CLIMATE ACTION PLAN

2018

UNIVERSITY OF CALIFORNIA
MERCED

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Dear Friends,

Climate change is one of the most serious global challenges we face. Universities have a unique responsibility to discover, demonstrate and share solutions to such challenges. As the first new research campus of the 21st Century, UC Merced has a once-in-a-generation opportunity to demonstrate from the ground up sustainable, economic, social and environmental systems that preserve the ability of future generations to meet their own needs. Our faculty, staff and students embrace this opportunity and are building sustainability into every aspect of the campus. As a living laboratory in a teachable landscape, our campus serves as a leader in finding and implementing climate change solutions in the San Joaquin Valley through our research, teaching and public service.

An important step in this effort is UC Merced's Climate Action Plan (CAP). This is a strategic roadmap that lays out an ambitious vision for our campus; emphasizing energy efficiency, renewable energy generation and climate offsets to reach our sustainability goals. UC Merced is on track to meet two major goals: UC President Janet Napolitano's Carbon Neutrality Initiative for the UC system to be carbon neutral by 2025 and the campus's own Triple Zero Commitment to use net zero energy, produce zero landfill waste and produce net zero greenhouse gas emissions by 2020. These ambitious goals require campus-wide education, outreach, and participation.

Beyond achieving our campus goals, it is my hope this CAP will initiate a dialogue on regional solutions to climate change and accelerate the reduction of greenhouse gas emissions in the San Joaquin Valley. I am personally committed to sustainability as it is vital to the future of UC Merced, the Merced community, and the Central Valley. Given UC Merced's Triple Zero Commitment and the support and dedication of the campus community, I am confident that we will meet this challenge.

Sincerely,

DOROTHY LELAND
Chancellor

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CLIMATE ACTION PLAN, UNIVERSITY OF CALIFORNIA, MERCED

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Portions of this document were reviewed and commented upon by those listed below.

This plan will become a living document that reflects input from the entire UC Merced community. This plan will be updated and made available to the public on an annual basis. Participation and feedback into this ongoing process is invited.

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EXECUTIVE SUMMARY

This Climate Action Plan (CAP), provided by the University of California, Merced (UC Merced):

- Builds on a founding commitment to environmental stewardship and articulates a vision of climate sustainability for the campus.
- Presents a climate baseline for the UC Merced campus.
- Provides a summary of goals, progress to date, and planned activities related to saving energy, generating renewable power, and offsetting greenhouse gas emissions.
- Provides a focused presentation of climate-related planning and clarifies policy commitments included in UC Merced's Long Range Development Plan (LRDP) and being planned by individual "sustainability stakeholders" working through the Chancellor's Advisory Committee on Sustainability.
- Satisfies requirements of the Climate Protection Practices section of the University of California (UC) Policy on Sustainable Practices, The Climate Registry, and the Climate Leadership Carbon Commitment.
- Begins a dialog with respect to climate planning on the UC Merced campus. This plan will be updated and made available to the public on an annual basis. Participation and feedback into this ongoing process is invited.

The primary commitments driving this plan include goals for:

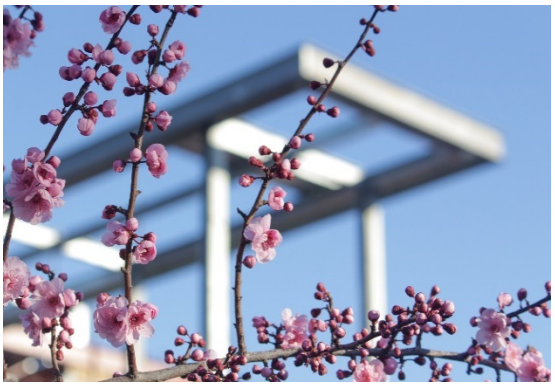
- A net zero energy campus by 2020, to include campus energy use and exclude off-campus use, commuting, and air travel.
- A climate neutral University by 2020, to include campus, Downtown Center and exclude commuting and air travel.

UC Merced is pursuing these goals with a heavy emphasis on energy efficiency in new building design, implemented through benchmark-based building energy performance targets. Thus, UC Merced's basic approach to mitigating climate effects is to:

1. Save as much energy as is economically feasible
2. Generate from renewable sources as much energy as is consumed annually (net zero energy)
3. Offset remaining greenhouse gas emissions, prioritizing on-site and regional offsets (climate neutrality)

While many of the initiatives included in this plan will save money, the plan does require resources that have not yet been fully identified or sourced. By defining these goals, UC Merced is taking the first step towards initiating development of these resources.

1. INTRODUCTION



UC Merced's CAP builds on a founding commitment to environmental stewardship and articulates a vision of climate sustainability for the campus. These commitments are guided by UC system-wide policy, UC Merced goals, state law, and federal law. This roadmap provides an opportunity to present a focused view of climate-related planning and to clarify climate-related commitments included in UC Merced's 2009 Long Range Development Plan (LRDP)[1] and 2020 plan.[2]

The CAP meets requirements of the Climate Protection Practice section of the University of California (UC) Policy on Sustainable Practices, The Climate Registry and the Climate Leadership Carbon Commitment.

With a long-term goal of climate neutrality, this plan begins a dialog with respect to climate-related planning on campus. The challenges related to climate change are significant and can only be addressed through continued communication, effort, and action. The main 2016 Climate Protection targets from the UC Policy on Sustainable Practices are to:

- Reduce greenhouse gas (GHG) emissions to 1990 levels by 2020
- Achieve climate neutrality for scope 1 & 2 sources by 2025
- Achieve climate neutrality for Climate Leadership specified scope 3 sources by 2050

Since UC Merced was established later than the given targets above, the campus strives to achieve carbon neutrality by 2020. In this strategic outline, UC Merced provides:

- Definitions to help clarify further work on climate goals
- A UC Merced climate baseline that is consistent with its reporting to The Climate Registry (TCR) and Second Nature
- A basic approach to meeting the requirements of the policy, which emphasizes saving energy first, generating renewable power second, and offsetting GHG emissions third
- A summary of goals, progress to date, and planned activities related to saving energy, generating renewable power, and offsetting GHG emissions

[1] UC Merced's 2009 LRDP, which are comprehensive land use plans to guide future physical growth of the UC Merced campus, are available to view at http://merced2020.ucmerced.edu/resources/lrdp

[2] UC Merced's 2020 plan describes the innovative effort to enhance student life and expand access to the University by adding a range of facilities to our campus. It also includes detailed background information developed during the formative stages of the project. Documents for the plan are available to view at http://merced2020.ucmerced.edu/

2. DEFINITIONS

1. **ASHRAE:** American Society of Heating, Refrigerating and Air-Conditioning Engineers is a global society advancing human well-being through sustainable technology for the built environment. The Society and its more than 50,000 members worldwide focus on building systems, energy efficiency, indoor air quality, refrigeration and sustainability.
2. **Biogas:** A mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. It is a renewable energy source that can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste.
3. **Campus:** The main UC Merced campus.
4. **Campus-Related:** Associated with UC Merced but not reflected in campus or off-campus values. As required by UC policy, UC Merced reports campus-related greenhouse gas emissions for commuting (travel to and from campus on a day to day basis by students, the faculty, and staff) and air travel paid for by or through the University as part of its pledge to the Climate Leadership Carbon Commitment.
5. **Carbon Mitigation:** Efforts to reduce or prevent GHG emissions
6. **Carbon Sequestration:** The process involved in the carbon capture and the long-term storage of atmospheric carbon dioxide
7. **Carbon Offset:** a reduction in emissions of carbon dioxide or greenhouse gases made in order to compensate for or to offset an emission made elsewhere.
8. **CAP:** Climate Action Plan to achieve the university's emission reduction targets of year 2000 levels by 2014 and 1990 levels by 2020.
9. **CBC:** Acronym for California Building Code.
10. **Climate Neutral:** According to the UC Policy on Sustainable Practices, climate neutrality means a net zero impact on the earth's climate, achieved by minimizing greenhouse gas emissions as much as possible and using carbon offsets or other measures to mitigate the remaining GHG emissions.
11. **Energy:** Electricity (MWh), natural gas (therms), propane (gallons), gasoline (gallons), or diesel (gallons) consumed. Energy consumption across different units may be expressed collectively in units of one million BTU (MBTU).
12. **GHG Emissions:** Emissions of the six greenhouse gases covered under the Kyoto Protocol: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydroflurocarbons (HFCs), per- fluorocarbons (PFCs), and sulfur hexafluoride (SF6), expressed as metric tons of CO2 equivalents (CO2e) according to the California Climate Action Registry reporting protocol avail- able at http://www.climateregistry.org/tools/protocols/general-reporting-protocol.html.
13. **Off-Campus:** Facilities owned or operated by UC Merced that are not located on the main campus. This includes leased facilities.
14. **LEED:** Leadership In Energy and Environmental Design certification provides independent verification of a building or neighborhood's green features, allowing for the design, construction, operations and maintenance of resource-efficient, high-performing, healthy, cost-effective buildings.

15. **Living Laboratory of Sustainability**: every decision made is a decision about sustainability
16. **LRDP**: Acronym for "Long-Range Development Plan" a comprehensive land use plan that identifies the policies and physical development needed to achieve the University's academic goals for an established time horizon and a specified enrollment level
17. **MGSF:** Building maintained gross square feet, synonymous with the Revised California Method (RevOGSF50) method for calculating Outside Gross Square Feet, defined as

    MGSF = BG + CU - NP
    BG = Basic Gross Area
    CU = Covered Unenclosed Area
    NP = Non-assignable Area (i.e., parking, etc.)

    UC Merced uses MGSF when available for climate planning purposes.
18. **Net Zero Energy**: Generate from renewable sources as much energy as is consumed annually.
19. **Renewable Energy Credit (REC)**: a certificate corresponding to the environmental attributes of energy produced from renewable sources such as wind or solar.
20. **Site Energy:** The amount of energy consumed at a site as reflected in utility bills.
21. **Source Energy:** The amount of raw fuel required at a site, including all transmission, distribution, and production losses. Source energy is useful when analyzing alternative approaches to using energy and reducing energy consumption. Source energy is calculated using site energy national average Source-Site Ratios reported in Energy Star Performance Ratings Methodology for Incorporating Source Energy Use dated December 2007 and available at http://www.energystar.gov/ia/business/evaluate_performance/site_source.pdf.
22. **Sustainability**: the ability to meet present needs without compromising the ability of future generations to meet their needs.
23. **TCR:** Abbreviation for "The Climate Registry"
24. **UC**: Abbreviation for "University of California"

3. UC MERCED CLIMATE BASELINE

For the purposes of this plan, UC Merced is defining a climate baseline that reflects current energy usage and GHG emissions, as well as projected building-related campus energy consumption.[3] In order to leverage climate reporting already performed by UC Merced, current usage and emissions are defined using the calendar year 2007 (CY07). UC Merced has reported two years of GHG emissions to the California Climate Action Registry (CY06 and CY07) and one year of GHG emissions to support the Climate Leadership Carbon Commitment (CY07). For UC Merced, 2007 provides a reasonable baseline reference, as this is the first full year in which the main campus was in operation. The specific, current values reported as the baseline include:

- Campus energy consumption for CY07
- Campus related GHG emissions for CY07

Projected building related campus energy consumption reflects energy consumption associated with the planned build-out of the campus from its current footprint of 104 acres to an eventual footprint of 815 acres, as expressed in the LRDP and the UC Merced/University Community Environmental Impact Statement/Environmental Impact Report (EIS/EIR).[4] This project assumes compliance with current Building Energy Performance Targets (see section 5B).

Energy consumption and emission intensities are also presented per square foot and per student. UC Merced will continue to calculate these consumption and emission intensities for planning purposes. The specific values used to calculate intensities include:

- Average of the total student population for the 2006-2007 and 2007-2008 academic years
- Maintained Gross Square Feet (MGSF) of buildings, calculated based on a proration of building MGSF occupied through CY 07.

For the climate baseline (tables below located at the end of this document):

- Table 1 Building Details, provides details for all campus buildings and offsite facilities for the 2007 Calendar year.
- Table 2 Climate Baseline, provides campus and campus-related energy consumption and emissions for CY07.
- Table 3 Campus Buildout Projection, provides projection of student population and built square footage over the campus build-out based on the campus EIR/EIS.
- Table 4 Campus Building Energy Use Projection Based On Building Performance Targets, provides projected building-related campus energy consumption for build-out of the campus.

3 Note that this plan explicitly addresses climate impacts from operations and activities only, not those associated with embedded energy the total energy used to manufacture and supply a product, material, or service at its point of use. Embedded GHG emissions are being reduced through UC Merced's commitment to US Green Building Council certification (through Materials & Resources credits). The LRDP has moved the campus goal for certification from LEED Silver to LEED Gold for all permanent buildings.

4 The EIS/EIR is available at https://merced2020.ucmerced.edu/sites/merced2020.ucmerced.edu/files/documents/2020_adeir102708web.pdf

Note the following:

- Less than 10% of the eventual 815-acre campus has been built as of CY07.
- For CY07, buildings account for 96% of all energy usage.
- For CY07, there is 848,000 MGSF of built space on campus, and 227,000 MGSF off campus (79% Campus / 21% Off Campus).
- The campus is achieving its current building performance targets (annual electricity use, peak electricity demand, and annual natural gas use - see Section 5B).
- For CY07, Building Site Energy Use Intensity is 0.11 MBTU/yr/MGSF on campus and 0.09 MBTU/yr/MGSF off campus. Building Source Energy Use Intensity is 0.23 MBTU/yr/MGSF on campus and 0.21 MBTU/yr/MGSF off campus.
- For CY07, total GHG Emissions are 7,222 metric tons CO2e on campus, 1,740 metric tons CO2e off campus, and 6,711 metric tons CO2e campus-related (47% campus / 11% off campus / 42% campus-related).
- The UC Merced campus does not have 1990 and 2000 emissions levels as referenced by the UC climate policy. In the spirit of the policy requirement, UC Merced's building energy performance targets imply a consistent reduction in energy use and emissions intensity over the build-out of campus.
- The campus climate baseline includes a projection of building energy use. Other projections of significant non-building energy uses, such as transportation, are not yet prepared.

4. APPROACH

UC Merced's basic approach to mitigating its climate effects is to:

A. Save as much energy as is economically feasible

B. Generate from onsite renewable sources as much energy as is consumed annually (net zero energy)

C. Continued participation in the University Whole Sale Power program which will bring to the campus 97% Clean Renewable Energy through the grid by 2020.

D. Offset remaining greenhouse gas emissions, prioritizing on-site and regional offsets (climate neutrality)

This approach recognizes that energy efficiency can often be the most cost-effective approach to reducing GHG emissions. For UC Merced, energy efficiency commitments are a key part of making the net zero energy and climate neutrality goals feasible.

5. SAVING ENERGY

As background, energy use at UC Merced is currently dominated by buildings. Building performance is driven by the design of the campus energy infrastructure and building design. Once a building is constructed and commissioned, its performance is influenced by occupant behavior, building maintenance, and building retrofits. Transportation, which will become an increasingly significant portion of campus energy use over time, is driven primarily by the efficiency of fleet purchases and policies that influence parking and commuting.

UC Merced's current activities and commitments in each of these areas (campus energy infrastructure, new building design, occupant behavior, building maintenance, building retrofits, and transportation) are presented below.

A. CAMPUS ENERGY INFRASTRUCTURE

UC Merced has developed an energy infrastructure for campus that includes central cooling for all buildings, thermal energy storage for campus cooling, and central heating for primary academic buildings. This centralized infrastructure and thermal energy storage saves energy, reduces peak period demands, and saves money by:

- Increasing the opportunities to realize savings from system optimization. It is typically easier to produce savings by optimizing a single system, rather than by optimizing several distributed systems.
- Increasing the efficiency of cooling. It is more efficient to operate chillers in the middle of the night when temperatures are lower.
- Reducing the cost of cooling. Electricity is cheaper in the middle of the night than during peak period, summer afternoons.

UC Merced generally intends to continue this basic strategy to future campus infrastructure development, including the 2020 project, subject to more detailed engineering and cost analysis as the campus is designed. As stated in the LRDP, the campus will:

- Minimize grid-connected peak electricity loads by shifting electricity for cooling away from peak electricity demand periods. (Sustainability Policy SUST-6, excerpt)[5]

B. NEW BUILDING DESIGN

UC Merced has committed to energy-efficient design for all new, permanent buildings. As stated in the campus LRDP:

- Buildings will be designed to consume half of the energy and demand of other University buildings in California, surpass Title 24 [California's Energy Efficiency Standard] minimum efficiency standards by 20%, and achieve all LEED credits for optimizing energy efficiency. (Sustainability Policy TZC-1, excerpt)[5]

In practice, this commitment requires creation of an energy model for each new building in the design phase so that the building can be modeled against the performance requirements and the design can be modified if required. The process of developing building energy benchmarks used by UC Merced was adapted for use by UC San Francisco in 2011, and climate-adjusted, benchmark-based performance targets were used in the design-build proposal process for the Mission Bay Faculty Office Building. More recently in 2014, based on the success of developing appropriate building energy use benchmarks at UC Merced and UC San Francisco and designing to whole-building energy performance targets at UC Merced, UCOP has applied the same method to develop benchmark-based baselines and targets for all UC campuses in a 2014 Document, "Benchmark-based, Whole-Building Energy Performance Targets for UC Buildings". This document provides targets for all campuses, climate adjusted, to those currently being used at UC Merced (50% of benchmark, except for maximum thermal load at 80% of benchmark). UC Merced's targets are presented in Table 5 of this document.

The campus target is set at 50% of the 1999 UC/CSU benchmarks. This target is being phased in such that the first 600,000 gross square feet of buildings were designed to consume no more than 80% of the benchmarks, the next 600,000 gross square feet of buildings were designed to consume no more than 65% of the benchmarks, and all buildings thereafter have been and will be designed to consume no more than 50% of the benchmarks.

To date, these benchmark-based building energy performance targets have driven efficiency in new building design at UC Merced because they account for the entire building performance, not just selected systems as is the case with the other building code-based targets (30% below Title 24 and achieving all LEED Credits). This system is working well for the UC Merced campus and in all cases, it is performing better than targets. UC Merced uses data collected through the campus-wide building energy management system to calculate actual building performance in relation to the targets on an annual basis. UC Merced has operationalized the performance benchmarking process on a real-time basis through an online dashboard that shows real time energy consumption of each building.

5 The 2009 LRDP energy efficiency goal is complemented by a goal to achieve LEED Gold certification for all new permanent facilities (Sustainability Policy SUST-2).

UC Merced uses Title 24 and American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) for determining energy performance for the LEED Green Buildings rating systems and is based on a percentage of energy savings beyond the code maximum energy allowance. The UC Sustainable Practices Policy states that all new building projects are to outperform CBC energy efficiency standards by 20%. The campus has been able to max out all the LEED Optimize Energy Performance credits, but percent savings can become confusing as energy codes become more stringent. A percentage savings beyond code is relative to a moving baseline, as the code is regularly updated per statute and the more stringent standards are enabled by technological advances.

California updated its energy efficiency standards in 2001, 2005, and 2008 which reduced maximum energy use from between 5% to 8%. The 2013 update reduced an additional 20% energy use and the 2016 will add another 5% reduction.

Whole-building energy performance targets can be based on a static baseline in this case, the UC benchmarks developed from the 1999 UC/California State University building stock. As new energy efficiency technologies and approaches become available, the target for new buildings can be moved as appropriate to continue making progress toward zero-net energy buildings. The baseline will stay the same, however, allowing for easy evaluation of energy efficiency across buildings and over time.[6]

Percent savings beyond code is also a limited measure because not all of the energy used in buildings is regulated by the CBC. In past code cycles, regulated energy only included heating, cooling, hot water, and interior lighting. Process energy, plug loads, commercial refrigeration, and other non-regulated energy uses were not included because the codes did not establish a baseline for these end uses. In the 2013 code cycle, fan and pump energy and some process loads are included in the energy efficiency standards for the first time. However, much of the building energy use remains unregulated, an estimated 30% averaged across all building types. This creates uncertainty as to whether percent savings includes all building loads or only those regulated, and does not incentivize taking energy efficiency measures on unregulated loads (Eley et al. 2011). Whole-building energy performance targets are based on total energy use and by definition include all building loads.[6]

In addition, whole-building energy performance targets are easier to verify in operations because they are not dependent on the modeling assumptions of a baseline case. Measured verification enables campuses to gain a better understanding of which energy efficiency measures are most effective. It also provides measured evidence for the fact that energy efficiency in new construction projects is oftentimes more cost-effective then later retrofits. Furthermore, whole-building energy performance targets can be carried through to operations and they are much more integrated with UC's climate action policy, as they provide a method of predicting and verifying greenhouse gas emissions of new buildings.[6]

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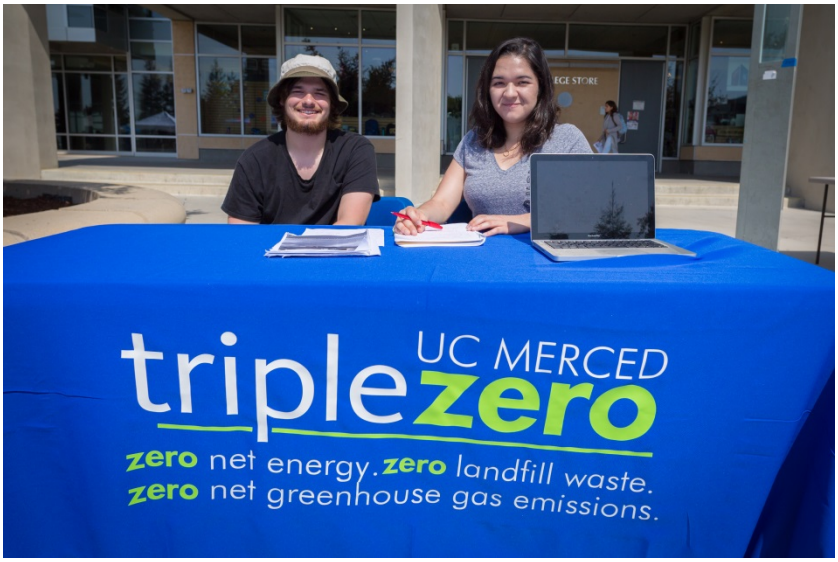
6 Taken from the "Benchmark-based, Whole-Building Energy Performance Targets for UC Buildings, March 2014"

C. OCCUPANT BEHAVIOR

Building occupants can significantly affect the energy use intensity of a building, independent of the building design. UC Merced currently has the following programs in place:

- LEED Lab, a student-driven class that certifies existing campus buildings under LEED Operations and Maintenance. In this class, students look at current building operations and energy consumption to determine energy efficient measures and occupant behavior changes that could help improve energy performance.
- Energize Colleges Program develops and supports part-time student internship positions that address important campus and community energy projects, offer work based experience and professional training, and educate the campus on energy efficiency.
- Green Labs is a program that collaborates with individual laboratories and researchers to inform, identify best practices, and assess areas of improvement in research efficiency. The findings of these assessments are then provided to the laboratories and researchers.
- Green Offices is a program that…
- EcoReps…

These programs will help sensitize building occupants to energy consumption and address significant future energy loads on the UC Merced campus.



D. BUILDING MAINTENANCE

Building maintenance can also significantly affect building performance. To date, UC Merced Facilities Management activities have emphasized routine work order requests, emergency response, and preventative maintenance. Facilities Management also uses extensive monitoring data from its campus-wide building energy management system (part of UC Merced's "Living Laboratory") to troubleshoot systems and verify energy performance. Facilities Management is working to establish means to more explicitly direct building maintenance in a way that will maximize reductions in energy consumption. This work will be integrated with efforts to optimize operations in the building performance benchmarking system as discussed above in Section 5B. UC Merced is currently collecting extensive data that, given higher staffing levels, could be analyzed and acted upon to save energy.

E. EXISTING BUILDING POTENTIAL PROJECTS

UC Merced is pursuing a limited number of building energy efficiency projects within its relatively new and efficient on-campus building stock and in off-campus buildings. The below list of projects has been provided to the UC Office of the President with a total savings of approximately 370,000 kWh/year and 56,000 therms/year. UC Merced will continue to identify and implement cost-effective building efficiency projects as staffing allows.

Campus Five Year Energy Goals

Calendar Year	kWh/year savings achieved by projects completed in this year	Therm/year savings achieved by projects completed in this year	Total project costs	Financing needed to fund these projects		
2017	10,000.00	0	$135,000.00	$135,000.00	Facilities A, B, controls	Lighting & controls
2018	50,000.00	0	$155,000.00	$155,000.00	Fresno Center	Lighting & controls
2018	100,000.00	14,000	$125,000.00	$125,000.00	Science Engineering 1	RCx
2019	50,000	12,000	$100,000.00	$100,000.00	Library RCx	
2020	120,000	30,000	$250,000.00	$250,000.00	Classroom & Office Bldg. 1	lighting & Control
2021	40,000	0	$650,000.00	$650,000.00	Campus LED lighting	
			$1,415,000.00			

F. TRANSPORTATION

Transportation-related energy use includes fuel consumption by fleet vehicles and a contracted campus and regional transit service, known as CatTracks. Transportation energy use and emissions are reported in the total values of the climate baseline (Table 2) at the end of the document, where the total value includes energy or emissions associated with buildings, transportation, and grounds keeping equipment. The transportation values reflect 31 fleet vehicles (of which one is diesel and the rest are gasoline powered), four CatTracks gasoline minibuses or vans, and two CatTracks compressed natural gas (CNG) buses. In early 2008, the campus acquired two additional natural gas fleet vehicles. Campus has since eliminated the natural gas fleet and is now using clean diesel.

UC Merced Transportation, Parking and Fleet Services (TAPS) is committed to the University of California's sustainability vision. TAPS has short- and long-term goals that will incorporate alternative means of transportation to, from and within the campus in an effort to reduce greenhouse gas (GHG) emissions. TAPS has set a goal to reduce its carbon footprint. Specifically, the department seeks to:

1. Expansion of hybrid and/or battery-operated fleet
2. Reduction of Single Occupancy Vehicle (SOC) Vehicle Miles Traveled (VMT) rates through aggressive marketing and development of incentives to participate in alternative transportation programs (i.e. message boards, departmental competitions)
3. Adapt a clean-fleet procurement policy
4. Standardize fleet ordering cycles
5. Offer Zero-emission vehicle incentives

In 2015, TAPS partnered with Zipcar to provide a self-sustaining and hands off program which provides alternative transportation to UC Merced students, faculty and staff. Zipcar is an American car-sharing company and a subsidiary of Avis Budget Group. Zipcar provides automobile reservations to its

members, billable by the hour or day; members pay a monthly or annual membership fee in addition to car reservations charges. While alleviating traffic congestion and strengthening the university's sustainability efforts, UC Merced and Zipcar have grown together to serve over 400 students, faculty and staff in its partnership since late 2015. In 2016, UC Merced's Zipcar program reduced 528,000 lbs.of CO_2 from entering the atmosphere.

In 2011 Zimride was introduced to the UC Merced campus. Zimride by Enterprise is an online ride-matching service that easily connects drivers and passengers heading to the same area, making it a great solution for those who don't have cars on campus to find rides for weekend trips or going home to visit on breaks or for those who have cars to share travel costs. Zimride users can also form carpools with other students, faculty or staff who are looking to share rides back and forth to campus. To date there have been 1,536,698 miles posted and 338,073lbs of CO_2 reduced.

UC Merced is currently represented on the Citizen Focus Group for the City of Merced Active Transportation and Safe Routes to School Planning Committee. The Transportation and Safe Routes to School Plan will prioritize pedestrian and bicycle projects, and include an implementation strategy based on funding sources. Though a citywide plan, the projects and programs will be focused in Central Merced with an aim to improve bicycle and pedestrian access to downtown from all surrounding neighborhoods, including UC Merced. This will help with the already congested traffic along Lake and Bellevue Roads and the anticipated increase in traffic congestion due to the 2020 project construction.

Existing Transportation Demand Management (TDM) Programs

1. **Vanpool, Carpool, Ridesharing & Carsharing:** For those who participate in sustainable and alternative modes of transportation, incentives are available through Commute Connection. This program is designed to help commuters make the transition from driving alone to a convenient ridesharing option such as carpooling, vanpooling, bicycling/walking or riding transit. The program's overall goal is to: "Improve air quality, public health, and roadway operations by promoting the use of sustainable travel options and other employer-based TDM strategies."

2. **Emergency Ride Home Program For Employees:** Commute Connection's Emergency Ride Home (ERH) program was established to encourage commuters to use alternative modes of transportation such as biking, walking, riding transit, carpooling or vanpooling by providing assurance that they can get home in the event of an emergency should they be left without a vehicle.

3. **Bicycle and walk to work incentives:** Based on availability of funding, Commute Connections can offer incentives for those who choose to ride their bike or walk to and from campus.

4. **Marketing & Educational campaigns focused on alternative transportation options:** Transportation Services participates throughout the year in various events held on campus to promote sustainability and alternative transportation options. Digital and paper marketing materials are developed and distributed as appropriate.

5. **Increased number of clean air commuter permits for eligible carpools to promote ridesharing:** Transportation Services evaluated and implemented additional clean-air cards to those who travel from longer distances. This assists in the growth of participating members.

6. **Secured grants to fund purchase of fuel efficient and low emission fleet vehicles:** TAPS actively seeks participation with local and state partners to assist in the funding of electric and hybrid vehicles, charging stations and infrastructure.

7. **Electric charging stations in the North Bowl, LeGrand and Library Lots:** Transportation Services values the importance of providing EV charging stations in various parking areas of campus. Transportation Services is doing this proactively and prior to any mandates directed by the State of California.

8. **Annual surveying of campus community commuting patterns:** Transportation Services values the feedback provided by a transit study to assess trip data, commuting patterns and fuel consumption. This information is valuable to deliver additional programs or services guided toward alternative and sustainable transportation options, including campus transit, single-occupancy reductions and bicycle and walking programs.

9. **Information table at both New Student Orientations (NSO) and New Employee Orientations (NEO):** Our office actively participates in these staff and student introductory programs to share alternative options to driving a car to campus. We provide information relating to vanpooling and carpooling, Zipcar, Zimride and CatTracks, our campus transit system.

10. **Zipcar and Zimride car sharing and ridesharing programs:** UC Merced has partnered with Zipcar to bring self-service, on-demand car sharing to UC Merced. With Zimride, customers can collaborate with others through an online matching service to get where they need to go along with others going the same direction.

UC MERCED ROUTE MILEAGES

PROTERRA

Route Segment	Loop Length (mi)	Daily Miles	Total Deadhead	Daily Route Miles	Days run/week	weeks run/year	Days per year	Annual Miles
AB	25	353	10	363	5	48.0	240	87,106
C1 Blue/Gold	19	243	10	253	5	48.0	240	60,768
C2	17	297	10	307	5	48.0	240	73,615
E Line	30	90	10	100	5	48.0	240	24,000
G Line	23	230	10	240	5	48.0	240	57,600
Fastcat	21	310	10	320	5	48.0	240	76,837
NiteCat	21	71	10	81	5	48.0	240	19,517
E1	16	199	10	209	5	48.0	240	50,275
E2	18	192	10	202	5	48.0	240	48,480
H	25	338	10	348	5	48.0	240	83,527
	Avg	232	10	242			Total	581,724
							Avg	58,172

UC Merced is currently looking at the feasability of adding an all battery electric bus fleet to campus. These new buses, manufactured by Proterra, would produce zero emissions and help reduce our campus scope 1 emissions.

6. GENERATING RENEWABLE ENERGY

The campus's 2009 LRDP has set the following goal, which it currently plans to apply to on-campus energy only (not off-campus or campus-related):

- Net Zero Energy: Achieve net zero energy by 2020 through aggressive conservation efforts and development of renewable power. (Sustainability Policy TZC-1, excerpt)

Note that this goal puts UC Merced on the forefront of a statewide effort expressed in the California Public Utilities Commission's "Big, Bold Energy Efficiency Strategy" that all new commercial construction will be net zero energy by 2030. Also note this goal is supported by the Merced Energy Research Institute, a cross-disciplinary research institute emphasizing research in energy efficiency and renewable energy.

The first step in implementing this goal has been the development of a 1 MW solar photovoltaic array on campus. This array was built under a Power Purchase Agreement (PPA). Under a PPA, a third party designs, installs, owns and operates the system and the University purchases the delivered electricity. For this project, UC Merced retains all Renewable Energy Credits for the project. This array generates and produces approximately 2,367 MWh annually (approximately 12% of the total campus energy and .97MW (22%) of the campus peak load.

Currently we have a contract in place with Sun Power to provide 4.2 MW of solar over North Bowl 1 & 2 parking lots and on the roof of Housing 4. This project will produce over 8,372,512 kWh annually using current technologies in solar panels and construction is nearing completion.

Another project we are pursuing is using biogas generated from the local Highway 59 landfill for campus electricity and hot water generation, which will supply approximately 2 MW of electricity and 250,000 therms of biogas annually, with a potential of up to 500,000 therms. Currently, the local Highway 59 landfill is burning off the gas. This gas would be brought to campus where power turbines would convert the gas to electricity for the entire campus and hot water for upper campus. The existing boilers at Central Plant provide hot water to upper campus (academic buildings) or everything to the east of the Fairfield Canal. Centralized boilers for heating hot water are provided at each building to the west of the Fairfield Canal (auxiliary buildings) or lower campus. The biogas project would not be able to support lower campus of approximately 250,000 therms or the 2020 project buildings of approximately 585,000 therms, therefore offsets would be needed.

After all the renewables are put into place by 2020, the campus will still have about 9 million kilowatt

hours of electricity to mitigate. Currently, the University of California is an Energy Service Provider and procures renewables that are supplied to 7 university campus's including UC Merced. This program is called the Wholesale Power Program (WPP). By 2021, all energy provided to the campus through the grid will be 97% clean renewable energy, leaving a small percentage of 3% to offset. Below is the current Power Content Label through 2021 of the Wholesale Power Program.

ANNUAL POWER CONTENT LABEL The Regents of the University of California - ESP #1389							
ENERGY RESOURCES	**2015 UCOP Actual**	**2016 UCOP Prelim**	**2017 UCOP Estimated**	***2018 UCOP Trended***	***2019 UCOP Trended***	***2020 UCOP Trended***	***2021 UCOP Trended***
Eligible Renewable	24%	44%	51%	63%	62%	62%	62%
Biomass & biowaste	0%	0%	0%	0%	0%	0%	0%
Geothermal	15%	0%	0%	0%	0%	0%	0%
Eligible hydroelectric	0%	0%	0%	0%	0%	0%	0%
Solar	0%	38%	51%	63%	62%	62%	62%
Wind	9%	6%	0%	0%	0%	0%	0%
Coal	0%	0%	0%	0%	0%	0%	0%
Large Hydroelectric	0%	3%	32%	24%	28%	32%	35%
Natural Gas	0%	0%	0%	0%	0%	0%	0%
Nuclear	0%	0%	0%	0%	0%	0%	0%
Other	0%	0%	0%	0%	0%	0%	0%
Unspecified	76%	53%	17%	13%	10%	6%	3%
TOTAL	100%	100%	100%	100%	100%	100%	100%

THE CLIMATE REGISTRY EPS PROTOCOL The Regents of the University of California - ESP #1389							
Emissions Factor	**2015 UCOP Verified**	**2016 UCOP Draft**	**2017 UCOP Estimated**	***2018 UCOP Trended***	***2019 UCOP Trended***	***2020 UCOP Trended***	***2021 UCOP Trended***
MT CO2/MWh	0.326	0.224	0.062	0.046	0.031	0.016	0.000
lbs CO2/MWh	719.05	493.34	136.91	102.48	68.39	34.30	0.20

7. OFFSETTING GREENHOUSE GAS EMISSIONS

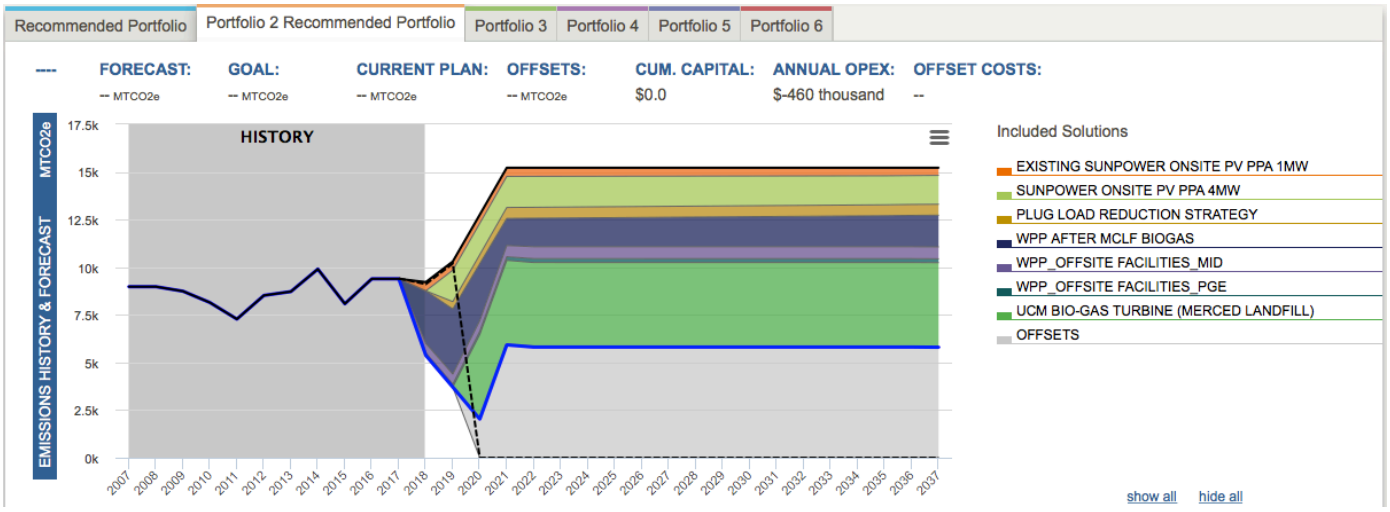
UC Merced intends to offset its remaining greenhouse gas emissions as stated in the LRDP:

- Achieve zero carbon emissions (carbon neutrality) by 2020. Minimize atmospheric carbon generation by campus operations and employ measures to mitigate carbon emissions such as aggressive tree planting. Onsite and regional measures will be prioritized. (Sustainability Policy TZC-3 of the 2009 LRDP)

As stated on the prior page, UC Merced will generate 100% of its electricity usage with solar and biogas, so the electricity supplied to the campus will be clean energy. There is only about 250,000 therms of gas that will be clean energy with about 800,000 therms that the campus will pursue offsets for.

The campus is still strategizing on offsite facilities through purchase power, Renewable Energy Credits (RECs) and offsets. Offsite facilities currently consume 3 million kWh of electricity and 60 thousand therms of gas annually. Below is the current recommended Portfolio 2, developed through the Fovea Cap Tool. Fovea Cap Tool serves as a planning instrument designed to summarize carbon neutrality portfolio's and

impact. The tool developed by Fovea Services in partnership with UCOP, and used on all University campuses, incorporates strategies identified that make up various scenario's the campus could use to achieve carbon neutrality by 2020. The portfolio below shows the total included strategies to achieve climate neutrality. The dotted black line shows when our emissions will hit zero at 2020.



Below is the cost associated with the recommended portfolio over a 20-year period. The numbers in black are business as usual. The green numbers are the recommended portfolio numbers. There will be 9k metric tons of CO2 saved on average each year, 1 Million dollars saved in offsets and 17 million dollars saved on energy costs for a total of 18 million dollars saved over a 20-year period.

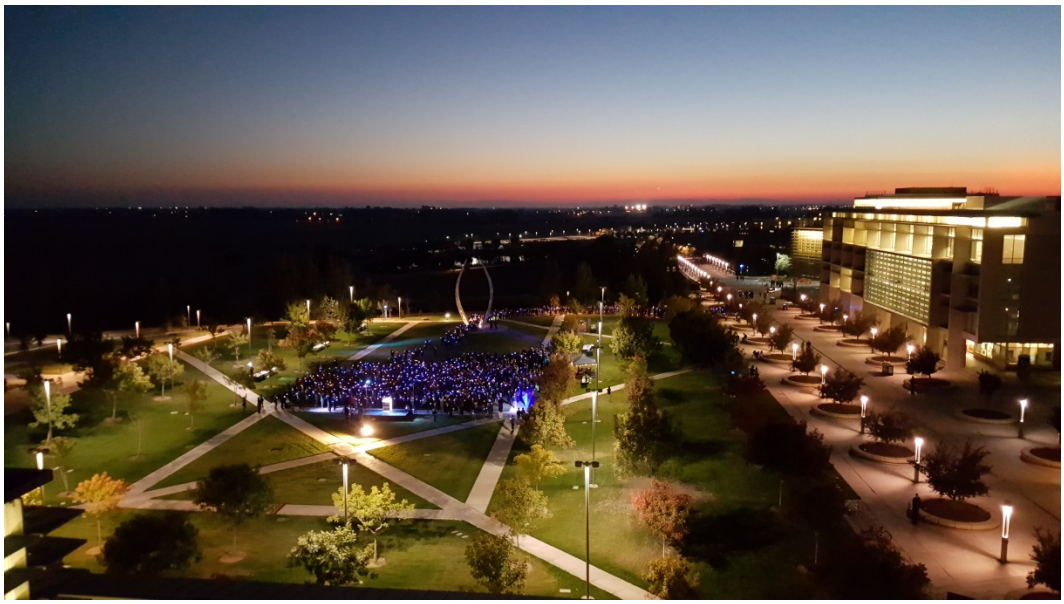
PORTFOLIO	DESCRIPTION	AVG GHG MTCO2e / Yr	NET PRESENT VALUE (NPV) *Incremental to BAU*			
			CAPEX	NON-ENERGY OPEX	ENERGY PURCHASES	TOTAL
Portfolio 2 Recommended Portfolio	Existing CAP Options + Merced Landfill Biogas	5 K *-9 K*	$0 *$0*	$1 M *-$1 M*	$77 M *-$17 M*	$78 M *-$18 M*

8. CONCLUSION

This Climate Action Plan provides steps towards clarifying UC Merced's commitments and plans to mitigate climate effects. This plan will be updated and made available to the public on an annual basis. Three areas are anticipated to be of critical importance as climate protection activities proceed.

A. EDUCATION AND OUTREACH

Education and outreach forms a foundation for climate-related activities on campus. Through the Chancellor's Advisory Committee on Sustainability, goals and objectives are being defined related to education and outreach, which include development of sustainability content in the campus core curriculum, facilitation of sustainability-related community partnerships, and communications regarding sustainability.



B. CLUBS AND ORGANIZATIONS

UC Merced is comprised of a variety of clubs dedicated to fostering the culture of sustainability, and their numbers increase with every semester. The clubs include: Earth Club, Engineers for a Sustainable World, Sustainability Outreach Student Association, and the Sustainable Agricultural Society. The organizations include: Student Sustainability Council and the Yosemite Leadership Program.

Alongside the clubs and organizations on campus, UC Merced has structured curricular and co-curricular programs that give students the opportunity to grow as green professionals in the workforce. The programs include: LEED Lab, Eco Reps, UC Merced Recycles, UC Sprouts, and Energize Colleges.

C. TRACKING PROGRESS

UC Merced currently intends to communicate progress towards achieving climate goals through updates to the Chancellor's Advisory Committee on Sustainability and this climate action plan. This regular communication provides a structure for tracking progress and data to evaluate changes against the campus climate baseline (see Table 2 at the end of this document). Over time, UC Merced anticipates developing a formalized list of performance indicators to track progress in achieving goals.

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TABLE 1: BUILDING DETAILS

On-Campus Buildings

Building Name	OGSF	ASF	BGSF	CY07 GSF/MGSF	Constructed	Occupied	Applicable Design Target % of Benchamrk	Applicable Space Category for Target
Science and Engineering - 1 Building	211,678	111,554	186,719	199,865	1/1/06	12/1/06	80%	Lab/Complex
Kolligian Library - Building	215,961	132,920	176,312	196,137	1/1/05	8/1/05	80%	Class/Office
Classroom and Office Building	105,435	54,174	102,710	104,073	12/31/05	12/31/05	80%	Class/Office
Central Plant	31,683	2,047	28,897	28,897	1/1/05	8/1/05	80%	Lab/Complex
Telecomm Building	4,783	268	3,950	4,367	1/1/05	8/1/05	80%	Lab/Complex
Police Trailer	4,260	3,859	4,260	4,260	7/2/05	9/2/05	NA	NA
Calaveras Hall	15,760	13,420	15,122	15,441	1/2/05	9/2/05	80%	Housing/Serv
Terrace Center	19,463	10,516	14,793	17,128	1/2/05	9/2/05	80%	Housing/Serv
Tulare Hall	15,760	13,414	15,122	15,441	1/2/05	9/2/05	80%	Housing/Serv
Madera Hall	15,668	13,414	15,030	15,441	1/2/05	9/2/05	80%	Housing/Serv
Stanislaus Hall	15,760	13,420	15,122	15,441	1/2/05	9/2/05	80%	Housing/Serv
Kern Hall	15,577	13,420	14,939	15,441	1/2/05	9/2/05	80%	Housing/Serv
Kings Hall	15,485	13,416	14,847	15,441	1/2/05	9/2/05	80%	Housing/Serv
Fresno Hall	7,822	6,719	7,567	7,695	1/2/05	9/2/05	80%	Housing/Serv
San Joaquin Hall	7,822	6,719	7,567	7,695	1/2/05	9/2/05	80%	Housing/Serv
Merced Hall	15,760	13,414	15,122	15,441	1/2/05	9/2/05	80%	Housing/Serv
Pump House	1,417	0	1,417	1,417	1/1/04	8/1/04	80%	Lab/Complex
Valley Terraces Dining	32,461	19,715	22,492	24,477	1/2/05	9/2/05	80%	Lab/Complex
Gallo Recreation and Wellness Center	36,610	29,357	34,017	35,584	12/31/05	12/11/06	65%	Class/Office
Sierra Terraces - Mariposa	41,238	29,863	41,206	41,254	9/1/07	9/2/08	65%	Housing/Serv
Sierra Terraces - Tuolumne	42,402	29,688	42,402	42,402	9/1/07	9/2/08	65%	Housing/Serv
Subtotal On-Campus	**872,805**	**531,317**	**779,613**	**823,338**				

Off-Campus Buildings

Building Name	OGSF	ASF	BGSF	CY07 GSF/MGSF	Constructed	Occupied
Castle 1200	85,274	63,380	69,169	78,861	1/1/1989	3/1/2002
Castle 1201	10,272	9,052	10,272	10,272	1/1/1989	6/1/2004
TC-1 Tri-College Lease	1,481	1,481	1,481	1,481	1/1/1989	2/1/1999
TC-2 Tri-College Lease	942	942	942	942	1/1/1989	2/1/1999
TC-3 Tri-College Lease	587	587	587	587	1/1/1989	2/1/1999
Bakersfield Center Lease	16,305	16,305	16,305	16,305	1/1/2001	9/1/2001
Mondo Building Lease	10,074	10,074	10,074	10,074	1/1/1930	5/1/2004
2001 Grogan Avenue	24,416	24,416	24,416	24,416	1/1/1971	7/1/2005
Castle Academic Trailers #1 (Research)	2,000	2,000	2,000	2,000	1/1/2008	1/1/2008
Castle Academic Trailers #2 (Research)	2,148	2,148	2,148	2,148	1/1/2008	1/1/2008
Promenade Building	6,575	6,575	6,575	6,575	11/4/2006	7/1/2008
Wawona-Research Station #4000	1,423	1,423	1,423	1,423	9/30/1934	9/30/2006
Wawona - Learning Center/Classroom #4050	868	868	868	868	9/30/1934	9/30/2006
Wawona - Vincent House	784	784	784	784	9/30/1960	9/30/2006
Wawona - Livingston House	2,600	2,600	2,600	2,600	9/30/1960	9/30/2006
Wawona - Station Mangers Residence	2,331	2,331	2,331	2,331	9/30/1964	9/30/2006
Chancellors Residence	3,565	3,565	3,565	3,565	1/1/1997	9/1/1999
Fresno	66,710	46,456	63,653	66,289	1/1/1997	1/1/1998
Olive Ave Wharehouse	35,250	35,250	35,250	35,250	9/1/1985	1/5/2008
Subtotal Off-Campus	**273,605**	**230,237**	**254,443**	**266,771**		
Total	**1,146,410**	**761,554**	**1,034,056**	**1,090,109**		

NOTES: (a) Gallo Rec and Wellness does not fit well in either of the three space categories, and is assigned Housing/Service category on an interim basis.
(b) The Facilities/Police Department Trailer is temporary, but is included in the calculation of a campus-wide target. This target was not necessarily used in design.

TABLE 2: CLIMATE BASELINE (CY07)				
	On-Campus	**Off-Campus**	**Campus-Related**	**Total**
Square footage (MGSF)	823,338	266,771	n/a	1,090,109
Student Population (FTE)	1595		n/a	1,595
Building Electricity Use (MWh/yr)	11,749	3,099	n/a	14,848
Building Electricity Use (kWh/yr/MGSF)	15	14	n/a	15
Building Electricity Use (% of target)	82%	n/a	n/a	n/a
Building Electricity Use (% of benchmark)	65%	n/a	n/a	n/a
Building Electricity Peak Period Demand (MW)	1.6/2.8	n/a	n/a	n/a
Building Electricity Peak Period Demand (W/MGSF)	2.1/3.8	n/a	n/a	n/a
Building Electricity Peak Period Demand (% of target)	89%/156%	n/a	n/a	n/a
Building Electricity Peak Period Demand (% of benchmark)	37%/64%	n/a	n/a	n/a
Building Natural Gas Use (therms/yr)	424,778	93,157	n/a	517,935
Building Natural Gas Use (therms/yr/MGSF)	0.55	n/a	n/a	n/a
Building Natural Gas Use (% of target)	87%	n/a	n/a	n/a
Building Natural Gas Use (% of baseline)	69%	n/a	n/a	n/a
Building Propane Use (gallons/yr)	0	1,848	n/a	1,848
Building Backup Diesel Use (gallons/yr)	1025	41	n/a	1,066
Transportation Natural Gas Use (therms/yr)	7322	0	n/a	7,322
Transportation and Grounds Gasoline Use (gallons/yr)	17931	0	n/a	17,931
Transportation and Grounds Diesel Use (gallons/yr)	2590	0	n/a	2,590
Building Site Energy Use (MBTU/yr)	82,708	20,062	n/a	102,770
Building Site Energy Intensity (MBTU/yr/MGSF)	0.11	0.09	n/a	0.1
Building Site Energy Intensity (% of target)	84%	n/a	n/a	n/a
Building Site Energy Intensity (% of benchmark)	67%	n/a	n/a	n/a
Total Site Energy Use (MBTU/yr)	86,026	20,062	n/a	106,088
Total Site Energy Intensity (MBTU/yr/student)	54	n/a	n/a	67
Building Source Energy Use (MBTU/yr)	178,512	45,241	n/a	223,753
Building Source Energy Intensity (MBTU/yr/MGSF)	0.23	0.21	n/a	0.1
Total Source Energy Use (MBTU/yr)	181,890	45,241	n/a	227,132
Total Source Energy Intensity (MBTU/yr/student)	114	n/a	n/a	142
Building GHG Emissions (metric tons/yr)	6,947	1,740	n/a	8,688
Building GHG Emissions (metric tons/yr/1000 MGSF)	9	8.1	n/a	8.8
Total GHG Emissions (metric tons/yr)	7,222	1,740	6,711	15,673
Total GHG Emissions Distribution (%)	46%	11%	43%	100%
Total GHG Emission Intensity (metric tons/yr/student)	4.5	n/a	n/a	9.8

1) 1 MWh = 3.412 MBTU, 1 therm = 0.1 MBTU, 1 gallon propane = 0.0910 MBTU, 1 gallon gasoline = 0.1242 MBTU, 1 gallon diesel = 0.1387 MBTU
2) Source-Site Ratios: for Electricity = 3.340, for Natural Gas = 1.047, for Propane = 1.01, for Gasoline = 1.01, for Diesel = 1.01
3) All ratios are national average source-site ratios reported in Energy Star Performance Ratings Methodology for Incorporating Source Energy Use dated December 2007 , except Gasoline assumed to be equal to Diesel.
4) In one billing month the chillers were operated during the peak period, yielding a peak period demand of 2.8 MW. For other months, chillers were operated off-peak as designed, and the maximum peak period demand was 1.6 MW. Both values are reported for completeness.

TABLE 3: CAMPUS BUILDOUT PROJECTION

FY Beginning	Planning Year	Estimated # of Students (Fall)	Estimated Built Sq Ft
2007	1	2,009	730,251
2008	2	2,718	857,118
2009	3	3,414	865,640
2010	4	4,381	961,162
2011	5	5,198	1,066,943
2012	6	5,760	1,066,943
2013	7	6,195	1,205,509
2014	8	6,268	1,367,845
2015	9	6,685	1,367,845
2016	10	7,336	1,451,989
2017	11	7,800	1,451,989
2018	12	8,300	1,774,684
2019	13	9,000	2,009,940
2020	14	9,600	2,764,360
2021	15	10,000	2,764,360
2022	16	10,000	2,764,360
2023	17	10,000	2,764,360
2024	18	10,000	2,764,360
2025	19	10,000	2,764,360

TABLE 4: CAMPUS BUILDING ENERGY USE PROJECTION BASED ON BUILDING PERFORMANCE TARGETS

FY Beginning	Annual Electricity Based on Existing Targets (MWh)	Annual Natural Gas (Therms)	Campus Building Site Energy (MBTU)	Campus Building Source Energy (MBTU)	Campus Building Source Energy (MBTU) per Student	Campus Building Source Energy (MBTU) per Square Foot
2007	12,204	455,781	87,218	186,798	93	0.26
2016	21,599	509,668	124,663	299,506	41	0.21
2017	22,333	517,232	127,923	308,663	40	0.21
2018	22,719	535,409	131,058	314,965	38	0.18
2019	24,925	638,927	148,937	350,943	39	0.17
2020	30,090	864,977	189,165	433,471	45	0.16
2021	36,172	1,102,244	233,643	527,624	53	0.19
2022	36,172	1,102,244	233,643	527,624	53	0.19
2023	36,172	1,102,244	233,643	527,624	53	0.19
2024	36,172	1,102,244	233,643	527,624	53	0.19
2025	36,172	1,102,244	233,643	527,624	53	0.19

NOTES:
1) Values in bold are actual, not estimated.
2) Peak Period Demands assume thermal energy storage of energy used to produce cold water.
3) 1 MWh = 3.412 MBTU, 1 therm = 0.1 MBTU
4) Source-Site Ratios are national averages from Energy Star: Electricity = 3.340, for Natural Gas = 1.047.

TABLE 5: BUILDING PERFORMANCE TARGETS

Target	Units	Laboratory/Complex	Classroom/Office	Housing and Services
			100% of Benchmarks	
Max Demand	watts/gsf	6.73	3.65	2.55
Annual kWh	kWh/yr/gsf	40.7	15.1	10.6
Max CHW	tons/kgsf	3.74	2.03	1.42
Max Therms	th/hr/kgsf	0.43	0.12	0.18
Annual Therms	th/yr/gsf	1.82	0.2	0.28
			80% of Benchmarks	
Max Demand	watts/gsf	5.38	2.92	2.04
Annual kWh	kWh/yr/gsf	32.56	12.08	8.48
Max CHW	tons/kgsf	2.99	1.62	1.14
Max Therms	th/hr/kgsf	0.34	0.1	0.14
Annual Therms	th/yr/gsf	1.46	0.16	0.22
			65% of Benchmarks	
Max Demand	watts/gsf	4.37	2.37	1.66
Annual kWh	kWh/yr/gsf	26.46	9.82	6.89
Max CHW	tons/kgsf	2.43	1.32	0.92
Max Therms	th/hr/kgsf	0.28	0.08	0.12
Annual Therms	th/yr/gsf	1.18	0.13	0.18
			50% of Benchmarks	
Max Demand	watts/gsf	3.37	1.83	1.28
Annual kWh	kWh/yr/gsf	20.35	7.55	5.3
Max CHW	tons/kgsf	1.87	1.02	0.71
Max Therms	th/hr/kgsf	0.21	0.06	0.09
Annual Therms	th/yr/gsf	0.91	0.1	0.14