Increasing the amount of renewables UCSB purchased above the 33% renewables by the 2020 standard will greatly decrease campus emissions.

- Biogas procurement – Substituting natural gas with Biogas would greatly reduce scope 1 emissions. One option is for the Campus to procure biogas through a purchase agreement with a local gas company. For example, BioFuels Energy, LLC ("BFE") secured long term bio-gas rights from the Point Loma Wastewater Treatment Facility and has developed the first commercial project in California to purify wastewater treatment digester gas for injection into natural gas pipelines. Under a long term Power Purchase Agreement, BFE has agreed to provide 2.8 MW of Biogas to the University of California San Diego. Another option would be to build a campus biodigester that could be fueled by campus waste. UC Davis received a research grant from the Public Interest Energy Research (PIER) program of the California Energy Commission to develop and construct a pilot-scale anaerobic digester system that will be fueled by campus waste and produce enough biogas to generate approximately four million kwh of electricity annually.

3 | Purchasing offsets

- Purchase renewable energy credits and offsets – Offsets will need to be purchased if the University cannot secure enough renewable energy to cover natural gas and electricity demand. Offsets will also need to be purchased for emissions from propane and diesel usage which cannot be eliminated or substituted.

At some point, emissions must be further reduced by increasing the use of renewable energy or by obtaining offsets. Emissions from electricity can be eliminated with the purchase of 100% renewable energy, while emissions from natural gas, propane, and diesel usage that cannot be eliminated or substituted will require offsets.

5.9 PROJECTED FUTURE EMISSIONS AND REDUCTIONS

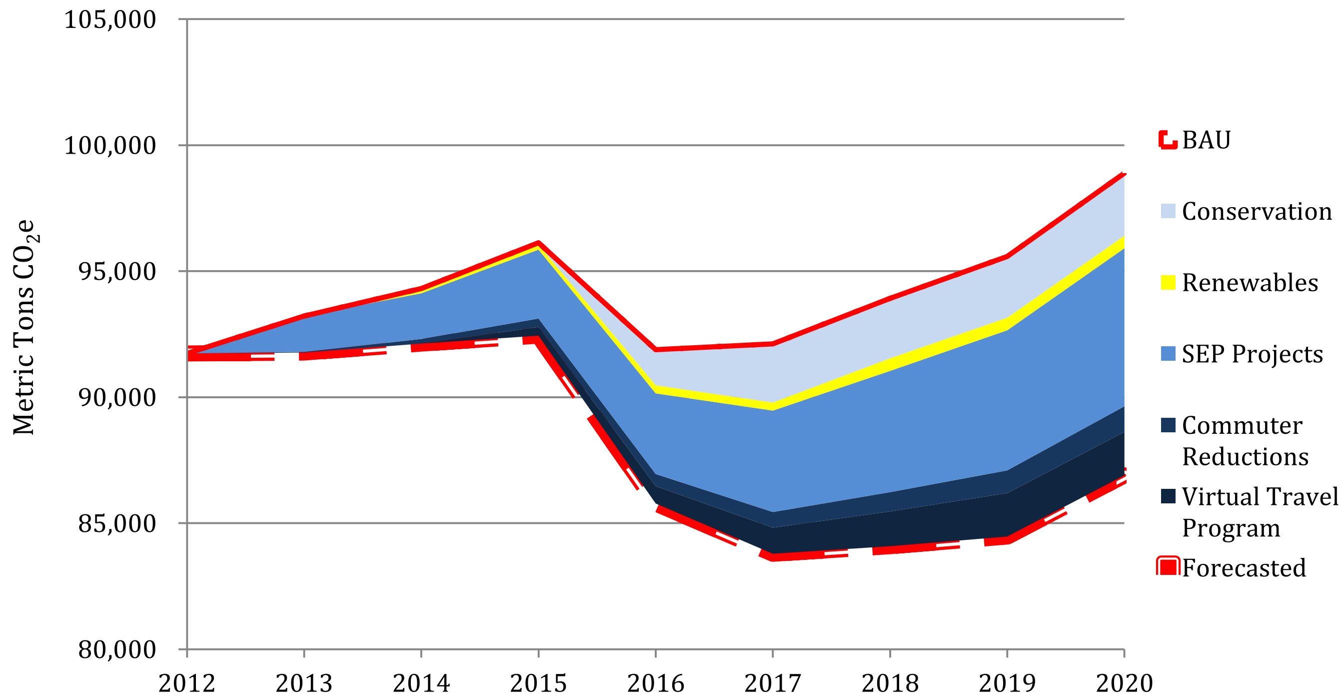

Figure 8: Projected GHG Emissions between 2012 and 2020

Figure 8 details UCSB's forecasted GHG emissions between 2012 and 2020. The trend contains several specified reduction measures:

- Conservation: emission reduction estimate - 2,374 MT CO2e, resulting from behavioral change. Based on case studies, a 5 percent reduction in electricity use by 2020 is achievable if the campus successfully decentralizes the main utility budget.

- On-site Renewable Energy: emission reduction estimate - 498 MT CO2e, resulting from build-out of renewable energy generation capacity on campus. The campus is currently adding photovoltaic arrays on the roof of parking lot 22; the project began construction in October 2013 and will be completed in June of 2014. Additionally, the campus plans on adding two large photovoltaic arrays (approximately 500 kilowatts each) before 2020, resulting in a build-out of an additional 1000 kilowatts of on-site solar production.

- Strategic Energy Partnership: emission reduction estimate: 6,272 MT CO2e, resulting from energy efficiency projects. These projects are funded through utility incentives, capital project costs, and UC bond financing.

- Air Travel Reduction: emission reduction estimate: 1,724 MT CO2e, resulting from reduced travel budgets, coupled with increased use of video conferencing. This CAP assumes a 5 percent reduction in air travel through incentivizing teleconferencing over in-person travel. In further iterations of this CAP, air travel emissions will be revised through a standard UC approach currently under development. Additionally, the university has no formalized programs to incentivize video/tele-conferencing, but promoting/subsidizing this alternative shall be actively pursued.

- Commuting Reduction: emissions reduction estimate: 1,016 MT CO2e' resulting from housing new population growth in proximity to campus.

UCSB's planned mitigation and reduction measures put the campus on a trajectory to achieve the 2020 emissions targets. Additional measures will be necessary in order for the campus to achieve GHG neutrality by 2025. UCSB will have to reduce scope 1 and 2 emissions by an additional 44,824 MT CO2e in order to meet the 2025 carbon neutrality goal of zero net operating emissions. This will require a $14.5 million in energy efficiency projects and a $700,000 annual investment in conservation efforts. While large reductions can be made through energy efficiency and conservation, which have a considerable return on investment and payback period, at some point, emissions must be further reduced by increasing the use of renewable energy or by obtaining offsets. UCSB will need to spend an additional 7 million dollars in 2025 for the purchase of carbon free energy and offsets, increasing our annual utility bill significantly which is currently around 12 Million Dollars annually (Appendix 10.7).

6 OFFSETS

After implementing projects to mitigate emissions from the UCSB campus, the purchase of renewable energy certificates and/or carbon offsets will be necessary to achieve carbon neutrality. The definitions, prices, and markets for offsets are rapidly changing. Future iterations of the UCSB CAP will include specific information for strategizing the campus approach to purchasing offsets.

The following information is drawn from a graduate seminar study at UC Berkeley, conducted in spring of 2011, on the purchase of carbon offsets as a strategy for reaching climate neutrality. The report looks at carbon offset protocols recognized under the Cap and Trade program being designed by the California Air Resources Board (CARB), pursuant to AB 32. Additionally, a discussion of the requirements by American College & University Presidents' Climate Commitment (ACUPCC) Voluntary Carbon Offset Protocol is outlined below.

According to the American College & University President's Climate Commitment (ACUPCC) Voluntary Carbon Offset Protocol:

> "A carbon offset is a reduction or removal of CO_2e GHG emissions that is used to counterbalance or compensate for ("offset") emissions from other activities; offset projects reducing GHG emissions outside of an entity's boundary generate credits that can be purchased by that entity to meet its own targets for reducing GHG emissions within its boundary. Generally, offsets fall into two categories: 1) emissions reductions or avoidance, such as replacing a diesel generator with solar panels, and 2) sequestration, or removing GHGs from the atmosphere, such as planting trees that will absorb CO_2 as they grow. There are many different types of projects that generate offsets in both categories; however, different offset markets and offset standards only recognize certain project types as acceptable."

AB 32 also states that carbon offsets must be real, permanent, quantifiable, verifiable, enforceable, and additional. "Additional" means that the offset will reduce emissions that would not have been reduced without the existence of the carbon offset project. Permanence can be difficult to prove when sequestering carbon, whether in trees or underground. For instance, if the forest is eventually burned down, then the carbon in the trees will no longer be sequestered, and the offset no longer exists. Though carbon offsets can be controversial and risky, guidelines for protocols and guidelines continue to be formalized.

On December 16, 2010, CARB approved regulations for the proposed Cap and Trade program. Under the program, CARB will set the total amount of GHG emissions allowable for covered facilities and will issue these as "allowances," which will be denominated in metric tons of CO_2e. Entities that emit more than 25,000 MT CO_2e through scope 1 direct onsite emissions can trade these allowances to the extent that they have too many or too few for their operations. In addition, the program would allow covered entities to meet a certain amount of their emissions limit through the use of offsets.

UCSB is not currently included in the Cap and Trade program; however, the UC-System is working with the State Legislature to determine the feasibility of the UC-System making alliances in order to satisfy AB 32.

Thus, while the direct relevance of CARB's guidelines for carbon offsets is limited, a review of CARB's proposed regulations for offsets is still useful for campus planning purposes.

Existing protocol through ACUPCC provides a common framework for managing carbon emissions on college and university campuses to achieve GHG neutrality. As indicated in the ACUPCC Voluntary Carbon Offset Protocol, a university should first try to meet the self-imposed GHG emission reductions. If the campus cannot achieve GHG neutrality in a certain time period, then the campus should consider purchasing carbon offsets. From the perspective of the ACUPCC, it is not necessary to incorporate carbon offsets into each college or university's climate action plan. The Campus should evaluate the effect and the value of offsets in accordance with its own unique circumstances. The ACUPCC participating institutions should go through each carbon offset investment option and compare the costs and risks between offset investment, purchasing credits, project development, and forward delivery of offsets. If UCSB purchases or invests in offsets from another entity, the Campus must ensure that offsets are not double counted, reducing both institutions' climate change impact. The ACUPCC Protocol indicates that the term "offset" refers to the reduction and removal of GHG emissions; therefore, avoidance projects are not recognized as offsets. The Campus will most likely invest in a portfolio of offsets over time from the AB 32 compliant list and the voluntary-compliant list and in accordance with ACUPCC protocol.

Currently, the Campus has invested in Renewable Energy Credits from several wholesale renewable energy providers as part of LEED certification projects. Ellison Hall and Santa Rosa Residential Hall purchased 3.13m KWH of renewable energy in 2012. Although these reductions account for approximately 3%of total energy use, these credits are not quantified in our annual GHG inventory and, therefore, are not included in our Climate Action Plan per directions from The Climate Registry.

7 FINANCING

UCSB currently does not have a specified budget for GHG emission reduction actions. In addition, due to the current economic state of the UC system, UCSB continues to have limited funds and will experience a continued staff shortage over the next several years. Therefore, the majority of the funds for mitigation projects will likely come from extramural sources and/or creative financing/partnerships. The following sources of funding are available or are being considered for financing these actions:

- Strategic Energy Partnership – This is a UCOP partnership program with Southern California Edison (SCE) and Sempra Energy, the local investor-owned utilities for the UCSB campus. This program provides for funding through UCOP and rebate funding by SCE for SEP projects. We anticipate that the program will extend through 2016, with an addition $15 million requested for investment in energy efficiency projects. However, this program has not been extended past 2016.

- UC Funding – UC financing can be secured with energy cost savings or other income sources. There is a minimum project return requirement for University-borrowed funds, and Department of Finance approval is needed to allow for capital debt service to be paid with energy cost savings.

- The Green Initiative Fund - Smaller projects may be funded by The Green Initiative Fund (TGIF), a student fee-generated grant program that receives approximately $150,000 annually to allocate towards green projects. Students pay $2.60 per quarter towards TGIF with the primary mission to reduce the campus' impacts on the environment, specifically GHG emissions. This program is currently funded through 2014. Examples of projects funded to date include solar power projects, wind turbines, natural gas meters, an on-campus hourly rental Zipcar, electric vehicle charging stations, Educational Energy Efficiency Video for the Residence Halls, Electric Hand Dryers in Library Bathrooms, Energy and Comfort Re-commissioning, student internship funding to assist with campus energy intensity data collection, and real-time energy consumption displays in office spaces. UCSB's Green Initiative Fund was first established in the UC system in 2006.

- Student Services Renewable Energy Initiative - In April 2010, UCSB's students approved the "Student Services Renewable Energy Initiative." The revenue generated by quarterly student fees is used to fund large-scale renewable energy projects at UCSB, which include a half-megawatt array designed for the roof of Parking Structure 22, scheduled for completion in February 2014. The fee increase of $6 per quarter will generate nearly $3.4 million dollars by the time it sunsets in 2020. According to information from the Association for the Advancement of Sustainability in Higher Education (AASHE), the "Student Services Renewable Energy Initiative" will surpass all other U.S. colleges and universities in the amount of funding generated annually for the creation of on-site renewable energy. The Renewable Energy Initiative is being administered by the student-majority Renewable Energy Initiative Governance Board and is part of the Division of Student Affairs Zero-Net Energy Plan.

State Programs – through the Energy Conservation Assistance Act (ECAA), the state offers loans at a 1% interest rate for Energy Efficiency & Energy Generation Projects. The interest rate is fixed at 1% for the term of the loan. Approximately $6 Million in loan funding is expected to be available during Fiscal Year 2014-15, and the maximum loan amount is $3 million per applicant. Loans must be repaid from energy cost savings or other legally available funds within a maximum term of 20 years (including principal and interest).

Federal Programs – Federal government programs that can be used to provide funding for projects include:

Federal Tax Credits – The federal government provides tax credits for solar energy systems, wind energy systems, fuel cells, and energy-efficient commercial buildings. These credits cannot be received by the University but can be received by a private sector third party owner.

Department of Energy – Research grants.

New Construction – Several mitigations are related to standards for new buildings. These measures will be incorporated into the building design, and the cost will be covered within the capital budget for each project. Currently, the Campus strives for LEED Gold in new construction and major renovations.

UCSB Programs:

- Capital Plan – Energy efficiency and GHG emission reduction projects can be included in the Capital Plan. This is a rolling five-year plan that addresses capital improvements for the Campus. Projects can be moved into the plan, depending on priority.

- Department budgets – Measures taken by individual departments can be funded within their department budgets.

- UCSB research projects – U.S. Department of Energy and other research grants may be sought to advance the technology for measures of a research nature, such as methane capture from coastal seeps.

8 TRACKING PROGRESS

Sustainability Efforts are coordinated through the Office of Administrative Services. Although the sustainability organizational chart includes many different players crossing multiple departments, responsibility for tracking and assessing the progress of this plan lies with Administrative Services. Within Administrative Services, the office includes a Sustainability Coordinator who works under the Associate Vice Chancellor for Administrative Services. Additionally, the Sustainability Coordinator and Associate Vice Chancellor work very closely with the Senior Associate Vice Chancellor, who oversees Campus Design and Facilities, Transportation and Parking Services, and Housing and Residential Services. The Office produces a website (www.sustainability.ucsb.edu) and has overall responsibility for implementation of this CAP.

The Campus Sustainability Committee advises the Chancellor and campus administrators on matters of campus sustainability, makes recommendations on sustainability initiatives, helps prioritize and monitor the execution and progress of the Campus Sustainability Plan toward campus goals, makes recommendations on allocations of available funding resources, and provides guidance in the creation and fostering of alliances.

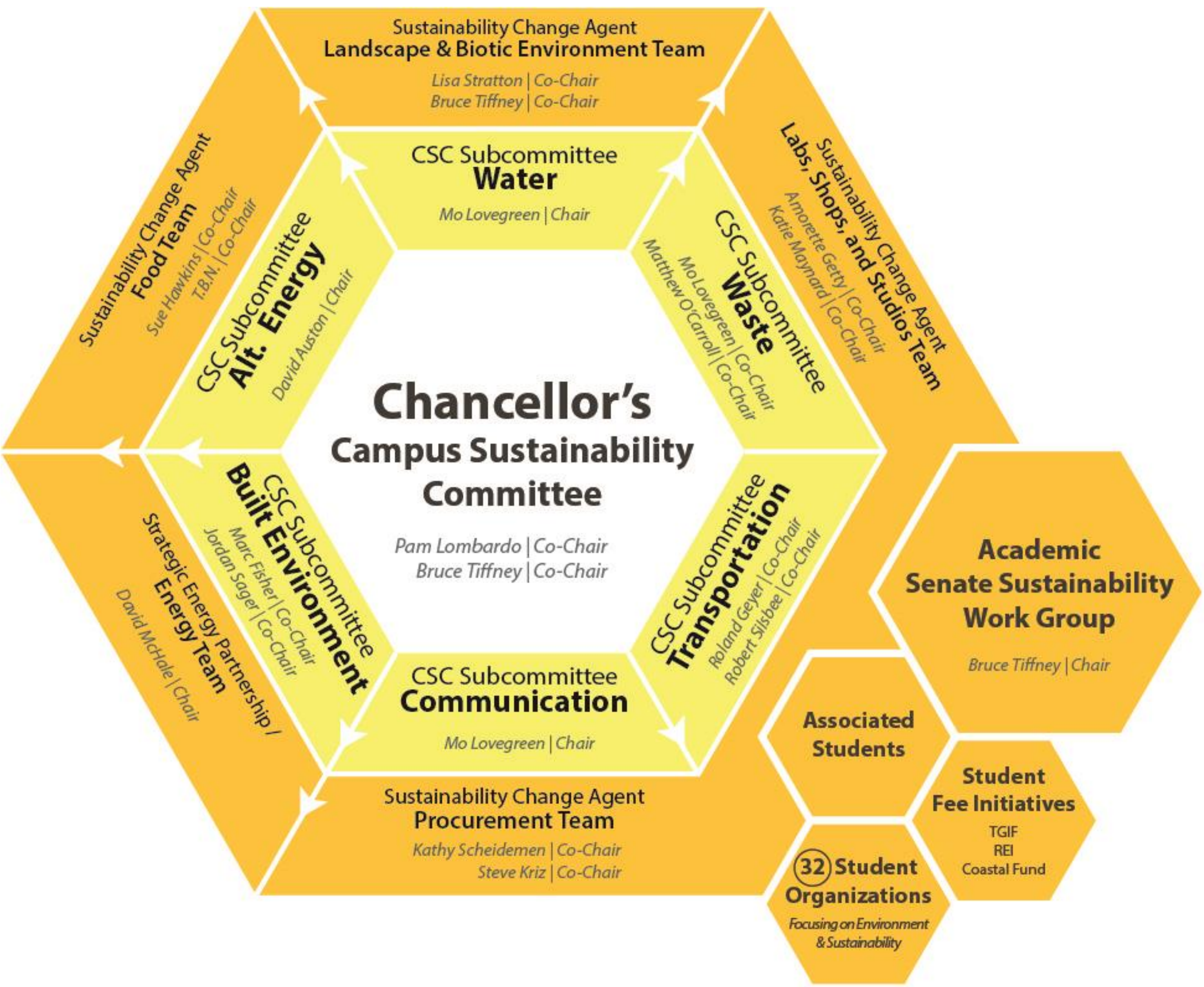

Figure 9: Chancellors Sustainability Committee Organizational Structure

The Committee will conduct an ongoing and thorough consultative process to solicit campus input in developing the vision to enhance the University's international leadership in this critically important area. These efforts will use the Campus Sustainability Plan and this CAP as blueprints for the campus' sustainability efforts.

Beginning in August 2010 and annually thereafter, UCSB reports progress in implementing this CAP to UCOP and the campus community. This report will include an assessment of:

- Campus performance for the previous year, including total GHG emissions, progress toward targets, and GHG emissions metrics.
- Records of mitigations implemented, effectiveness of all mitigations, and explanations of mitigations that were not implemented.
- Campus growth and operational changes that occurred in the reporting year.
- Proposed changes in the CAP to improve performance or respond to policy changes.

In 2011 and then biennially thereafter, UCSB will submit a narrative progress report.

In addition, UCSB will continue to report GHG emissions information and planned reductions to the ACUPCC and the Association for Advancement of Sustainability in Higher Education (AASHE) through their websites and provide an annual GHG emissions inventory to The Climate Registry.

9 CONCLUSIONS AND RECOMMENDATIONS

The campus' 2020 projected emissions with mitigation are 12% below the 2020 targets, thanks to the implementation of currently planned energy efficiency and emission reduction measures. However, current and anticipated economic conditions of the UC system will affect funding for implementation of many planned projects, which could, in turn, slow progress toward achieving the near-term targets. If growth projections are correct, additional energy efficiency and conservation efforts will need to be adopted in order to surpass the 2020 target. In addition to these efforts, the University will need to procure large quantities of carbon-neutral energy and purchase offsets in order to achieve carbon neutrality by the 2025 target.

Economic conditions will continue to cycle, and new solutions will continue to emerge. It is essential that the University maintain a consistent effort with the flexibility to adjust to changing conditions in order to achieve the ultimate target of GHG neutrality by 2025.

10 APPENDIX

10.1 CAMPUS EMISSIONS DATA & INFORMATION

Table 22: UCSB Demographics

Year	Calif OGSF	Students	Faculty & Staff	Total Population
1990	4,385,989	18,391	3,870	22,261
1991	4,407,300	18,519	3,825	22,344
1992	4,417,041	18,655	3,795	22,450
1993	4,399,750	18,581	3,840	22,421
1994	4,555,371	17,834	3,863	21,697
1995	4,641,618	18,224	3,922	22,146
1996	4,834,028	18,531	4,118	22,649
1997	4,953,109	18,940	4,094	23,034
1998	4,943,327	19,363	4,177	23,540
1999	4,995,616	20,056	4,177	24,233
2000	4,956,902	19,962	4,344	24,306
2001	4,971,128	20,373	4,321	24,694
2002	5,039,013	20,559	4,275	24,834
2003	5,044,098	20,847	4,642	25,489
2004	5,194,757	21,026	4,627	25,653
2005	5,846,097	21,016	4,629	25,645
2006	6,332,012	21,082	4,834	25,916
2007	7,034,889	21,410	4,947	26,357
2008	7,106,531	21,868	5,240	27,108
2009	7,309,577	22,850	5,175	28,025
2010	7,971,792	22,218	4,906	27,124

2011	8,123,500	21,685	4,443	26,128
2012	8,335,240	21,927	4,394	26,321
2013	8,426,917	22,146	4,600	26,746
2014	8,578,625	22,368	4,805	27,173
2015	8,730,334	22,591	5,011	27,602
2016	8,882,042	22,817	5,217	28,034
2017	9,033,750	23,045	5,422	28,468
2018	9,185,458	23,276	5,628	28,904
2019	9,337,167	23,509	5,833	29,342
2020	9,488,875	23,744	6,039	29,783
2021	9,585,458	23,981	6,117	30,099
2022	9,682,042	24,221	6,196	30,417
2023	9,778,625	24,463	6,274	30,737
2024	9,875,209	24,708	6,353	31,060
2025	9,971,792	24,955	6,431	31,386

Table 23: UCSB Scope 1, 2, 3 Emissions (BAU)

`	Scope 1 - Stationary Combustion (Campus)	Scope 1 - Stationary Combustion (Other)	Scope 1 - Mobile Combustion	Scope 1 - Fugitive Emissions	Scope 2 - Purchased Electricity (Campus)	Scope 2 - Purchased Electricity (Other)	Scope 3 - Air Travel	Scope 3 - Commuting	TOTAL CO_2e
1990	11,281	1,996	1,004	10	34,355	1,000	21,925	19,166	90,736
1991	11,652	1,998	1,007	10	34,801	1,005	20,729	19,196	90,400
1992	12,022	2,001	1,012	10	35,248	1,009	20,288	19,227	90,817
1993	12,393	2,004	1,010	10	35,694	1,014	20,685	19,258	92,068

1994	12,764	2,007	979	10	36,140	1,019	20,469	19,288	92,678
1995	13,135	2,010	999	10	36,587	1,023	20,686	19,319	93,769
1996	13,507	2,014	1,020	10	37,033	1,028	20,930	19,350	94,892
1997	13,583	2,015	1,037	10	38,240	1,044	20,931	19,380	96,240
1998	15,335	2,028	1,058	10	41,932	1,083	21,343	19,411	102,199
1999	17,032	2,040	1,088	10	41,162	1,075	21,175	19,442	103,023
2000	15,862	2,031	1,091	10	38,534	1,047	21,651	19,472	99,699
2001	15,557	2,029	1,108	10	34,096	939	21,740	18,782	94,262
2002	15,178	2,027	1,114	10	29,166	825	21,724	18,091	88,136
2003	12,805	2,010	1,142	10	25,282	722	23,823	17,400	83,194
2004	13,808	2,018	1,149	10	23,021	636	23,983	16,710	81,334
2005	16,297	2,696	1,148	10	24,685	1,374	24,233	16,019	86,462
2006	16,443	2,700	1,160	10	25,753	1,385	25,559	15,328	88,337
2007	18,291	2,716	1,179	10	26,265	1,390	26,417	14,638	90,905
2008	18,124	2,715	1,211	10	27,609	1,404	28,260	13,947	93,281
2009	19,059	2,723	1,250	10	28,055	1,431	28,188	13,256	93,973
2010	19,630	2,729	1,212	10	27,974	1,450	26,991	12,566	92,563
2011	20,216	2,953	1,127	10	27,492	1,233	25,759	12,163	90,954
2012	18,902	2,301	1,422	10	27,398	1,348		12,903	91,703

							27,419		
2013	20,410	2,711	1,388	10	25,420	1,262	28,265	12,363	92,568
2014	20,752	2,714	1,410	10	25,846	1,266	29,109	12,560	95,160
2015	21,094	2,717	1,431	10	26,272	1,270	29,968	12,604	97,628
2016	21,436	2,719	1,453	10	22,004	1,050	30,840	12,500	95,059
2017	21,778	2,722	1,474	10	22,355	1,053	31,728	12,403	97,370
2018	22,120	2,725	1,496	10	22,706	1,057	32,630	12,452	99,856
2019	22,462	2,727	1,518	10	23,057	1,060	33,546	12,363	102,237
2020	22,804	2,730	1,540	10	23,408	1,064	34,478	12,368	104,742
2021	23,045	2,732	1,556	10	23,655	1,066	35,425	12,193	106,019
2022	23,285	2,734	1,572	10	23,902	1,068	36,388	12,322	107,613
2023	23,526	2,736	1,588	10	24,150	1,071	37,366	12,452	109,224
2024	23,767	2,738	1,604	10	24,397	1,073	38,360	12,583	110,851
2025	24,008	2,740	1,620	10	24,644	1,075	39,371	12,715	112,495

10.2 STRATEGIC ENERGY PARTNERSHIP PROJECT LIST 2012 -2016

Table 24: STRATEGIC ENERGY PARTNERSHIP PROJECT LIST 2012 -2016

Project Name	Date Project Complete	Best Available kWh Reduction	Best Available therm Reduction	Total energy savings KWH/Y	Best Available Electric Incentive($)	Best Available Gas Incentive($)	Best Available Project Cost	Project Status
MBCx - Ortega	29-Dec-14	-	9,443	276,747	$0	$9,443	$ 850,000	ACTIVE

MBCx - Environmental Health & Safety (Gas)	25-Dec-14	-	1,000	29,307	$0	$1,000	$ 22,500	ACTIVE
MBCx - Central Plant Chilled Loop	23-Dec-14	400000	0	400,000	96000	0	$ 350,000	ACTIVE
MBCx - Cheadle Hall (Electric)	22-Dec-14	75,000	0	75,000	$18,000	$0	$ 62,500	ACTIVE
MBCx - Cheadle Hall (Gas)	22-Dec-14	-	2,500	73,268	$0	$2,500	$ 62,500	ACTIVE
Retrofit - LED Roadway Lights	12-Dec-14	157,436	0	157,436	$37,785	$0	$ 93,200	ACTIVE
Retrofit - MAC Lighting	17-Oct-14	17,589	-	17,589	$4,221	$0	$ 19,583	ACTIVE
MBCx - Anacapa (Electric)	17-Apr-14	70,000	0	70,000	$16,800	$0	$ 55,000	ACTIVE
Retrofit - Art Building Partial Lighting	17-Apr-14	2408	0	2,408	577.92	0	$ 70,000	ACTIVE
Retrofit - Hot Water Loop Phase 1	4-Apr-14	0	29652	869,014	0	29652	#########	ACTIVE
MBCx - Anacapa (Gas)	27-Mar-14	0	7,500	219,803	$0	$7,500	$ 55,000	ACTIVE
Retrofit - Harder Stadium Flood Light Replacement	10-Mar-14	53,239	0	53,239	$12,777	$0	$ 30,000	ACTIVE
MBCx - Santa Rosa (Gas)	27-Feb-14	0	6,000	175,843	$0	$6,000	$ 50,000	ACTIVE
MBCx - Carrillo (Gas)	20-Jan-14	0	48,750	1,428,722	$0	$48,750	$ 177,500	ACTIVE
MBCx - Life Science (Gas)	15-Jan-14	0	15,000	439,607	$0	$15,000	$ 50,000	ACTIVE
Retrofit - Parking Structure 10 Lighting	15-Jan-14	183,916	-	183,916	$44,140	$0	$ 150,000	ACTIVE
Retrofit - Rec Center Pool Covers	19-Dec-13	0	30,614	897,208	$0	$15,088	$ 18,860	ACTIVE
Retrofit - Parking Structure 22	17-Dec-13	241437	0	241,437	57944.88	0	$ 375,849	ACTIVE

Lighting								
MBCx - Santa Cruz (Gas)	19-Sep-13	-	8,449	247,616	$0	$8,449	$ 88,000	Complete
Retrofit - Robertson Gym Lighting	19-Sep-13	48,515	-	48,515	$11,644	$0	$ 131,957	Complete
Retrofit - Girvetz Hall Lighting	3-Sep-13	61,684	-	61,684	$14,804	$0	$ 109,741	Complete
Retrofit - South Hall Lighting Replacement	2-Sep-13	195,542	0	195,542	$46,930	$0	$ 316,400	Complete
MBCx - Santa Cruz (Electric)	3-Jun-13	71290	0	71,290	17109.6	0	$ 88,000	Complete
MBCx - Carrillo (Electric)	31-Dec-12	480,983	-	480,983	$115,436	$0	$ 190,515	Complete
MBCx - Santa Rosa (Electric)	31-Dec-12	107,221	0	107,221	$25,733	$0	$ 50,000	Complete
Retrofit - PLOS Phase 2	31-Dec-12	10,892	0	10,892	$1,140	$0	$ -	Complete
Retrofit - Santa Catalina Renovations (Gas Savings)	31-Dec-12	0	11,167	327,273	$0	$11,167	$ 200,000	Complete
MBCx - Psychology	7-Dec-12	243,806	0	243,806	$58,513	$0	$ 184,496	Complete
Retrofit - Bio 2 Turbocor Chiller VFD	29-Nov-12	959,286	0	959,286	$230,229	$0	#########	Complete
MBCx - Broida Hall	9-Oct-12	961713	0	961,713	243803.5	0	$ 465,000	Complete
MBCx - Life Science (Electric)	24-Sep-12	364,225	0	364,225	$87,414	$0	$ 88,000	Complete
Retrofit - Kerr Hall Lighting	21-Sep-12	51,196	0	51,196	$12,287	$0	$ 119,042	Complete
MBCx - CNSI (Gas)	11-Sep-12	0	18,361	538,108	$0	$18,361	$ 259,867	Complete
Retrofit - Campuswide Bi-Level Stairwell Lighting	4-Jun-12	108,350	0	108,350	$26,004	$0	$ 162,379	Complete
Retrofit - Bren Aircuity Lab Ventilation	1-Jun-12	74,990	-	74,990	$17,998	$0	$ 150,079	Complete

(Electric)								
Retrofit - North Hall Lighting	4-May-12	33,413	0	33,413	$8,019	$0	$ 113,200	Complete
Retrofit - CNSI Data Center Server Replacement	1-May-12	285926	0	285,926	68622.24	0	$ 90,088	Complete
Retrofit - Bren Aircuity Lab Ventilation (Gas)	13-Apr-12	0	30577	896,124	0	30577	$ 150,079	Complete
MBCx - Snidecor	30-Dec-11	143,616	37,197	1,233,753	$34,468	$37,197	$ 111,932	Complete
Retrofit - Bio 2 Heating Upgrade	30-Dec-11	-	70,725	2,072,745	$0	$70,725	$ 763,387	Complete
Retrofit - Bio 2 Infst. (Animal Cage Washer)	30-Dec-11	16,283	10,140	313,457	$3,907	$10,140	$ 320,000	Complete
Retrofit - De La Guerra Kitchen Hood	30-Dec-11	159,689	3,901	274,016	$38,325	$3,901	$ 146,706	Complete
Retrofit - North Hall Data Center Chilled Water Loop	30-Dec-11	260,200	-	260,200	$62,488	$0	$ 146,623	Complete
Retrofit - North Hall Data Center Economizer	30-Dec-11	26,197	0	26,197	$6,287	$0	$ 22,694	Complete
Retrofit - PLOS Phase 1	29-Dec-11	99,897	0	99,897	$10,455	$0	$ -	Complete
Retrofit - Event Center Lighting (Thunderdome)	9-Nov-11	223,832	0	223,832	$53,720	$0	$ 232,130	Complete
MBCx - CNSI (Electric)	31-Oct-11	1382637	0	1,382,637	331832.9	0	$ 259,867	Complete
Retrofit - Chilled Loop E-W Extension	1-Mar-11	359675	0	359,675	86322	0	$ 961,180	Complete
MBCx - Bio 2 (Gas)	29-Dec-10	-	55,236	1,618,808	$0	$55,236	$ 69,045	Complete
MBCx - Bio 2 (Electric)	15-Dec-10	895,131	0	895,131	$211,973	$0	$ 284,175	Complete
Retrofit - Anacapa and	8-Oct-10	95,700	0	95,700	$22,968	$0	$ 45,672	Complete

San Rafael Dorm Lighting								
Retrofit - Bio-2 AHU (V-Belt to Direct Drive)	10-Sep-10	332,685	0	332,685	$79,844	$0	$ 516,685	Complete
Retrofit - Mesa Parking Structure Lighting	16-Jul-10	212,430	0	212,430	$50,983	$0	$ 169,860	Complete
MBCx - HSSB (Electric Savings)	8-Mar-10	301,546	0	301,546	$72,371	$0	$ 21,588	Complete
Retrofit - State Lighting	5-Jan-10	179,147	0	179,147	$42,995	$0	$ 113,400	Complete
Retrofit - 2009 Transformer Load Management	28-Dec-09	97,429	-	97,429	$23,383	$0	$ 105,600	Complete
Retrofit - Rec Center Pool Pump VFD	14-Dec-09	227,496	0	227,496	$54,599	$0	$ 151,140	Complete
MBCx - HSSB (Gas Savings)	11-Dec-09	0	1,660	48,650	$0	$1,660	$ 21,588	Complete
Retrofit - Carrillo Kitchen Hood	8-Dec-09	45,081	1,563	90,900	$10,819	$1,563	$ 49,655	Complete
Retrofit - Low Pressure Drop Filters	7-Dec-09	182,014	-	182,014	$43,683	$0	$ 55,000	Complete
Retrofit - Housing Lighting	1-Dec-09	98,441	0	98,441	$23,626	$0	$ 49,795	Complete

10.3 RPS ADJUSTED SCE EMISSIONS FACTORS USED BETWEEN 2012 AND 2020

Table 25: RPS Adjusted SCE Emissions Factors Used Between 2012 and 2020

Year	Purchased Electricity in kWh			
	Purchased Electricity CO_2 [lbs/MWh]	**Purchased Electricity CH4 [lbs/GWh]**	**Purchased Electricity N2O [lbs/GWh]**	**Purchased Electricity CO_2e [lbs/MWh]**
1990	1067.04000	28.29170	6.23160	1069.56592

1991	1067.04000	28.29170	6.23160	1069.56592
1992	1067.04000	28.29170	6.23160	1069.56592
1993	1067.04000	28.29170	6.23160	1069.56592
1994	1067.04000	28.29170	6.23160	1069.56592
1995	1067.04000	28.29170	6.23160	1069.56592
1996	1067.04000	28.29170	6.23160	1069.56592
1997	1067.04000	28.29170	6.23160	1069.56592
1998	1067.04000	28.29170	6.23160	1069.56592
1999	1067.04000	28.29170	6.23160	1069.56592
2000	1067.04000	28.29170	6.23160	1069.56592
2001	963.82750	28.29170	6.23160	966.35342
2002	860.61500	28.29170	6.23160	863.14092
2003	757.40250	28.29170	6.23160	759.92842
2004	654.19000	28.29170	6.23160	656.71592
2005	654.19000	28.29170	6.23160	656.71592
2006	654.19000	28.29170	6.23160	656.71592
2007	654.19000	28.29170	6.23160	656.71592
2008	654.19000	28.29170	6.23160	656.71592
2009	667.60000	28.29170	6.23160	670.12592

2010	681.01000	28.29170	6.23160	683.53592
2011	681.01000	28.29170	6.23160	683.53592
2012	**659.68000**	28.94000	6.17000	661.20044
2013	595.31290	25.74545	5.67076	597.61149
2014	595.31290	25.74545	5.67076	597.61149
2015	595.31290	25.74545	5.67076	597.61149
2016	490.64250	21.21878	4.67370	492.53694
2017	490.64250	21.21878	4.67370	492.53694
2018	490.64250	21.21878	4.67370	492.53694
2019	490.64250	21.21878	4.67370	492.53694
2020	490.64250	21.21878	4.67370	492.53694

10.4 STUDENT LIFE INITIATIVES: THE DIVISION OF STUDENT AFFAIRS ZERO-NET ENERGY STRATEGIC PLAN

Student Affairs at UCSB has been a leading division on climate action and planning. The division has set forth impressive commitments to certify at the LEED Platinum level for all Student Affairs buildings and facilities (approximately 450,000 square feet of administrative buildings and a recreational and aquatics complex) and achieve divisional zero net energy on an annual basis. Student Affairs projects and initiatives which promote sustainable renewable energy and energy conservation are crucial to addressing campus climate change. Student Affairs anticipates exceeding its fixed energy budget cap in 2016, which may require the division to pull resources from other areas, including staff wages and funding for student services.

Many organizations attempt to solve the problems of climate change and rising energy costs through energy efficiency enhancements only. In contrast, the UCSB Student Affairs Zero Net Energy plan addresses energy efficiency enhancements coupled with onsite renewable energy generation. Energy efficiency enhancements include projects such as: dimming electronic ballasts, occupancy and daylighting controls, lighting controls networks, tuning lighting with dimmable ballasts, LEDs for floodlights and display lights, ICLS retrofits, office retrofits, elevator retrofits and bi-level corridors, HVAC duct flow management, occupancy sensor thermostats, condensing boilers, variable speed pool pumps, pool covers, and Energy Star rated appliances. Additionally, the division also plans on installing one megawatt of online generation through solar power and a thermal water pre-heat array for the planned aquatics complex. By investing in energy efficiency and onsite renewable energy generation, UCSB Student Affairs will reduce its net energy costs to zero and eventually produce an energy surplus. This will result in a significant decrease in overall campus GHG emissions.

Outside of installing new hardware and software to support carbon reduction, the Student Affairs energy plan also highlights the importance of community commitment through behavioral changes. Educating students and staff about responsible energy consumption habits is an on-going divisional effort. For example, to help create an energy use feedback loop for staff, UCSB Student Affairs has partnered with the Institute for Energy Efficiency and The Green Initiative Fund (TGIF) to create a desk top application for building occupants which displays energy inefficiencies at the departmental and individual office level. Further ongoing education efforts include having provided information to new students on campus sustainability via the orientation process. Divisional Managers are made aware of sustainability initiatives via quarterly meetings, and individual departments are kept informed via regular business officer meetings.

As a division, Student Affairs hopes to provide a template for other organizations who strive to reduce greenhouse gas emissions while eliminating ongoing utility costs. Zero Net Energy will enable UCSB's Division of Student Affairs to redirect its annual $1 million utility bill to services and programs that promote student success. As such, Zero Net Energy responds to students' demands that today's institutions be educationally, fiscally, and environmentally responsible. Funding for the Student Affairs Zero Net Energy plan is made possible through student fees, particularly The Renewable Energy initiative (discussed further in the Section IX Financing). Through the Renewable Energy Initiative, the campus will: 1) become a leading promoter in the use of ZNE to address significant environmental and economic challenges, 2) significantly reduce use of fossil fuels and carbon emissions, 3) gain greater energy independence, 4) help meet UCSB Climate Action Plan goals for a carbon neutral campus by 2025, and 5) direct a significant proportion of savings generated from this initiative to student services.

10.5 CLIMATE CHANGE AND COMMUNITY OUTREACH

The Sustainability Communications Committee was established in the spring of 2008 with a central goal of communicating and collaborating with the Goleta and Santa Barbara communities on a regular basis with regard to sustainability. The Communications Committee has done tremendous work to increase visibility around climate change issues and to educate our internal and external stakeholders about climate change.

Below is a list of some successful community outreach programs the campus has undertaken in the area of climate change:

- The Annual Central Coast Sustainability Summit - The Summit is an annual conference with the goal of sharing best practices and building collaborations to address complex environmental issues in our region. Topics discussed at the third annual summit included renewable energy options, buy-local initiatives, new paradigms of volunteerism, energy-saving improvements, environmentally preferable purchasing, and investing in youth and career training for the future.

- The Santa Barbara Summit on Energy Efficiency – Established in 2008 by the Institute for Energy Efficiency, this conference is an annual event which brings together stakeholders in efficiency technologies, facilitating growth and collaboration. The Summit brings together national leaders in industry, academia, and government for two days of in-depth discussions on the latest advancements in the fast-moving sector of energy efficiency.

- Earth Day Celebrations – The past few Earth Day Celebrations in downtown Santa Barbara have been collaborations between the Community Environmental Council and the Bren School of Environmental Science and Management. In addition, several UCSB booths educated the local community on the sustainability programs and student research happening on the UCSB campus.

The communications team is also working to spread awareness about climate change social media, and outreach materials. Below is a list (where?) of some of the successful sustainability campaigns the communications team at UCSB is currently working on:

- Creating posters for the green message boards around campus, primarily geared towards increasing student education and involvement in sustainability.

- Creating a Public Relations Campaign. Phase I of our image campaign, on-campus, included DigiKnows (rotating slides displayed on digital screens) and posters. Phase II went public in winter 2013 with 15-second videos shown in all local movie theaters, signage on four of the 40ft hybrid buses, a newsletter and blog on the sustainability website, and bi-weekly articles in the campus publication, The Bottom Line.

10.6 ENERGY SAVINGS AND COST CALCULATIONS FOR BEHAVOIRAL CHANGES

Energy savings from behavioral changes aimed at reducing energy use in buildings.

Information:

- Building energy use for 2012 = 726,294 MMBTU
- 10.5 Cents per KWH
- 70 cents per Therm
- 5% yearly energy cost increase
- 2% increase in annual program costs

Calculations (Energy savings):

- Energy savings were estimated by taking 5% of total electricity and Natural gas used annually.
- Energy costs*energy savings
- Costs = 5 FTE employees at 75,000 plus 49% benefits = $558,750 (2014)

Table 26: Savings Estimates

	2014	2020
Program costs	558,750.00	$ 659,325
Energy Savings (KWH)		5,549,335
Energy Savings (Therms)		214,316
Energy cost ($/KWH)	0.105	0.1365
Energy Cost ($/Therm)	0.7	0.91
Energy costs savings ($/Yr)		952,511.79

On-Site Roof Top Renewable Energy

Parking Lot 22 Solar Project:

Information:

- Capital Cost = $2,500,000
- SCE Rebate = $ 440,000
- Cost to UCSB = $2,060,000
- Energy Savings (KWH/Y) = 628,000
- Current Energy costs ($/KWH) = $ 0.105
- Discount rate = 5%
- Energy cost increase = 4 – 6%

Table 27: Payback period calculations

4% increase in energy costs			5% increase in energy costs			6% increase in energy costs		
Year	Energy Savings	Discounted	Year	Energy Savings	Discounted	Year	Energy Savings	Discounted
2014	$ 65,940	$65,940	2014	$65,940	$ 65,940	2014	$ 65,940	$65,940
1	$ 68,578	$65,312	1	$69,237	$ 65,940	1	$ 69,896	$66,568
2	$ 71,321	$64,690	2	$72,699	$ 65,940	2	$ 74,090	$67,202
3	$ 74,174	$64,074	3	$76,334	$ 65,940	3	$ 78,536	$67,842
4	$ 77,140	$63,464	4	$80,150	$ 65,940	4	$ 83,248	$68,488
5	$ 80,226	$62,859	5	$84,158	$ 65,940	5	$ 88,243	$69,140
6	$ 83,435	$62,261	6	$88,366	$ 65,940	6	$ 93,537	$69,799
7	$ 86,773	$61,668	7	$92,784	$ 65,940	7	$ 99,149	$70,464
8	$ 90,243	$61,080	8	$97,423	$ 65,940	8	$ 105,098	$71,135

9	$	93,853	$60,499	9	$102,295	$	65,940	9	$	111,404	$71,812
10	$	97,607	$59,922	10	$107,409	$	65,940	10	$	118,088	$72,496
11	$	101,512	$59,352	11	$112,780	$	65,940	11	$	125,174	$73,187
12	$	105,572	$58,786	12	$118,419	$	65,940	12	$	132,684	$73,884
13	$	109,795	$ 58,227	13	$124,340	$	65,940	13	$	140,645	$74,587
14	$	114,187	$57,672	14	$130,557	$	65,940	14	$	149,084	$75,298
15	$	118,754	$57,123	15	$137,085	$	65,940	15	$	158,029	$76,015
16	$	123,504	$56,579	16	$143,939	$	65,940	16	$	167,511	$76,739
17	$	128,445	$56,040	17	$151,136	$	65,940	17	$	177,561	$77,469
18	$	133,582	$55,506	18	$158,692	$	65,940	18	$	188,215	$78,207
19	$	138,926	$54,978	19	$166,627	$	65,940	19	$	199,508	$78,952
20	$	144,483	$54,454	20	$174,958	$	65,940	20	$	211,479	$79,704
21	$	150,262	$53,935	21	$183,706	$	65,940	21	$	224,167	$80,463
22	$	156,272	$53,422	22	$192,892	$	65,940	22	$	237,617	$81,229
23	$	162,523	$52,913	23	$202,536	$	65,940	23	$	251,874	$82,003
24	$	169,024	$52,409	24	$212,663	$	65,940	24	$	266,987	$82,784
25	$	175,785	$51,910	20	$ 223,296	$	65,940	25	$	283,006	$83,572
26	$	182,817	$51,415	26	$234,461	$	65,940	26	$	299,986	$84,368
27	$	190,129	$50,926	27	$246,184	$	65,940	27	$	317,985	$85,172
28	$	197,734	$50,441	28	$258,493	$	65,940				
29	$	205,644	$49,960	29	$271,418	$	65,940				
30	$	213,870	$49,485	30	$284,989	$	65,940				
31	$	222,424	$49,013	31	$299,238	$	65,940				
32	$	231,321	$48,547								
33	$	240,574	$48,084								
34	$	250,197	$47,626								
35	$	260,205	$47,173								
36	$	270,613	$46,723								

On-site ground, carport, or roof mount solar cost estimates:

Information:

- Cost per Watt =$3.5
- Planned build out = 1000 kW
- Total project costs = 3.5 Million
- Energy Savings = 1,600,000 kWH per year
- Energy Costs = 10.5 Cents per kWH
- Discount rate = 5%
- Energy cost increase = 5%

Table 28: On-site ground, carport, or roof mount solar payback estimate

500 kw completed in 2016			500 kw completed in 2018		
Year	energy savings	Discounted	**Year**	energy savings	Discounted
2016	92,610.000	92,610.000	2018	102,102.53	102,102.53
1	97,240.50	92610	1	107,207.65	102102.525
2	102,102.53	92610	2	112,568.03	102102.525
3	107,207.65	92610	3	118,196.44	102102.525
4	112,568.03	92610	4	124,106.26	102102.525
5	118,196.44	92610	5	130,311.57	102102.525
6	124,106.26	92610	6	136,827.15	102102.525
7	130,311.57	92610	7	143,668.51	102102.525
8	136,827.15	92610	8	150,851.93	102102.525
9	143,668.51	92610	9	158,394.53	102102.525
10	150,851.93	92610	10	166,314.25	102102.525
11	158,394.53	92610	11	174,629.97	102102.525
12	166,314.25	92610	12	183,361.47	102102.525
13	174,629.97	92610	13	192,529.54	102102.525
14	183,361.47	92610	14	202,156.02	102102.525
15	192,529.54	92610	15	212,263.82	102102.525
16	202,156.02	92610	16	222,877.01	102102.525
17	212,263.82	92610			
18	222,877.01	92610			

Renewable electricity costs:

Table 29: Renewable energy costs

Purchased standard Electricity costs	Purchased Carbon Free Electricity costs	Onsite Solar ($/kWH)*	Onsite Solar ($/kWH)*

($/kWh)	($/kWh)	(30 year life Span)	(50 year life Span)
$0.105	$ 0.155	$0.110	$0.066

Information and assumptions:

- Purchased Renewable electricity
    - Purchased renewable energy from SCE will come at a 5 cent premium. Based on our current cost (10.5 cents) and a projected 5% increase in electricity cost, I have calculated the cost per kWH for 2014 and 2020

- Onsite Renewable
    - $3/Watt ground mount fixed
    - $3-$4/Watt for roof mount
    - $4/Watt carport ground mount
    - $4.5-$6/Watt for multi-story parking garages.
    - 3% interest rate

10.7 PROJECTED COSTS OF REACHING CARBON NUETRALITY

Information and assumptions:

15% reduction from 2020 scope 1 and 2 emission s can be made through energy efficiency and conservation efforts.

- Additional reductions in emissions from natural gas and electricity will need to be made through the purchasing of carbon neutral energy
- UCSB will need to buy carbon offsets for all scope one emissions, excluding natural gas.
- The average cost per MT CO_2e of conservation and energy efficiency was used to calculate future costs of reducing scope 1 and 2 emissions associated with electricity and natural gas by 15% below 2020 levels. It was assumed that the cost per MT CO_2e reduced would increase by 5% annually
- Purchasing 100% Renewable electricity will cost $0.05 per KWH
- Purchasing biogas will cost double what it currently costs.
- Offsets will cost 12.25 dollars per MT CO_2e reduced (based on current carb prices)

Table 30: Projected costs of Reaching Carbon Neutrality

Source	Emissions 2025 BAU (MT CO_2e 2025)	Mitigation strategies (MT CO_2e/Y)	Mitigation needed (Therm & KWH/Y) - 2020

Scope 1 (Nat- Gas)	26,648	4,183.00	564,882
Scope 1 (other)	1729	0	
scope 2 (electricity)	25,719	4,592.00	12,465,937
Renewable		498	2,228,000
total	54,097	9,273.00	

Mitigation strategies	Reduction (GHG)	$/CO2e	Cost ($)	Cost savings annual in 2025 $
Efficiency	4,359	3,322	14,481,315	3,566,030
Conservation	2,180	291	633,592	1,188,677
Carbon free electricity	17,535	249	4,362,837	(4,362,837)
Carbon free Natural gas	19,096	139	2,652,951	(2,652,951)
Offsets	1,729	12.25	21,185	(21,185)