

An aerial photograph of a modern building courtyard. The courtyard features a central water feature with a stone-lined channel and a large tree with yellow blossoms. Three people are sitting on a bench in the foreground, looking at a laptop. The scene is overlaid with a semi-transparent blue filter.

UNIVERSITY
OF
CALIFORNIA

Overcoming Barriers to Carbon Neutrality

A Report of the Carbon Neutrality Finance
and Management Task Force

August 1, 2017

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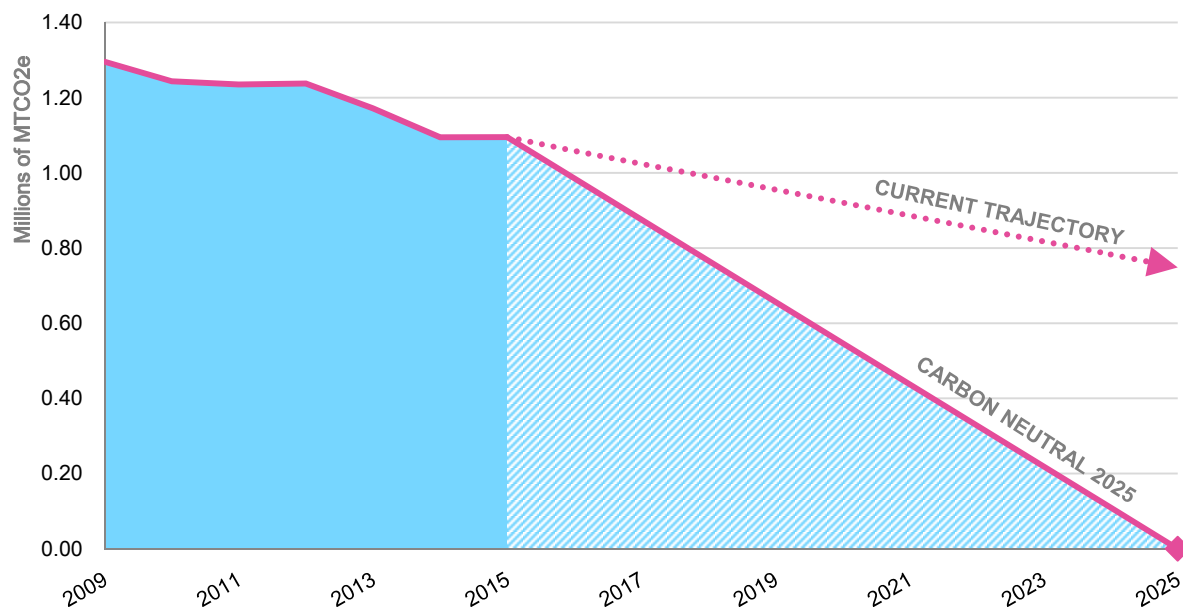
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EXECUTIVE SUMMARY

Global climate disruption poses serious and urgent environmental, social and economic challenges. The countries of the world will need to make massive changes across their energy and transportation systems in order to eliminate the emission of carbon dioxide and other greenhouse gases that are accumulating in the atmosphere and causing atmospheric temperatures to rise. These changes will require numerous innovative, scalable solutions in energy efficiency, power generation, industrial applications, transportation and more. Universities, with their threefold mission of education, research and public service, are ideally suited to contribute to developing these solutions. The University of California, with its vast intellectual resources on 10 campuses, five medical centers and three national laboratories, is uniquely positioned to play a leading role in this critically important endeavor.

In 2007, all 10 UC chancellors signed the American College and University Presidents' Climate Commitment, pledging to decarbonize their campuses by 2050. When UC President Janet Napolitano launched UC's Carbon Neutrality Initiative in 2013, the target date was moved to 2025. This bolder goal is both an opportunity and a challenge. It has galvanized many faculty, students and staff around an issue of enormous societal importance, driving new multicampus, multidisciplinary research and collaboration and enriching the curriculum. By focusing on what we must do to decarbonize, the UC system becomes a large set of living laboratories, each an active learning environment exploring solutions that have the potential to advance carbon neutrality worldwide.

UC Scope 1 and 2 Greenhouse Gas Emissions: Current Emissions and Trajectory Necessary to Reach Carbon Neutrality by 2025



This graph illustrates UC's current rate of progress toward eliminating carbon from our operations. We are on track for 2040. The question is how to gain sufficient momentum to achieve carbon neutrality by 2025.

The 2025 goal has also driven significant progress toward reducing carbon through efficient and innovative campus operations. Systemwide, UC's greenhouse gas emissions are now three percent below 2000 emissions levels, even with considerable growth in student enrollment and new building square footage. A combination of energy efficiency incentive programs, renewable energy procurement strategies, aggressive green building standards and other measures have set the university on a steady trajectory toward the elimination of carbon — by 2040. (See graph on page I.) The Carbon Neutrality Initiative calls us to accelerate our progress by implementing further operational and budgetary strategies to move us to carbon neutrality in just eight years.

The 2025 goal highlights the challenges that UC — and by extension other large organizations — will face in order to remove carbon from their everyday operations. Many financial and management barriers stand in the way, including funding constraints, competing priorities, and limits on debt capacity, as well as a lack of awareness and engagement on the part of most faculty, students, administrative leaders and staff. In addition, the university's coexisting models of centralized and decentralized decision-making may test our ability to move quickly to such an ambitious goal.

To provide oversight, research and recommendations for the Carbon Neutrality Initiative, President Napolitano has convened experts from across the university, including faculty, students, administrative leaders and operations staff, with expertise in energy and sustainability, environmental law, climate science, social science, budget and finance, facilities construction and operations, administrative services, capital planning and communication. The primary oversight group is the Global Climate Leadership Council (GCLC), formed in 2014. The GCLC subsequently established an Applied Research Working Group that, in early 2016, formed the Task Force on Carbon Neutrality Financing and Management to study the barriers impeding progress toward the goal and to recommend potential solutions. At the same time, a generous grant from the TomKat Charitable Trust made it possible to establish the UC-TomKat Carbon Neutrality Project, which is researching ways to eliminate campus reliance on natural gas and ways to foster broad-based attitudinal and behavioral change in support of carbon neutrality. Finally, a recently formed Carbon Abatement Technical Group is investigating the role that carbon offsets

Why 2025? And how much will it cost?

Concerns about the 2025 deadline largely stem from uncertainty about the costs, and these questions generated extensive debate during the course of our work.

Many stakeholders have asked that the deadline be reexamined. (See Appendix IV). However, our Task Force largely followed its directive from President Napolitano and set aside the “why 2025?” question to focus on “what’s next?”

Because we did not take a prescriptive approach to strategies for achieving carbon neutrality — each UC campus is in the process of choosing its own optimal path forward — we did not specify firm costs. Instead, we have recommended funding, financing and energy procurement strategies that can make implementation affordable and cost-effective.

We are sensitive to concerns about the overall cost of meeting the systemwide 2025 goal. We believe that the appropriate course of action is to move aggressively to implement cost-effective measures to reduce emissions, consistent with our recommendations, and to work toward meeting the 2025 goal. We anticipate that these next steps can be done without negatively impacting our budgets, but believe that our leaders should continue to evaluate the campus-specific financial implications to ensure that costs remain manageable.

might play in the Carbon Neutrality Initiative.

With this set of activities in place, our Task Force focused on the fiscal and administrative challenges we must overcome to achieve carbon neutrality by 2025. Determining how to decarbonize UC's seven central heating and cooling plants is among UC's toughest challenges and the TomKat natural gas group will make recommendations for how to do so. We anticipate, however, that eliminating direct carbon emissions from the heating and cooling plants cannot occur by 2025 given the large capital costs required to do so. As a result, the Carbon Abatement Technical Group will make recommendations about how to use offsets as a transition measure. The goal is to prioritize off-campus actions that have broad support because they are consistent with our educational mission and provide other co-benefits. All of these recommendations will need buy-in from the university's many stakeholders, which is the focus of the TomKat communications group.

Since mid-2016, our task force has been meeting and reaching out to the university community in order to understand what campuses need and how they approach the operational, fiscal, organizational and technological issues related to the Carbon Neutrality Initiative. The "Overcoming Barriers to Carbon Neutrality" report is the result of our efforts.

One of our Task Force's principal findings is that many campus leaders across the system have not fully embraced the Carbon Neutrality Initiative, especially its 2025 deadline (See Appendix IV). Perspectives vary widely among campus stakeholders as to the initiative's merit and priority. Moreover, each of UC's 10 campuses and five medical centers has its own culture, infrastructure, energy mix, competing priorities, budgetary constraints, and local climatic and topographic features that make a centralized, one-size-fits-all approach both impossible and undesirable. This has led us to a key conclusion: ***The successful transition to carbon neutrality hinges on securing broad support for the initiative among senior administrators, staff, faculty and our students. Additionally, the way in which carbon neutrality measures are implemented must respect campus autonomy in charting their own progress toward carbon neutrality while providing campuses with the leadership, tools and authority to accomplish the goal.***

Recommendations

Our Task Force focused its efforts in five broad areas that pertain to campuses and medical centers: funding and financing, energy efficiency and conservation, new buildings, communication and change management, and energy supplies. A sixth area addresses barriers specific to medical centers. We engaged campus-based subject matter experts, administrators, faculty and students through interviews, surveys and workshops. In addition, we shared preliminary findings and recommendations broadly to ensure that our recommendations reflect the university community's perspectives.

We have not attempted to provide a definitive path to carbon neutrality by 2025. Instead, we present a set of strategies that can be implemented based on the unique needs of each location. We built in flexibility for campuses to determine how to implement the recommendations based on campus-specific feasibility. We recommend centralized approaches only where they offer significant economies of scale or will be necessary to achieve meaningful carbon reductions.

We believe that each campus will need to implement a mix of strategies in each of the areas we have identified:

- **Funding and financing.** Accounting for the cost of carbon and integrating carbon management with utility budgets.
- **Energy efficiency and conservation.** Investing in deeper energy efficiency and developing and paying for qualified staff to operate finely tuned building systems.

- **New buildings.** Designing new buildings to carbon-neutral standards.
- **Communication and change management.** Engaging faculty, students and staff in the commitment to achieving carbon neutrality.
- **Energy supplies.** Procuring as much renewable energy as possible.
- **Medical centers.** Addressing the barriers unique to hospitals, including regulatory requirements and the primacy of patient care and safety.

Out of 28 recommendations, we highlight eight in this summary. These eight address the most challenging barriers and will involve the most significant organizational and financial changes. Implementing them will contribute the most to accelerating progress and putting the university in a position to achieve carbon neutrality by 2025. The remaining recommendations are critical best practices, already in place on some campuses, that need to be widely adopted in support of both operational excellence and carbon neutrality.

Funding and Financing

Funding concerns cut across all carbon reduction strategies. Even programs that pay for themselves, such as energy efficiency retrofits, often struggle for funding because they require large up-front investments, and typical budgeting practices mask long-term savings. Campuses are already employing multiple mechanisms to fund energy efficiency projects, procure green energy and reduce costs of carbon abatement. But they need to invest much more, and funding is a formidable barrier. These two recommendations are designed to improve the way that funding for carbon abatement activities is approached:

- **FF1. Integrate purchased utilities and carbon management functions as a stand-alone financial unit.** This recommendation is designed to make revenue streams and cost savings from energy efficiency and other carbon reduction measures available for additional energy efficiency and carbon reduction efforts. It will enable campuses to directly leverage energy-saving activities that have early-stage operational paybacks to support activities that are more expensive. It will help campuses prioritize funding for carbon reduction actions. The UC-TomKat Carbon Neutrality Project provides a detailed technical analysis in support of this recommendation.
- **FF2. Implement internal carbon charges.** We recommend first establishing a standardized, systemwide shadow price for carbon to account for the financial and regulatory risks associated with greenhouse gas emissions. This will help campuses prioritize funding for actions that reduce carbon emissions without charging an actual carbon fee. Once the shadow price has been operationalized, we recommend that campuses and medical centers self-assess and implement an internal charge based on actual campus carbon emissions and use the proceeds to fund further carbon reduction measures.

Energy Efficiency and Conservation

Data from many completed energy retrofit projects demonstrate that entire campuses and medical center non-acute facilities could attain 50 percent or more improvement in energy efficiency through a comprehensive program of energy retrofits. Deep energy efficiency projects can also result in long-term cost savings, although upfront costs can be high and payback can be long. Furthermore, precision building energy systems must be maintained by highly qualified staff. These funding and staffing strategies are designed to help campuses access sufficient capital to invest in deep energy efficiency projects and develop appropriate staff to maintain them.

- **EE1. Develop a comprehensive funding plan for energy efficiency projects.** We recommend that the Office of the President integrate energy efficiency into systemwide financing considerations and work with campuses to help develop funding strategies for energy efficiency projects.

- **EE2. Improve staffing for energy efficiency programs.** A major impediment to successful implementation of energy efficiency projects across campuses is the low number of qualified project delivery and operations staff. Our experience shows that the cost for new staff is more than covered by energy cost savings. We recommend that campuses evaluate the staffing levels needed to scale up energy efficiency investments and increase staffing accordingly.

New Buildings

Even with the most efficient use of existing space, new buildings will be needed as the university continues to grow. These recommendations are designed to help embed carbon reduction practices into planning, design and construction processes so that new buildings do not increase campus carbon emissions. We recommend that these be firm systemwide policies once adopted. We defer to the Systemwide Sustainability Steering Committee for specific implementation details.

- **NB1. Prioritize net-zero carbon for new building projects and all-electric designs for new housing.** We recommend that the Sustainability Policy Steering Committee evaluate ways to update the university's building policies to support net-carbon-neutral and all-electric design proposals. To achieve carbon neutrality, all new buildings must be, at minimum, carbon neutral, inclusive of any offsets purchased. All-electric designs, coupled with renewable energy sources, will be essential for campuses to reach net-zero emissions. Student housing projects may provide an early case for net-zero carbon strategies but will need to take into account cost considerations. UC's Carbon Neutral Buildings study, which was developed in support of this recommendation, analyzes options for new buildings and provides a framework for project-specific decisions.
- **NB2. Strengthen energy performance standards and incentivize low-energy design.** We recommend that the Sustainability Policy Steering Committee strengthen UC-wide design standards for new construction to include more aggressive energy conservation and carbon reduction/elimination measures. Energy Use Intensity (EUI) targets for new medical center facilities will also help promote high-energy performance design and should be incorporated into the planning and design processes for upcoming building updates. Although many projects voluntarily exceed current policy requirements for energy efficiency and carbon reduction, higher energy performance standards will need to be enshrined as university policy to make them a consistent, nonnegotiable priority.
- **NB3. Base capital project design decisions on life cycle cost analysis (LCCA).** We recommend that the Sustainability Policy Steering Committee adopt a new policy (similar to the California mandate that state agencies use LCCA) so that major capital project design decisions are based on energy and carbon costs over the life of a project. LCCA considers the value of a project from construction through end-of-life and can include carbon footprinting, the cost of energy and energy system operations and at least a shadow price for carbon. LCCA enables designers and decision makers to see the long-range savings that result from an energy-focused design standard.

Communication and Change Management

The Carbon Neutrality Initiative is an ambitious effort that presents unique communication challenges beyond the scope of our Task Force. For in-depth communication research and recommendations, we are relying on the TomKat Communications Strategy Working Group, whose faculty, students and practitioners from across the UC system are using audience research, system mapping, theory of change and other techniques to develop a new set of communication tools tailored to the UC Carbon Neutrality Initiative. Our recommendations lay the foundation for their strategies, with the following being of highest priority:

- **CM1. Position carbon neutrality as a campus and systemwide priority.** We recommend that the importance of the Carbon Neutrality Initiative and its connection to the UC mission be better communicated through targeted messaging that engages the regents, campus leadership, faculty, students and staff.

Call to Action

The ambitious goal of achieving carbon neutrality by 2025 has catalyzed campuses to accelerate their efforts and make admirable progress in the areas of energy efficiency and carbon reduction. Having communicated with many, if not most, of those who will be responsible for making carbon neutrality a reality for the University of California, we are confident in the energy-saving technologies and methodologies currently available, in the UC faculty and scholars working to improve upon them, and in the operations personnel who implement them. Still, our task force has concluded that 2025 is a target for which the university is not fully prepared. Reliance on natural gas, competition for funding, limited financing options, carbon-blind budgeting and planning procedures, and, above all, absence of a universally shared vision of the high priority of carbon neutrality, make the Carbon Neutrality Initiative an enormously difficult undertaking.

Yet the recommendations in our report make good business sense even in the absence of a carbon-related objective. While the recommendations will reduce carbon, they also stand to improve the quality of campus operations and business processes. In keeping with UC's threefold mission, they leverage UC's ongoing applied research and provide our students with innumerable learning opportunities, while serving the global public by leading the way to a sustainable climate future. We therefore urge the Office of the President and all campuses and medical centers to begin exploring how to put them into practice immediately.

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This report and related documents can be found online at <http://ucop.edu/carbon-neutrality-initiative/reports/>.

1. ORIGINS OF THIS REPORT

Climate Change

The evidence of climate change is irrefutable. Since 1750, the dawn of the Industrial Revolution, human activity has generated two trillion metric tons of carbon dioxide (CO₂) and other greenhouse gases. These emissions have helped warm the planet by 0.9 degrees Celsius. Continued or accelerated rates of warming may increase the frequency and intensity of weather disasters, cause loss of coastal land areas due to sea level rise, and destabilize current climate patterns. While increased CO₂ is a benefit for plant growth generally, rapid warming may contribute to the spread of infectious diseases, local increases in air pollution and the scarcity of fresh water in some locations.

In 2011, global emissions totaled around 50 billion metric tons CO₂ and emissions are growing at a rate of 2.2 percent per year, with sharper growth in developing economies. Many climate models predict this rate of increase puts the planet on target to warm by approximately 2 degrees Celsius in less than 40 years. The most current analysis by the Intergovernmental Panel on Climate Change (IPCC) suggests that by the end of the century, warming could range from 2.5 degrees to as much as 7.8 degrees Celsius, which would cause catastrophic climate disruption. The risk of significant climate-induced losses to society requires that we make a comprehensive effort to reduce those risks.

“Climate change is a global threat that demands more of our attention, not less. We must continue talking about it. We must continue research that provides scientific data to guide our climate strategy. We must doggedly hunt for solutions.”

“It is our responsibility as leaders, as academics, as scientists, as human beings, to act swiftly and decisively to protect the planet we call home. Future generations are counting on us.”

UC President Janet Napolitano

The Carbon Neutrality Initiative: UC’s Commitment to Lead

Reversing these emissions trends requires a global effort, and the University of California has made a commitment to lead. Students first initiated the call for UC to reduce its own emissions, and in 2007 the chancellors of all 10 campuses signed a commitment to achieving carbon-neutral operations. In November 2013, President Janet Napolitano launched the Carbon Neutrality Initiative, which commits UC to emitting net-zero greenhouse gases from its buildings and vehicle fleets by 2025. This would make the University of California the first major university system to reach net-zero emissions.

Many stakeholders regard the pursuit of carbon neutrality as a high priority that is central to the UC mission. As a unifying goal, it harnesses the university's depth in climate research, using our own campuses as living laboratories. It engages students and faculty in advancing climate solutions of statewide, national and global impact. Moreover, it exemplifies the university's commitment to public service by demonstrating that carbon neutrality is possible. Our successes will encourage other universities, industry and the public to use what we have learned so that they can also take similar paths towards carbon neutrality.

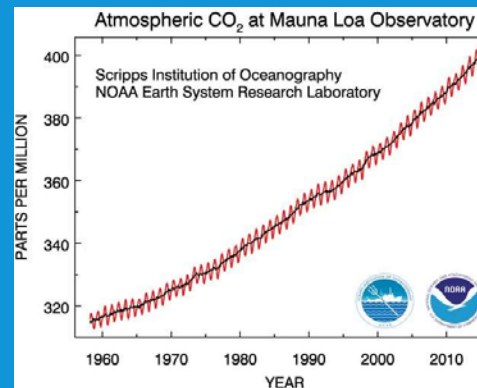
The Task Force: Purpose and Process

President Napolitano formed the Global Climate Leadership Council (GCLC) in 2014 to advise her about how to achieve carbon neutrality and to guide the campuses in advancing other sustainability goals. GCLC members include faculty, administrators, students and other experts from inside and outside UC. The GCLC engages a broad cross-section of the university community in seeking out best practices, policies and technologies to achieve carbon neutrality while advancing teaching and research in climate change and sustainability.

Although the university has made significant progress since the Carbon Neutrality Initiative was announced, we are not yet on a path to reach carbon neutrality by 2025. Several closely related efforts are underway to support strategic actions to achieve this goal. Most importantly, all of UC's campuses have developed and recently updated Climate Action Plans that outline strategies to reduce greenhouse gas emissions. The information in these plans forms the basis for a systemwide strategic plan to achieve carbon neutrality. Although these documents define the key strategies, implementing many of them has proven difficult.

In response, through its Applied Research Working Group, the GCLC formed the Task Force on Carbon Neutrality Financing and Management (the Task Force) in the spring of 2016. The Task Force includes faculty, staff and students with expertise in energy and sustainability, construction, environmental law, budget and finance, facilities operations, administrative services and capital planning. President Napolitano asked us to identify and prioritize the organizational barriers to achieving carbon neutrality by 2025 and to recommend ways to overcome these barriers.

The Keeling Curve



It was a University of California scientist, Charles David Keeling of the Scripps Institution of Oceanography at UC San Diego, who first established the linkages between fossil fuel combustion and global climate change due to the greenhouse effect. His methods of measuring atmospheric carbon dioxide revealed clear natural and man-made trends. The graph of Keeling's data from Mauna Loa is known as the Keeling Curve. His work is a cornerstone of modern climate science, and the Keeling Curve has become a powerful symbol of the role of fossil fuels in climate change.

Source: American Chemical Society

Our work is one of many concurrent tasks being implemented in support of the Carbon Neutrality Initiative. Other activities include:

- The UC-TomKat Carbon Neutrality Project, which was launched in 2016 to support multidisciplinary research on strategies with the potential to substantially accelerate progress toward carbon neutrality;
- UC's Carbon Abatement Working Group, which has been evaluating the potential role of off-campus actions (offsets) to reduce carbon emissions;
- UC's Energy Services Governing Board, a standing committee which is responsible for executing long-term renewable energy contracts.

Information on UC's Carbon Neutrality Strategic Framework and related projects is available at www.ucop.edu/carbon-neutrality-initiative.

Given the scope of the initiative and the range of collective efforts required to implement it, our report does not comprehensively address all actions necessary to achieve carbon neutrality. Our efforts complement those of the GCLC's Applied Research Working Group and the UC-TomKat Carbon Neutrality Project. The TomKat project has two working groups investigating two research priorities, with final recommendations expected by September 2017. Its Natural Gas Exit Strategies Working Group is evaluating options to seek alternatives to the use of natural gas as an energy source at UC, and its Communications Strategy Working Group is researching communication and change management strategies for the Carbon Neutrality Initiative. Both working groups are funded by a grant from the TomKat Charitable Trust and operate under the overall direction of David Auston, former executive director and current research professor at the Institute for Energy Efficiency at UC Santa Barbara and co-chair of the GCLC's Applied Research Working Group. The relationship of these projects to our research and recommendations is noted throughout this report.

Engaging Stakeholders in the Process

Leadership and participation by students, faculty and staff are essential to steer the university to carbon neutrality. Therefore, in evaluating how to achieve the 2025 goal, our Task Force's primary strategy has been to engage the larger university community in identifying challenges and potential solutions. We have conducted considerable research and fact-finding efforts among campus-based subject matter experts and our outreach has included UC's Council of Vice Chancellors for Administration (COVCA), its Council of Vice Chancellors for Planning and Budget (COVCPB) and its Energy Services Unit Governing Board (ESUGB). In total, more than 200 individuals have provided guidance to us through their participation in interviews, formal surveys and workshops, and by reviewing drafts of this report. We believe that involving those who will be responsible for implementing our recommendations, and tapping their deep understanding of the challenges unique to their campuses and operating units, is critical to creating a sense of ownership in our recommendations and in the Carbon Neutrality Initiative itself.

"Our Task Force process has brought many critical issues to light, and led us to a key conclusion: The successful transition to carbon neutrality hinges on securing broad support for the initiative among senior administrative leaders, staff, faculty and our students. Moreover, the way in which carbon neutrality measures are implemented must respect campus autonomy in charting their own progress toward carbon neutrality."

Debating the Trade-offs

From the outset, we have known that aligning campus financial processes and infrastructure plans with the carbon neutrality goal will entail complex, multifaceted strategies and difficult budgetary decisions. In the course of our work, we have learned that, even among leaders who recognize the importance of combating climate change, the Carbon Neutrality Initiative, with its extremely aggressive, self-imposed deadline of 2025, has not yet been fully embraced as a must-do, top-priority goal (See Appendix IV). Perspectives vary widely among campus stakeholders as to the merits and priority of the initiative. For example, we have heard from individuals who are passionate about achieving carbon neutrality and expect the university to “just do it.” This point of view does not take into account the complexities and resource demands of operating a university of this size and scope. Some campus leaders, including students, faculty and administrators, who do understand university budgets and competing priorities, have jumped to the conclusion that our primary solution will be to achieve carbon neutrality solely by purchasing offsets, which they perceive as a waste of money.

Our Task Force process has brought these critical issues to light and led us to a key conclusion: ***The successful transition to carbon neutrality hinges on securing broad support for the initiative among senior administrative leaders, staff, faculty and our students. Moreover, the way in which carbon neutrality measures are implemented must respect campus autonomy in charting their own progress toward carbon neutrality.***

Each of UC’s 10 campuses and five medical centers has its own culture, infrastructure, energy mix, competing priorities and budgetary constraints as well as local climatic and topographic features. A centralized, one-size-fits-all approach is both impossible and undesirable. We have worked hard to understand the unique tradeoffs and challenges that each campus faces in reaching carbon neutrality. We acknowledge that there are many unknowns and uncertainties, since no institution of UC’s size and scope has yet achieved carbon neutral operations. Our recommendations are designed to eliminate barriers rather than specify a definitive path for each campus to take to meet the goal. On several topics, we reached consensus that systemwide policy changes are the best way for our campuses to achieve a particular goal. But, on the whole, our approach is to give campuses the latitude to determine how best to implement most recommendations. At the same time, we recommend that the Office of the President facilitate coordinated efforts when economies of scale are needed to make a strategy affordable.

Why 2025, and How Much Will It Cost?

These are key questions for UC’s Carbon Neutrality Initiative, and they generated extensive debate during the course of our work. They are intertwined, since concerns about the deadline largely stem from uncertainty about the costs.

Many stakeholders, including the executive vice chancellors and provosts, have asked that the deadline be reexamined. (See Appendix IV.) Although we understand how important that concern is, our Task Force largely followed its directive from the president and set aside the “why 2025?” question to focus on “what’s next?” Specifically, our foundational task was to identify administrative and financial actions that UC should take now to help campuses cost-effectively make progress towards the 2025 goal.

Because we did not take a prescriptive approach to strategies for achieving carbon neutrality — each UC campus is in the process of choosing its own optimal path forward — we did not specify firm costs. Instead, we have recommended funding, financing and energy procurement strategies that can make implementation affordable and cost effective. Related work groups independently reinforce and expand upon our recommendations. For example, the TomKat Natural Gas Exit Strategies Working Group report describes in detail how reinvested savings from energy efficiency can become a funding source for further carbon reductions. UC's Energy Services Governing Board has already put in place procurement strategies designed to lower and stabilize the cost of biogas beyond 2025. It's possible that our researchers may develop new technological solutions pre- or post-2025 that make carbon-free operations even more cost effective, or that broader changes in energy markets and renewable technologies will bring costs down further.

Ultimately, the cost for UC to make the transition to carbon neutral operations hinges on the mix of strategies selected to reduce emissions, and on future energy and carbon prices. A cost-neutral 2025 solution would rely primarily on energy efficiency, a prescient portfolio of energy supplies, and mission-based carbon offsets that are relatively inexpensive. At the other extreme, the immediate systemwide replacement of campus combined heat and power plants might require an investment of more than \$3 billion, a strategy we have not recommended.

Pending a fully developed analysis of the budget impacts, we believe the anticipated cost associated with achieving carbon neutrality will not be so extreme. Energy costs currently represent about 1 to 2 percent of total university operating expenses. This compares to employee salary, wage and benefit costs that typically represent 50 to 60 percent of campus operating expenses. We anticipate that achieving carbon neutrality could increase operating expenses over the next five to 10 years, but we are optimistic that UC can reach carbon neutrality without net costs that significantly increase energy expenditures. Moreover, many of the strategies outlined to achieve carbon neutrality provide the secondary benefit of increasing energy independence and providing a hedge that reduces financial risk and facilitates budget planning. For example, long-term contracts for solar power establish firm prices for 20- to 25-year terms.

The UC system is actively working to evaluate all proposed solutions with financial rigor, and will continually refine carbon neutrality strategies accordingly.

2. CONTEXT AND ISSUES FOR DECARBONIZATION

Most of UC's greenhouse gas emissions come from the use of electricity from non-renewable sources and the use of natural gas to power seven campus combined heat and power plants. Thus far, all campuses, medical centers and the UC system have reduced their greenhouse gas consumption by implementing energy efficiency projects, procuring more renewable power, and developing on-campus renewable energy. Achieving carbon neutrality will require us to greatly expand our efforts in these and other areas.

Historical Utilities Funding and Cost Trends

Historically, UC budgets included Purchased Utilities (PUTs) as a distinct type of operating expense to cover energy, water and sewage treatment. On average, these expenses represent 1 to 2 percent of a campus's operating budget. State-supplied funds for utilities were adjusted periodically based on market conditions and campus growth, although this has not been the case for quite some time. With the new UC budget model and decline in state funding, many campus PUT budgets went into deficit, and subsequently were subsumed within other more fungible operating budgets, though the way in which utilities and energy projects are budgeted now varies considerably from campus to campus.

Successful energy efficiency programs and decreasing natural gas prices have led to a considerable decline in the total cost of utilities systemwide since 2008. Although practices vary by campus, avoided costs in utility expenses are helping to offset increases in other operating expenses.

Progress to Date

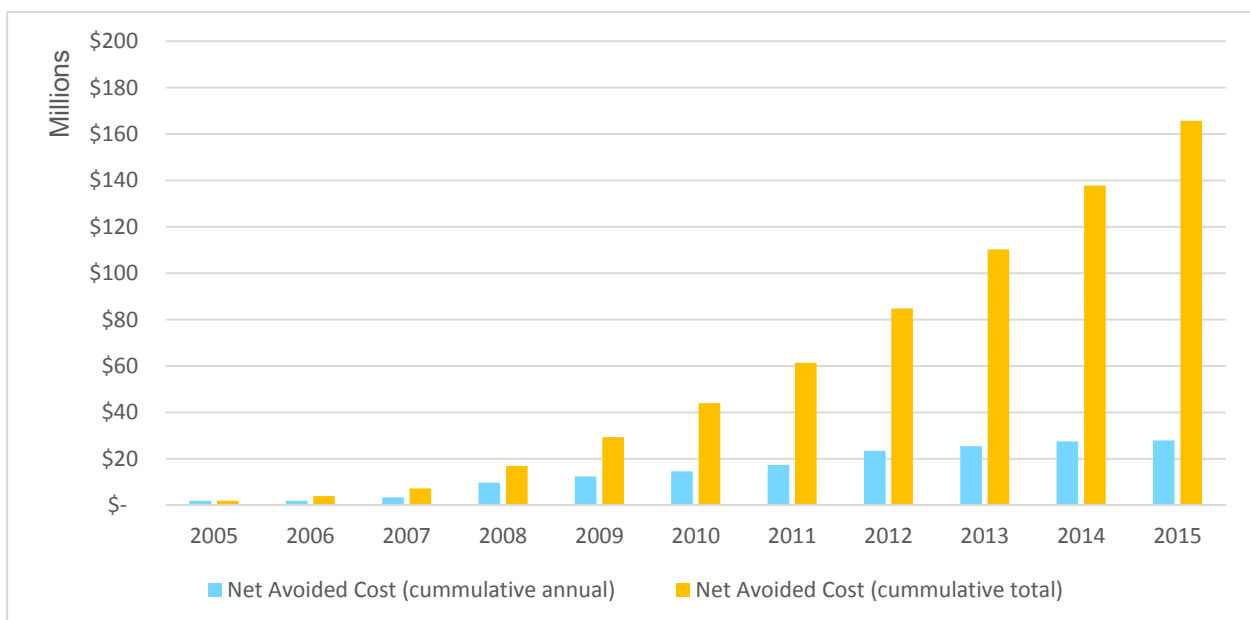
Since 2004 the university has reduced its greenhouse gas emissions by 170,000 metric tons while saving 289 million kilowatt-hours (kWh) of electricity and 17.7 million therms of natural gas. To put these reductions into context, systemwide UC's emissions are 3 percent below our emissions in 2000, even with the addition of new space totaling more than 36 million square feet and general campus enrollment growth of more than 66,000 students. Many campuses are exceeding their own goals as well as California standards for carbon reduction. Several programs have contributed to these successes, although some significant challenges stand in the way of achieving carbon neutrality by 2025.

Statewide Energy Partnership

The primary funding mechanism for energy efficiency programs since 2004 has been the Statewide Energy Partnership (SEP), formed by the UC system, the California State University system, and California's four investor-owned utilities (IOUs). Municipal systems serving Los Angeles and Riverside subsequently became part of the partnership, and all campuses are now eligible to receive SEP incentives. The SEP program provides financing for projects based on projected first-year energy savings. It funds equipment retrofits and monitoring-based commissioning, as well as staff training and education on the importance of energy efficiency. Utility company incentives are provided for qualifying projects to reduce project expenses and widen the range of projects that can be implemented with acceptable paybacks.

Since the SEP launched, UC campuses have registered more than 1,000 projects with the program. These projects have received more than \$80 million in incentive payments and avoided \$28 million in annual energy costs. Systemwide, the SEP program has enabled the university to invest in energy efficiency projects that have saved 170,000 metric tons of greenhouse gas emissions while avoiding \$166 million in energy costs, net of debt service, systemwide. And both annual and cumulative cost avoidance have risen dramatically since 2004. (See Figure 1.) Important co-benefits are reductions in deferred maintenance backlogs and avoided capital costs that would have otherwise been spent to expand the capacity of our infrastructure systems.

Figure 1: Avoided Costs from Energy Efficiency Projects, 2004-2015



A changing regulatory landscape has created uncertainty about the SEP program. Incentives are playing a smaller role in funding recent projects due to increasingly restrictive rules from the IOUs and the California Public Utilities Commission. The cost of staff time to apply for incentives plus the cost of metering to quantify energy savings outweigh the benefit of SEP incentives for some campuses.

Wholesale Power Program

The university has established a Wholesale Power Program to improve the campuses' abilities to directly manage their energy supplies and lower the cost of carbon-free electricity. In 2014, the university became a registered Electric Service Provider (ESP), which allows it to procure or produce electricity and provide it to campuses that have "direct access" rights authorized by the California Public Utilities Commission. Direct Access service allows retail electric service customers to purchase electricity from an ESP instead of from a regulated electric utility. Their electricity is delivered through the utility's distribution system. Direct Access customers are billed by their ESP for electricity and by the utility company for transmission and distribution of the electricity. Direct Access was introduced in the late 1990s as part of the

deregulation of California's utility industry. Seven UC campuses and three UC medical centers have full or partial direct access rights (the campuses served by municipal utilities are not eligible).

Approximately 25 to 30 percent of the university's purchased electricity is now served by the Wholesale Power Program. Participating campuses have decreased their carbon emissions while paying less than they did under past programs. As part of the Wholesale Power Program, UC recently opened a 60-megawatt (MW) solar PV project in the Central Valley and has contracted for an additional 20 MW installation. Combined, these agreements are the largest solar purchase by any university in the country. When complete, the solar projects will be capable of supplying approximately 14 percent of UC's total annual purchased electricity.

This program is overseen by UC's Energy Services Governing Board, which includes representatives from every campus and provides oversight for energy procurement decisions across the university. In practice, decisions about electricity use have been made by a subgroup that consists of the campuses and medical centers that participate in the Wholesale Power Program. The Office of the President establishes and maintains all third-party contracts for procurement and passes through transaction costs to the individual campuses. Because the program maintains its own working reserves, it does not require any additional funding to function properly. Individual campuses work through the governing board to access electricity supplies through the Wholesale Power Program. The university plans to provide 100 percent zero-carbon electricity to its direct-access campuses by the end of 2017. The blended cost for this renewable electricity is expected to remain lower than standard California electricity rates, though higher than the cost for electricity from our own combined heat and power plants.

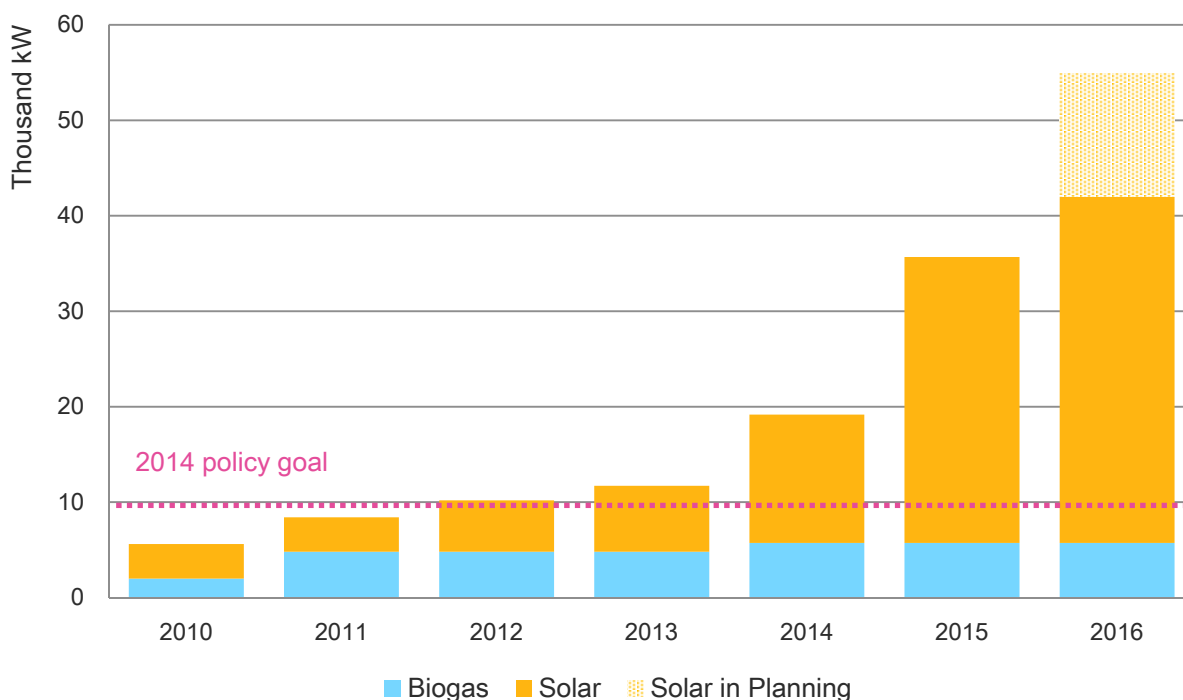
The existing Wholesale Power Program has proven effective and popular with the participating campuses. Expanding it would give the university more direct control of its energy portfolio, and the economies of scale should lower the associated per kWh administrative fees.

On-site Renewable Energy Generation

Generating renewable energy on campus land or buildings, most commonly from solar photovoltaic systems, is often a cost-effective way to reduce greenhouse gas emissions. Dozens of projects are now in place on UC campuses, totaling more than 36 MW of generation capacity. Many more projects are planned to come online before 2025. (See Figure 2.) Through their climate action and energy master planning efforts, campuses are evaluating the physical, financial and alignment-with-mission factors that dictate when larger on-site renewable projects can be implemented.

It must be noted that the widespread deployment of solar power has its own technological challenges. We use electricity at all hours, but solar plants — whether on-campus or off-campus — provide an intermittent power supply. The existing grid is not capable of matching demand with supply as more and more organizations deploy solar solutions. We encourage campuses to continue investing in solar, while acknowledging that much work in energy storage technology is needed to make this a fully scalable solution.

Figure 2: On-Campus Renewable Energy Capacity Exceeds Goal (MW)



The university has increased its renewable energy capacity by four times its 2014 policy goal.

Cap-and-Trade

California's cap-and-trade regulation went into effect on January 1, 2012, and established an enforceable compliance obligation beginning with 2013 greenhouse gas emissions. UC campuses joined together to take strategic actions to reduce the cost of this new regulation. UC invested in purchased allowances during the first few auctions, and the value of those allowances has steadily increased since then. California subsequently granted free allowances to UC in recognition that our campuses were already devoting considerable effort to directly reduce their emissions.

Administration of the program is coordinated by a cap-and-trade steering committee, made up of representatives from nine campuses and one medical center. Campuses individually retain verifiers and report emissions to the state Air Resources Board, while the Office of the President maintains account holdings and documentations and ensures regulatory compliance. This structure allows campuses to make cap-and-trade purchase decisions independently with advice from the Office of the President and consultants.

Thanks to the sequestration of funds earmarked for compliance and returns on those early investments, UC's current cap-and-trade program is now fully funded through about 2025. Thus, the program has been an effective strategy to cost-effectively administer UC's regulatory compliance obligations regarding greenhouse gas emissions.

Green Buildings

With more than 250 total certifications for green building design and operations, UC boasts the most Leadership in Energy and Environmental Design (LEED) certifications of any university in the country. Almost 20 percent of UC's building space is LEED certified, and UC Merced is the only campus in the nation where every building, including every residence hall, is LEED certified. Most important for achieving carbon neutrality, UC policy requires that all new buildings are at least 20 percent more energy efficient than required by California's already strict building energy code.

Vehicle Fleet Emissions

Although they represent only a tiny portion of total emissions, greenhouse gas emissions from UC's fleet vehicles are reflected in the carbon neutrality goal. The university has been reducing these emissions as well. In 2016, electric and hybrid vehicles accounted for 29 percent of all new fleet vehicle acquisitions. UCLA recently purchased three electric buses, and UC Irvine will become the first campus in the nation to deploy an all-electric bus fleet in 2017.

Central Heating and Cooling Plants

Currently, 65 percent of UC's greenhouse gas emissions come from the on-campus combustion of natural gas, mostly from large central heating and cooling plants. Seven campuses operate combined heat and power plants (CHPs) that burn natural gas to generate electricity and provide heating (and cooling at some sites) for campus buildings. (See Table 1.)

Historically, these plants have supported several university goals. They have been cost-effective in meeting campus energy needs and have been environmentally superior choices relative to other options available when they were built. They generate fewer pollutants and greenhouse gas emissions than some other systems. Some provide important business continuity benefits by producing electricity when the surrounding utility grid is down. This was an important consideration for construction of UC's newest CHP at UC Santa Cruz, which previously experienced many PG&E power outages.

UC Berkeley's CHP will come under the operational control of the campus in 2017. Prior to mid-2017 the combined heat and power plant was owned by a third-party that had operational control and carbon compliance responsibility. With this change, the campus will have carbon emissions responsibility.

Table 1. Campus Combined Heat and Power Plant Details

Location	Age	Electricity Capacity (MW)	Hot Water Temp (°F / steam)	Thermal Energy Storage?
Berkeley	30	25	Steam	No
Davis Medical Center	19	27	Steam	No
Irvine	10	19	Hot water	Yes
Los Angeles	20	52.8	Steam	No
San Diego	13	20	Hot water	Yes
San Francisco	20	11.5	Steam	No
Santa Cruz	2	4	Hot water	No

Although CHPs have been a tremendous asset for UC, the burning of natural gas presents a significant challenge to reaching carbon neutrality. Even UC's campuses without CHPs are highly invested in gas-

fired heating equipment, such as large boilers that produce steam or hot water for campus buildings. The challenge of decarbonizing these assets is similar to decarbonizing CHPs. One method for decarbonizing is to develop and purchase biomethane.

Biomethane Program

Biomethane is used as a substitute for natural gas to reduce emissions from campuses' heating and cooling plants and other gas-fired equipment. UC has procured biomethane through two long-term contracts that will eventually supply about 10 percent of UC's natural gas to all campuses and medical centers. This biomethane does not physically replace the natural gas used on campuses. Instead, UC has contracted to develop new biomethane projects as an "offset" to UC's natural gas usage. These projects will come on line in 2018 and 2019. All of the biomethane supplied from this program has zero carbon emissions per approved reporting standards. Additionally, the biomethane supplies serve as a compliance mechanism for California's cap-and-trade program. UC is researching related environmental benefits associated with our development of biomethane projects, such as the reduction of fugitive methane emissions resulting from better landfill gas collection systems.

Because biomethane is currently a highly valuable commodity in California, the university plans to sell all biomethane obtained before 2025 as a strategy to reduce long-term costs. Due to low natural gas prices, however, early-year cost premiums for biomethane pose a challenge for campus budgets and make it difficult to rely on this strategy to procure significantly larger amounts to offset our remaining natural gas usage.

Beyond the cost concerns, the biomethane program does not have universal UC community support as a long-term solution. UC research suggests that biomethane is not currently scalable as a statewide or national replacement for natural gas. Our researchers estimate that California's biomethane supplies may only total about 5 percent of current natural gas use. Thus, biomethane is not a complete solution to transition away from natural gas. Some simply prefer that UC stop combusting fossil fuels entirely. However, nearly all stakeholders acknowledge biomethane's role in our future low-carbon economy. Therefore, we consider UC's leadership in developing biomethane supplies an important strategy to meet the 2025 goal.

Natural Gas Exit Strategies

Natural gas exit strategies are immensely important in setting UC's path to carbon neutrality. The TomKat Natural Gas Exit Strategies Working Group is investigating two possible solutions:

- a) **Substitution of natural gas with combustible biofuels.** As discussed above, this approach may be expensive and challenging to scale up appropriately.
- b) **Electrification of heating and cooling systems, coupled with renewable electricity generation.** This would require an overhaul of existing campus infrastructure systems. Electrification is also a new construction approach, though, and provides an opportunistic way to replace existing systems when they reach end-of-life.

Both these options will cost more than business as usual. Natural gas prices are lower than they have been in decades, and biomethane costs considerably more. Energy efficiency enables both of the investigated solutions, potentially financing much of the biomethane premium cost and keeping operating

costs affordable for electrified buildings. Because the TomKat project is addressing these complex issues, we have not made recommendations relating to discontinuing natural gas use.

The Question of Offsets

A recently formed Carbon Abatement Technical Group is investigating the role of carbon offsets in the Carbon Neutrality Initiative. This group reports to UC's Energy Services Governing Board and the systemwide Climate Change Working Group. Therefore, our Task Force has not made recommendations regarding the use of offsets. We provide the following information as context because the question of offsets is so important to the Carbon Neutrality Initiative.

A carbon offset is a CO₂ (or other greenhouse gas) reduction in one location that is used to compensate for (or "offset") emissions made at another location. By acquiring or developing carbon offsets, institutions can justifiably claim reductions in their carbon footprint. The general theory behind offsets is that because carbon is a global rather than a local pollutant, it does not matter where the reduction takes place. A number of basic requirements for qualifying offsets have been internationally recognized. Emission reductions must be additional, real, verified, unique (not double-counted), enforceable, permanent and must not create leakage. Some UC faculty and students have expressed opposition to the use of offsets as a means of achieving carbon neutrality. They would prefer to have carbon reductions take place wholly within the UC system.

The GCLC's position is that institutions and individuals can most effectively lower their carbon footprint by improving energy efficiency, changing consumption patterns and increasing the use of renewable energy sources. This is UC's preferred path to carbon neutrality. As demonstrated in our recommendations, we strongly advocate for energy savings retrofits at our campuses and other strategies that create ongoing carbon reductions. However, major issues must be resolved, including finding a substitute for natural gas in central heating and cooling plants; eliminating all on-campus natural gas use; constructing on-site renewable energy generation systems; installing energy storage systems to mitigate the need for power from the grid; taking actions to prevent the release of fugitive gases from research activities and anesthesia; etc. Given the practical cost and timing considerations for these measures the GCLC recognizes that campuses may want or need to use carbon offsets to help neutralize their greenhouse gas emissions in the short term and even medium term. And the reality is that all of UC's campus climate action plans include investments in off-campus actions as part of their 2025 strategies, often through offset programs.

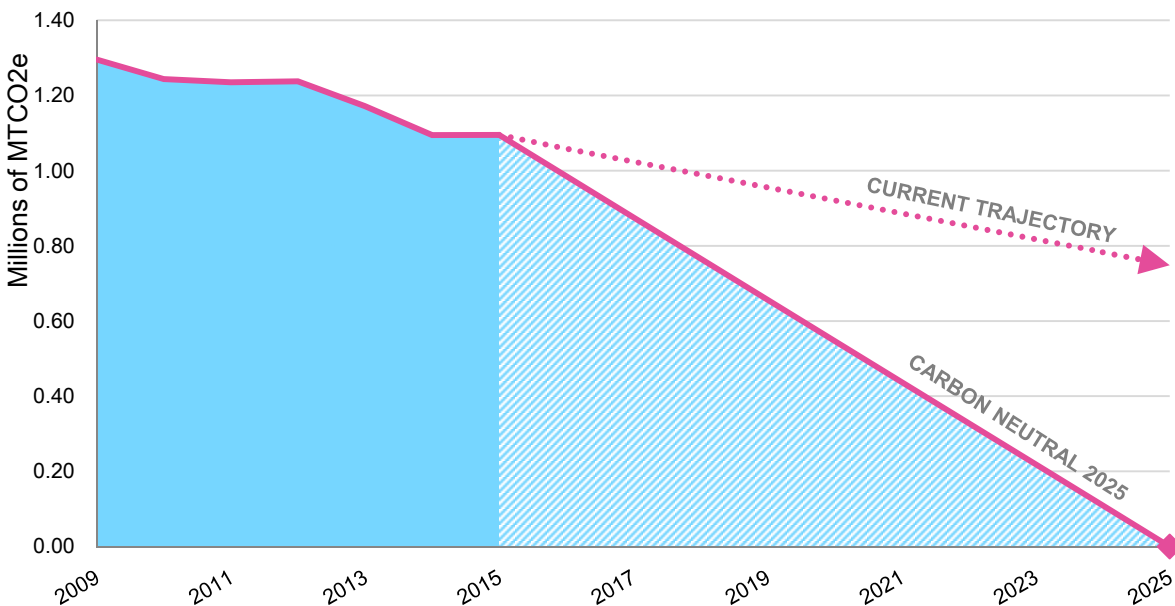
The Carbon Abatement Technical Group's goal is to help UC campuses and medical centers work together to develop a set of principles to guide a collective approach to procurement and management of carbon offsets. Well-designed off-campus offset programs could be developed to closely align with UC's teaching, research and public service mission.

The Need to Accelerate Progress

UC's current carbon reduction trajectory (Figure 3) is commendable, especially as campuses have continued to grow in enrollment and building square footage. The current trend is a positive reflection on the advocacy and hard work of students, faculty, staff, administrators and operations experts systemwide.

However, UC's emission abatement trajectory is not steep enough to get us to the 2025 goal. At the current rate of emission reductions, the university won't reach carbon neutrality before 2040. (See Figure 3.) UC will need to reduce emissions by more than 1 million MTCO₂e. That means the university has to ramp up efforts to reduce energy use, decarbonize energy supplies and implement off-campus greenhouse gas reduction actions to make the 2025 goal achievable.

Figure 3: UC Scope 1 and 2 Greenhouse Gas Emissions: Current Emissions and Trajectory Necessary to Reach Carbon Neutrality by 2025

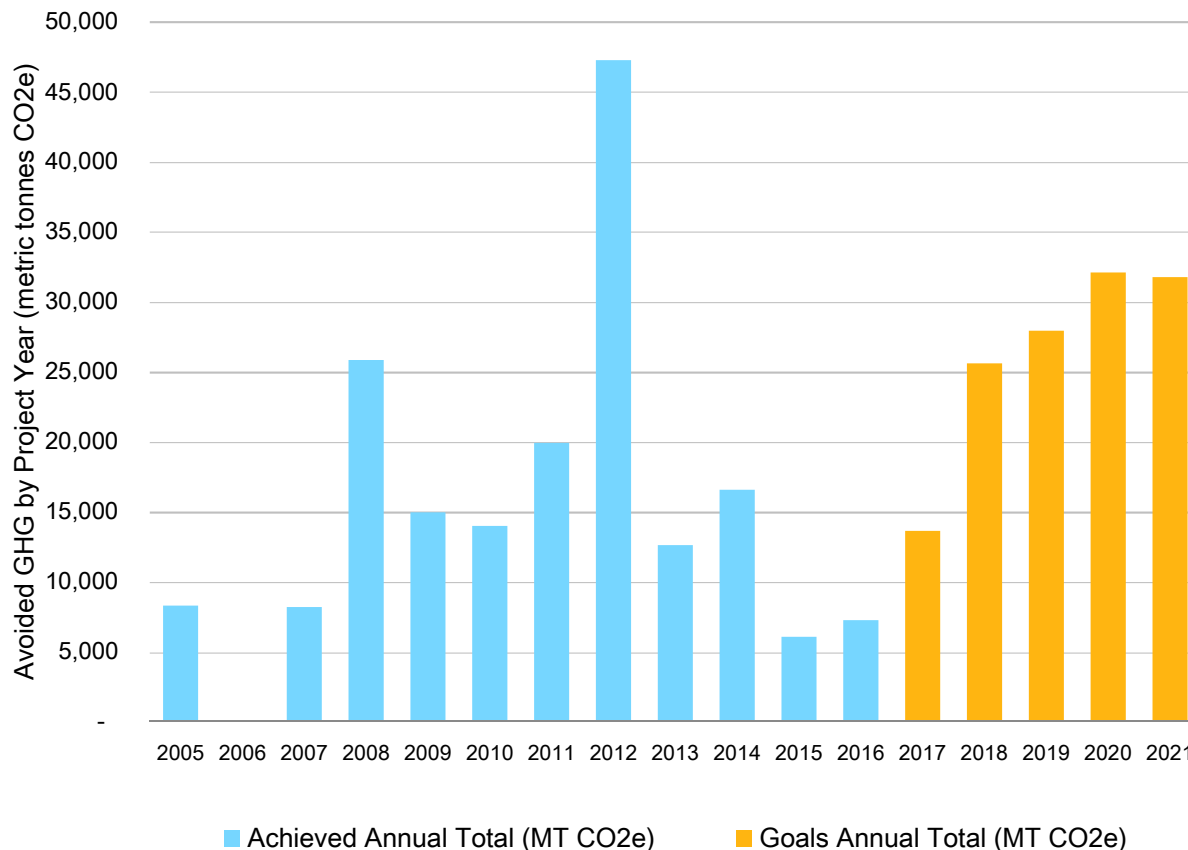


The university has less than 10 years to overcome many barriers to fulfill its carbon neutrality pledge. Among the most significant barriers for all locations are:

- **Competing demands and interests.** All campuses face competing demands and interests with limited budgets. Campus growth, seismic retrofit requirements and other campus needs are often prioritized before projects that would reduce carbon emissions beyond established requirements.
- **Lack of financing.** Even though many energy efficiency measures result in cost savings within five to 10 years, campuses have limited debt capacity and need financing mechanisms to cover the high upfront costs. Typically, neither the cost of carbon nor the life cycle cost savings are factored into cost analyses of retrofit or new building projects. Low-emission strategies thus often appear more expensive than they actually are. In other instances, given limited capital funds, the need to meet programmatic goals takes precedence over operational savings.
- **Variability of energy efficiency project volumes.** Although UC's overall carbon emissions are trending downward, there has been considerable variability in the volume of energy efficiency projects and resulting emission reductions year to year, as shown in Figure 4. Energy efficiency

project volumes have been decreasing since 2012. In 2016, carbon reduction from new energy efficiency projects was only about 15 percent what it was in 2012. UC must accelerate the pace of energy efficiency projects and sustain a higher reduction of emissions to gain adequate momentum to achieve carbon neutrality in 2025.

Figure 4: Historical Variability of Energy Efficiency Project Volumes by Year, and Goals through 2021



- Reliance on natural gas.** As described in the section on natural gas exit strategies, above, UC’s largest source of emissions is natural gas. Seven of our 10 campuses have heavily invested in natural gas-fueled combined heat and power plants (CHPs). Although natural gas is often considered a transition fuel for entities moving toward renewable energy, it still produces significant carbon emissions. We need cost-effective ways to transition away from gas-fired central plants, especially on the seven campuses with CHPs. The Carbon Neutrality Initiative provides a strong impetus for this, beginning with the TomKat Natural Gas Exit Strategies research. Making the transition will be an expensive undertaking.

- **Lack of information to support making carbon neutrality a priority.** We have found that the Carbon Neutrality Initiative is poorly understood. While campus leaders generally applaud the vision, they need more information to understand what steps they need to take to achieve the goal by 2025. Lack of clarity about how to reach carbon neutrality pushes this initiative down the priority list relative to other concerns.

Challenges Unique to Medical Centers

The university's five medical centers face unique challenges to reaching carbon neutrality while maintaining the quality and continuity of patient care in a highly regulated environment. UC's medical centers cover 150,000 inpatient visits and 4 million outpatient visits each year. Their organizational structures, financial circumstances and campus cultures reflect this mission and are consequently distinct from nonmedical campuses. Their teaching, research and patient care activities are inherently energy-intensive. Seismic retrofit requirements mean that all five medical centers must replace some of their hospital buildings before 2030, and most have already begun planning for these updates.

UC's medical centers operate under a centralized entity, UC Health, which provides a framework for them to collaborate, coordinate and integrate management initiatives. This structure, established in 2008, will be valuable in developing a systemwide approach to carbon neutrality challenges that are common to medical centers, including:

- **Patient needs.** Medical centers must place a priority on patient care, and programs that support carbon neutrality cannot interfere with the quality or continuity of care.
- **Regulatory requirements.** For the majority of their space, medical centers must comply with regulatory requirements specific to patient care facilities, including those set by the Office of Statewide Health Planning and Development (OSHPD). Regulatory requirements limit the types of energy conservation measures medical centers may pursue and also require that certain types of facility improvements, such as seismic retrofits, be prioritized. On the other hand, a large portion of medical center space is dedicated to administrative and other functions where carbon reduction strategies recommended for nonmedical campuses can be implemented.
- **Financial considerations.** Medical centers bring in substantial revenue from patient services, but they also incur high and increasing expenses that have outpaced revenue in recent years. In addition, energy efficiency projects in clinical settings may not match the returns provided by other medical center investments and may have higher costs or longer payback periods, since hospitals cannot be closed during energy retrofits.

For these reasons, the pace of change demanded by the Carbon Neutrality Initiative will be especially challenging for medical centers.

3. RECOMMENDATIONS

These recommendations reflect a year of work by members of our Task Force and many others. We have met regularly to explore the issues and barriers related to the 2025 carbon neutrality goal and to develop strategies for overcoming them. We created six workgroups to examine finance and funding, energy efficiency, new building projects, communication and change management, energy supplies and medical center issues relating to carbon neutrality. Each workgroup included Task Force members, staff from the Office of the President and additional subject matter experts. The workgroups researched the challenges and opportunities related to their focus area universitywide using various research methods, including surveys and interviews of campus administrators, operations personnel, students and faculty. Each workgroup had one month to prepare a presentation of findings and proposed recommendations for the Task Force. The proposed recommendations were then evaluated for their potential to eliminate significant barriers to achieving carbon neutrality by 2025. Those considered to be the most critical are presented in this section. Additional recommendations considered to be more easily implemented best practices, are included in Appendix I. Significant ideas that we elected not to recommend are outlined in Appendix III. Details of each workgroups' research and findings are in Appendices V through IX.

Where possible, for each recommendation, we have included critical funding and communication steps necessary for implementation. Many recommendations that apply to all locations include notes regarding special considerations for medical centers. We have listed medical center-specific recommendations in a separate section.

The recommendations are grouped by subject matter. However, we acknowledge the synergy among the recommendations and expect that implementation will be characterized by crossover and collaboration of effort so that the Carbon Neutrality Initiative becomes a technique for solving multiple challenges on campuses. We also emphasize that the way in which most recommendations are undertaken, and the organizational structures in place to accomplish them, should be left to each campus.

- Funding and Financing
- Energy Efficiency and Conservation
- New Buildings
- Communication and Change Management
- Energy Supplies
- Medical Center-Specific Recommendations

Funding and Financing

The university's budget model influences the nature of our recommendations for funding and financing. Historically, all revenue flowed to the Office of the President, which then allocated it to each of the campuses. Since 2008, however, revenues go directly to the campus from which they originated, and the Office of the President is funded through assessments on each of the campuses. There is no central pool of funds for major investments. Therefore, individual campuses must take primary responsibility for funding their investments, with support from the Office of the President in the form of financial planning tools, favorable financing policy, wholesale procurement, etc.

Funding concerns cut across all carbon reduction strategies. Campuses already employ multiple mechanisms to reduce costs of carbon abatement, fund energy efficiency projects and procure green energy, but they need more financial support to do everything necessary to achieve carbon neutrality by 2025. The following two recommendations are designed to improve funding for carbon abatement activities.

FF1. Integrate Purchased Utilities and Carbon Management as a Stand-Alone Financial Unit

We recommend that campuses integrate their purchased utilities and carbon management functions as stand-alone financial units.

This strategy is intended as an accounting mechanism, and the scope of this recommendation could vary considerably by campus. At the broadest example, campuses could elect to include all expenses associated with utility operations, cap-and-trade compliance, carbon reduction measures and the debt service for infrastructure capital costs. A minimal implementation might only include the creation of a revolving or spin-up fund to capture and reinvest the savings from completed energy efficiency projects.

This recommendation supports the prioritization of investments in energy and carbon reductions. The central idea is that revenue streams and cost savings from the implementation of energy efficiency and other carbon neutrality measures would be available to invest into additional efforts to reduce emissions.

To successfully implement this measure, campuses would need to set base budgets to cover the cost of current operating expenses. Ideally, campuses would also incorporate a planned escalation of the base budgets to reflect verified external inflation in electricity and natural gas prices or new campus growth. This budget-setting process would provide cost certainty to budget officers and staff responsible for energy management and carbon compliance.

This approach is intended to help increase the relative priority for funding carbon neutrality actions because it directly leverages carbon reduction activities that have early-stage operational paybacks (e.g., energy efficiency and coordinated energy procurement) to support activities that currently have a cost premium (e.g., biomethane). Currently, the savings from strategic energy contracting and energy efficiency programs are most typically directed to fill shortfalls in other operating budgets. UC Santa Cruz completed an Integrated Climate and Energy Study that demonstrated a positive net present value for

UC San Diego: Transition to a Stand-Alone Utilities Unit

UC San Diego plans to make its utility operation a stand-alone auxiliary unit in July 2017. As part of this plan, the campus will initiate a gradual transition toward a full-cost recovery rate model in which auxiliary operations are charged the local prevailing rates for utilities. Currently, UC San Diego's utility rates are lower than the surrounding community and do not include many of the associated costs, such as deferred maintenance, capital expansion and carbon compliance costs. Creating a stand-alone utility unit and bringing utility rates in line with actual costs will provide a new funding stream to address future utility needs. It will also enable UC San Diego to more easily fold carbon compliance into their energy program.

achieving carbon neutrality using an integrated portfolio approach. However, without the ability to capture some of the savings to fund the aspects of carbon neutrality that can entail increased costs, carbon neutrality can be viewed as purely a cost burden rather than a potential financial benefit.

By design, this approach places constraints on how campus budgets are managed. To be successful, top-level campus financial leaders, especially Vice Chancellors for Planning and Budget (VCPBs), would need to support this change. Adopting this approach sends a clear signal that carbon neutrality is a campus priority relative to other university objectives, and it provides a funding mechanism for implementing carbon neutrality strategies.

This is also one of the highest priority recommendations for medical centers, which face significant competing demands for their capital, many of which provide quick returns on investment. We recommend targeted programs to capture savings and fund further carbon neutrality efforts without directly competing against other high-return investments.

The UC-TomKat Carbon Neutrality Project, which was implemented concurrently with the Task Force's work, has made a similar recommendation. See "Strategies for Exiting from Natural Gas at the University of California," the report of the TomKat Natural Gas Exit Strategies Working Group to the TomKat Foundation, for a more detailed financial analysis.

FF2. Implement Internal Carbon Charges

We recommend that UC introduce carbon charges carefully, in broad stages that give campuses a high degree of control over their transition. First, we recommend establishing a standardized, systemwide shadow price for carbon to account for the financial and regulatory risks associated with greenhouse gas emissions and to prioritize the funding of actions to reduce those emissions. Then, once the shadow price is operationalized, campuses would be encouraged, as a best practice, to self-assess an internal carbon charge to incentivize carbon reduction and fund actions to further reduce greenhouse gas emissions.

Questions about a possible internal carbon charge garnered mixed responses in surveys conducted by our finance workgroup. The topic also generated substantial debate within the Task Force about whether such a charge should be introduced. Objections included the fact that implementing a carbon price across 10 campuses and five medical centers could prove administratively untenable. Additionally, charging for carbon increases the price of activities that are energy-intensive when the fuel in use is not renewable. Campuses are already facing financial constraints, making the addition of a carbon charge all the more controversial.

On the other hand, survey respondents and Task Force participants cited multiple arguments in favor of an internal carbon charge, including:

- It would incentivize campus actions to decrease carbon emissions based on cost avoidance, and it would help fund coordinated, off-campus carbon reduction actions.
- It would help to smooth the anticipated transition to higher carbon costs by gradually and voluntarily increasing funding in expectation of higher future carbon expenses.
- By internalizing what is now an external cost (i.e., future compliance costs), campuses can make the business case for investing in carbon neutrality-related campus improvements.

The Carbon Neutrality Initiative would benefit from a measured and collaborative approach to developing a carbon pricing program that addresses the needs and concerns of its diverse infrastructures and its research and teaching activities.

A handful of other organizations have implemented carbon charges, including Princeton, Swarthmore and more than 150 major companies. Chile has approved a carbon tax beginning in 2018, British Columbia has a revenue-neutral carbon tax, and the U.S. Environmental Protection Agency has published a social cost of carbon in the \$11–\$105 per metric ton range.

With all these considerations in mind, we recommend structuring the transition to carbon charges as follows:

First, Systemwide Shadow Pricing

As the first step toward internal carbon accounting, we recommend establishing a shadow price for carbon. A shadow price for carbon supports sound long-range planning. It would be included to account for carbon impacts in project plans and proposals and would facilitate life cycle cost analysis (discussed in the New Buildings section below), but campuses would not actually assess the charge to projects with carbon costs.

We intentionally set aside detailed discussion of the actual shadow price. A body of work remains to determine what the shadow price should be and how it should be implemented. Generally, it should start relatively low, similar to the floor price for cap-and-trade (currently \$12 to \$13 per ton), then escalate over time. A useful model for this practice is Swarthmore College, where the use of shadow pricing has encouraged capital planning decisions with climate resilience in mind. Swarthmore uses a starting price of \$40 per MTCO₂e, which they plan to revisit and revise annually.

Then, Campus Self-Assessment of Carbon Costs

Once campuses operationalize the shadow price and have experience with it, we recommend that campuses self-assess internal charges on their actual campus carbon emissions and use the proceeds from those funds to implement carbon reduction measures.

In the absence of a clear systemwide consensus, our recommendation for an internal carbon fee program is proposed as a best practice. We are hoping to have one or more UC campuses provide the leadership to implement their own carbon charge programs, refine the approach and build support. We do not currently propose this as systemwide policy.

What is shadow pricing?

“Shadow pricing is a method of investment or decision analysis that adds a hypothetical surcharge to market prices for goods or services that involve significant carbon emissions in their supply chain. ... Shadow prices can apply in all sorts of analyses of investments, procurements and other strategic decisions to give an edge to options that are more emissions-efficient, other things being equal. By analyzing capital expenditures and other important corporate plans with an eye to future regulatory or tax conditions, firms can manage the economic risk of a carbon-constrained future. ... This is particularly important for companies that invest in energy-intensive long-lived facilities. ... Second, shadow pricing is a concrete way to signal ... a firm ... commitment to climate change mitigation.” (Source: Brookings Institution)

A shadow price is a modeling tool used for financial analysis and decision making. It differs from an internal carbon charge, which is an actual surcharge based on emissions associated with delivered electricity and gas.

If implemented, internal carbon charges would apply to the core campuses, medical centers and auxiliaries based on utility spending. The university could apply the carbon assessment based on the actual emissions associated with the delivered electricity and gas. Zero emissions supplies such as the electricity from the Wholesale Power Program would not be assessed a charge. For auxiliary units, this could be implemented by adding a surcharge to the internal recharge rates for gas and electricity. As with the shadow price, any implemented carbon charge should start with a relatively low price, similar to the floor price for cap-and-trade. Each year thereafter, the university should estimate the price and provide an annual true-up to adjust cost factors. Over time, the charge should escalate. At this time, it is not practical to apply it at the college/departmental level, primarily because many campuses do not separately charge for and track energy use.

In addition, it would be advantageous for one or more early-adopter campuses to pilot internal carbon charges before a broader implementation is considered. The adoption of internal carbon charges would logically be implemented after a campus has integrated utilities and carbon compliance in a stand-alone cost center per the previous recommendation.

Energy Efficiency and Conservation

Our recommendations emphasize energy efficiency because energy efficiency is a clear-cut pathway to cost-effective reductions in greenhouse gas emissions. In addition, energy efficiency reduces utility expenditures and addresses deferred maintenance backlogs. Energy efficiency strategies build on UC's extensive expertise in this field.

The deferral of capital expenditures for campus energy infrastructure is significant. As buildings across a campus undergo deep energy retrofits, the aggregate demand on centralized chillers, pumps, cooling towers, boilers, turbines and solar arrays is reduced considerably — to an extent that can avoid or defer capital expansion of these costly infrastructure elements. Additionally, when the bonds that finance energy retrofit projects are fully repaid, the net savings derived from these projects will increase dramatically. The energy retrofit projects financed by UC in 2010 will be paid off in 2025, which will coincide with costs of decarbonizing energy sources that are being essentially deferred until then.

Historically, building energy systems have been based on worst-case parameters for occupancy, airborne hazards and environmental conditions. Older systems also run at constant rates, wasting massive amounts of energy. Making such systems “smart” is a demonstrated best practice on UC campuses. It involves the use of sensors and software in buildings to create a precision energy delivery system in which just the right amount of energy is sent at just the right time to just the right location. This approach is equally applicable to new construction and existing buildings.

Data from many completed energy retrofit projects demonstrate that entire campuses and medical center nonacute facilities could attain 50 percent or more improvement in energy efficiency from their pre-SEP baseline through a comprehensive program of energy retrofits. This is, by far, the most cost-feasible way to take the largest bite out of any campus or medical center carbon footprint.

A significant barrier, however, is how to access sufficient capital for deep energy efficiency projects. Respondents to our Energy Efficiency Workgroup outreach expressed a strong need for a financing tool

that provides access to a reasonable cost-of-capital while avoiding debt-capacity issues and competition with academic programming priorities. They also stressed that staffing for energy management programs is well below what is needed to plan, implement and maintain advanced building energy systems.

The following recommendations are intended to help campuses better prioritize energy efficiency measures and facilitate funding and staffing.

EE1. Develop a Comprehensive Funding Plan for Energy Efficiency Projects

We recommend that the Office of the President integrate energy efficiency into systemwide financing considerations and work with campuses to help develop funding strategies for energy efficiency projects.

This recommendation addresses three important issues related to funding energy efficiency projects on campuses and medical centers: (1) long payback cycles, (2) limited debt capacity and (3) competing budget demands. At present, no comprehensive plan exists to address the relationship between these issues and energy efficiency.

A comprehensive financing plan will assist the university, campuses and medical centers in navigating the complex financing landscape and will open up new energy efficiency financing options.

The following approaches would help campuses implement deep energy efficiency programs that support carbon neutrality:

- **Adjusting the SEP debt service coverage ratio requirement.** Debt-capacity is a significant issue for many campuses and all medical centers. Historically, only portfolios of projects that provided avoided costs greater than or equal to 115 percent of the projected debt service have been implemented. Given the significant co-benefits of energy retrofit projects, such as addressing deferred maintenance on all the components of building energy systems, it could be argued that any projects with a net payback should be implemented. In addition, the reduction of carbon emissions and anticipated future carbon costs could be factored into financial feasibility.
- **Quantifying and including co-benefits of energy efficiency in financial analysis.** As part of the energy master planning process, a best practice would include estimating those co-benefits of energy efficiency that can be quantified so that the financial benefits of energy efficiency become evident. The estimated avoided costs could be displayed for all retrofit projects alongside a carbon-reduction benefit at a significant number, e.g., \$40/MT.
- **Matching financing terms with energy infrastructure lifespans.** Deep energy efficiency building retrofits frequently involve replacing systems with long lifespans, such as motors, transformers, fans, etc. The financing terms should match the useful life of the projects being financed.

EE2. Improve Staffing for Energy Efficiency Programs

We recommend that campuses recruit more staff as needed to ensure the successful implementation and operation of their energy efficiency projects.

A major impediment to successful implementation of energy efficiency projects across campuses is the low number of qualified project delivery staff and operations personnel. Almost every campus has fewer than the recommended 0.6 to 1.0 permanent full-time energy management staff per million square feet of space. Adequate numbers of qualified staff are needed to plan, implement and operate facilities that have advanced, high efficiency energy systems. Without qualified staff, campuses cannot realize the full potential for emission reductions and energy and cost savings over the life of the project. Added staff would be paid for by energy efficiency savings, which could become more readily available when an integrated utility purchasing and carbon management unit is established as described in the recommendation above.

EE3. Track Campus and Medical Center Energy Efficiency Goals

We recommend that the president and chancellors review progress toward energy efficiency goals on an annual basis.

A program to track and report progress toward energy efficiency goals at the highest organizational levels of the university will raise awareness while increasing accountability for aggressive energy efficiency goals. It will elevate energy efficiency programs among other priorities while also providing a means to identify best practices that can be replicated across campuses.

We discussed, but did not reach consensus about, whether UC should institute new policies to establish specific targets for reductions in energy consumption. While many Task Force members assert that minimum reduction targets are essential to achieve carbon neutrality, others point out that some campuses confront more barriers to energy efficiency than others, making a required minimum unfairly burdensome.

A case study in collaboration: UC's Million Lamp Challenge

UC campuses purchase large quantities of light bulbs, including incandescent and compact fluorescent (CFL) bulbs. Incandescent bulbs, first patented in 1879, are known energy-wasters. CFLs, a lower energy bulb developed in the 1970s in response to energy shortages, have been bested by ultra-efficient lamps made from light-emitting diodes (LEDs).

Recent technology developments, in combination with California's regulatory environment, have made exceedingly high-quality, low-energy LEDs widely available to replace incandescent bulbs and CFLs.

UC researchers and administrators are planning a systemwide lamp conversion program that will make the use of LED lamps universal across the UC campuses. This project has enormous potential for energy savings, waste stream mitigation and maintenance cost reduction.

The Million Lamp Challenge was initiated by the California Lighting Technology Center (CLTC) under the guidance of CLTC director Michael Siminovitch, in collaboration with Jeremy Meadows, associate director of Strategic Sourcing, and Eric Eberhardt, director of Energy Services, at the Office of the President. Their consultations with campus procurement officers and lighting buyers have been extremely supportive. They have determined that the scale of the procurement, coupled with the CLTC's longstanding relationships with lamp manufacturers, is likely to result in the university purchasing LED lamps at close to the manufacturers' cost.

At the campus level, support for funding and staffing of energy efficiency projects must come from campus leadership. For the Carbon Neutrality Initiative to succeed, campus leaders will need to actively support certain best practices, including:

- Providing sufficient staffing levels for energy management;
- Ensuring highly qualified energy management staff through hiring practices and professional development programs;
- Empowering energy management teams to be proactive in initiating and implementing energy efficiency measures; and
- Requiring campus participation in coordinated systemwide energy efficiency programs and projects.

Tracking energy efficiency goals will impart a clearer picture of all the benefits of energy efficiency, giving campus leaders a stronger incentive to prioritize these programs and empowering their teams to implement them.

This is also one of the most important recommendations for UC medical centers. Developing energy efficiency goals specific to each medical center and recording annual progress toward them will be a necessary step toward making these projects a priority at all UC medical centers.

EE4. Create Systemwide Collaborative Projects

We recommend that the Office of the President develop a range of optional programs to help campuses advance their energy efficiency projects.

All UC campuses have many energy efficiency and resource conservation needs in common. The planning, budgeting and contracting process can be streamlined, and implementation costs significantly reduced, if common energy efficiency support programs are coordinated. Staff in the Office of the President can help to facilitate this work and take action as directed by the campuses. In addition to cost savings, this approach will enable campus energy managers to focus on campus-specific refinements while more “generic” contracting and procurement tasks are managed collectively. The goal is to develop a range of programs that support campus needs with participation being entirely optional.

Medical centers will also benefit from systemwide collaborative energy efficiency projects coordinated through UC Health and tailored specifically to patient care environments.

New Buildings

The most cost-effective way to avoid emissions from campus growth is to use existing building space more effectively. Even with the most efficient use of existing space, however, new buildings will be necessary as the university continues to grow. To achieve carbon neutrality, carbon impacts must be factored in at each step of the capital planning, design and construction process. In addition to the energy-related and financial planning recommendations above, this will require:

- establishing net-carbon-neutral design standards for new construction;
- adopting stronger energy design standards for buildings;

- offering incentives to prioritize aggressive energy efficiency strategies;
- understanding the life cycle costs of design decisions; and
- easing funding constraints for projects that have delayed savings.

Our three recommendations for new buildings are intended to embed deep carbon reduction into new building planning, design and construction processes. They represent a range of options to achieve these goals. Additional data and discussion are needed to settle on a consensus recommendation, but our Task Force’s position is that any changes of this type should be adopted as firm systemwide policies. We defer to the systemwide Sustainability Policy Steering Committee for specific implementation details.

NB1. Prioritize Net-Zero Carbon for New Buildings and All-Electric Designs for New Housing

We recommend that the Sustainability Policy Steering Committee evaluate ways to modify the university’s building policies to include requirements for net-carbon-neutral or net-carbon-positive new buildings and all-electric designs for housing projects.

Net-carbon-neutral buildings emit net-zero carbon, and net-carbon-positive buildings actually decrease overall carbon emissions from a campus. In addition, such facilities offer significant educational, inspirational and promotional value to UC campuses. All-electric buildings that rely on energy from 100 percent renewable sources are carbon neutral without requiring additional energy conservation measures or offsets. Buildings powered by energy from nonrenewable sources may require carbon emissions to be offset by emission reduction measures elsewhere, on or off campus, to achieve net-carbon neutrality.

All-electric design is typically financially feasible for buildings such as housing facilities, but may be more challenging for energy intensive laboratories and medical centers. Therefore, we recommend the development of new university policy requiring all-electric designs only for new housing facilities as a step toward net-carbon neutrality in new buildings.

The question of whether to recommend a net-zero carbon requirement for all new buildings was a source of considerable discussion among Task Force members. To reach carbon neutrality, all new buildings will need to be, at minimum, net-carbon-neutral. However, accomplishing new buildings with net-zero carbon emissions, even when calculated at the campus scale, could require additional funding that many campuses currently do not have in their capital project budgets. In addition, such a requirement would disproportionately affect campuses that require more new laboratory or hospital facilities, which are energy-intensive.

The need to balance increasingly stringent building energy performance standards and up-front costs is a core challenge to reaching carbon neutrality by 2025. We know it can be done because there are examples on every campus where talented design teams have minimized the costs of energy-efficient “net-zero carbon-ready” buildings through integrated design.

An example of how a campus can grow without increasing total energy consumption can be found at UC Davis. This campus has combined rigorous energy efficiency standards for new buildings with aggressive energy efficiency retrofits on existing buildings. The campus now uses less energy than it did 20 years ago, despite tremendous building growth during the same period.

We ask that the Systemwide Sustainability Policy Steering Committee further evaluate how to implement net-carbon-neutral or net-carbon-positive requirements for new buildings, then make a recommendation for how best to address this through university policy. In support of this recommendation, Point Energy Innovations recently developed energy models for UC's primary building types and climate types to analyze the energy and cost implications for several design options. UC's Carbon Neutral Buildings report provides a framework for project-specific decisions.

NB2. Strengthen Energy Performance Standards and Incentivize Low-Energy Design

We recommend that the Sustainability Policy Steering Committee consider strengthening the UC-wide energy performance standards for new construction to include more aggressive energy conservation and carbon reduction/elimination measures.

Typically, capital costs and budget constraints associated with the program for a capital project drive planning and design decisions. Budget pressures often lead to value-engineering energy efficiency measures out of projects due to their higher up-front cost, even if the energy savings will pay back over time. Ironically, brand new buildings can become prime candidates for energy efficiency retrofits if energy efficiency measures are dropped up front. Unless required to consider carbon impacts, planners, designers, chancellors and regents are unlikely to prioritize design characteristics that may increase immediate costs even if they promise long-term operating cost savings. We have concluded, therefore, that any recommendations for energy performance targets beyond those currently required by university policy would also need to be enshrined as policy to signal them as a nonnegotiable priority. A majority of the campus design professionals we surveyed stated that recommending more aggressive energy performance targets for carbon neutral buildings simply as a best practice would not likely lead to any change from current practices. Instead, these targets must be a requirement.

The university can further encourage high energy performance design by prioritizing design-build teams that exceed energy efficiency design standards. For example, UC Irvine uses performance goals and metrics to create incentives for design-build teams to present cost-effective, energy efficient designs. In their proposal evaluations, they give bonus points for plans that meet "stretch goals" for energy efficiency and on-site solar production, exceed the campus's required LEED Gold standard to meet the LEED Platinum standard and outperform Title 24 by more than the minimum required 20 percent. This process has resulted in projects that have generated savings up to 50 percent below Title 24. UC Irvine's design team selection criteria also emphasize capabilities in high-performance design that features low-energy use over the life of the project.

The UC system can further promote high energy performance design by addressing existing Energy Use Intensity (EUI) targets and developing new targets for new medical center facilities. In particular, new acute care facilities are currently exempt from EUI targets under the UC Sustainable Practices Policy. To comply with upcoming seismic retrofit requirements, all five medical centers will have to replace some of their hospital buildings before 2030 and have already begun planning for these updates. EUI targets for these new buildings need to be developed immediately to ensure they're incorporated into the planning and design process.

NB3. Base Capital Project Design Decisions on Life Cycle Cost Analysis (LCCA)

We recommend that the Sustainability Policy Steering Committee consider adopting a new policy requirement that major capital project design decisions be based on life cycle cost analyses that take into account future energy and carbon costs.

Life cycle cost analysis (LCCA) takes into consideration the cost of a project from construction through end-of-life. It is used to forecast the “total cost of ownership” of a project, rather than limiting budget evaluations to the immediate cost of construction. LCCA can and should include carbon footprinting, the cost of energy and energy system operations and at least a shadow price for carbon. LCCA enables designers and decision-makers to see the long-range savings that result from an energy-focused design standard.

The State of California has mandated that all state agencies use LCCA in evaluating and comparing infrastructure investments and alternatives. (Exec. Order. B30-15). Although the University of California is not directly subject to it, the mandate reflects the growing industry trend toward incorporating LCCA into decision processes. For instance, Stanford University has required LCCA since 2005 for all of its capital projects. Drawing on more than a decade of implementing its LCCA policy, Stanford has an LCCA library that allows project managers to consult past building studies and metrics. Its LCCA policy includes specific approval thresholds, including automatic approval for design measures that have a payback period of less than five years.

A downside of LCCA is the concern that project designers might try to “game the system” by defining life cycle metrics to their advantage. UC Irvine models a variant of the LCCA approach that prevents this possibility. UC Irvine has adopted Construction Quality and Cost Standards that inherently express life cycle costs, and these standards are applied consistently across all construction projects. By requiring projects to meet these standards, UC Irvine avoids the concern that some low-life-cycle cost but less critical features might be prioritized over other more important features. Together with its design-build performance standards and design team selection criteria, this system has enabled UC Irvine to double its square footage without increasing its energy consumption.

Although a minority of Task Force members oppose mandating LCCA for every major capital project, the majority considers this mandate necessary to reach carbon neutrality by 2025. The majority also supports the development of an LCCA Guide, similar to Stanford University’s guidelines, to facilitate the incorporation of LCCA into decision-making. A key for successful implementation will likely be to establish additional funding sources beyond existing capital budgets (e.g., from carbon assessments or revolving funds). Done properly, this recommendation puts UC on a better long-term financial footing.

Communication and Change Management

CM1. Position Carbon Neutrality as a Campus and Systemwide Priority

We recommend working with the TomKat Communications Strategy Working Group on deep communication strategies that will energize the university community and elevate carbon neutrality as a priority.

The Carbon Neutrality Initiative presents unique communication challenges. It is an ambitious effort whose ultimate goal, carbon neutrality, is perceived as important and daunting. At the same time, the goal is not well understood, and some view “neutrality” as rhetorically uninspiring. As a result, the goal of carbon neutrality by 2025 is not fully embraced by all those who need to prioritize it in order to be successful.

Energy cost-savings and co-benefits, carbon charges, new funding opportunities and stronger university policies provide important incentives for prioritizing carbon reduction projects. But these actions need to be embraced at the campus level. Top-down approaches to implementing them will likely not succeed. Therefore, a significant challenge for the initiative will be to weave carbon neutrality into our institutional culture and processes in such a way that it is consistently factored in alongside campuses’ many competing priorities. Making such a shift will require understanding and addressing organizational structures, behaviors, attitudes and expectations that inhibit or enable the adoption of new ideas. It must be a collaborative effort by all campuses that addresses the unique perspectives and resources of each location. This type of communication research and planning is beyond the scope and expertise of the Task Force. Fortunately, the Carbon Neutrality Initiative has the ability to draw from UC social sciences research that can inform our ability to move collectively toward carbon neutrality as a shared goal.

For intensive communication research and recommendations that support carbon neutrality, we are relying on the TomKat Communications Strategy Working Group. This group includes more than 20 faculty, students and practitioners from across UC campuses and the Office of the President who have expertise in communications, behavioral psychology, journalism, political science and education. The Communications Strategy Working Group is assessing current communication practices at UC and other institutions and utilizing audience research, system mapping, theory of change and other techniques. They will develop new messaging and branding strategies and prototype a set of communication tools tailored to the UC Carbon Neutrality Initiative. They will be filing their report in early September 2017.

Our communication recommendations are intended to help lay the foundation for the communication strategies being developed by the TomKat Communications Strategy Working Group.

CM2. Emphasize the Connection to the UC Mission

Messaging should emphasize the relationship of the Carbon Neutrality Initiative to the UC mission and promote faculty, student and staff involvement in refining solutions that will meet campus needs.

Faculty outreach by the Task Force elicited comments regarding the connection of the Carbon Neutrality Initiative to UC's mission, including:

- “UC is on the cutting edge of climate change research, therefore it is important we leverage that research for the betterment of society.” (Matthew Barth, professor of electrical and computer engineering, UC Riverside)
- “The Carbon Neutrality Initiative will demonstrate how a complex system — one that not only educates more than 230,000 students but also operates five medical centers, runs 11 police departments, manages multiple housing complexes, constructs and maintains sophisticated research labs and more — can reduce its carbon footprint to zero and in doing so provide leadership, know-how and experience to the rest of the world.” (Ann Carlson, Shirley Shapiro Professor of Environmental Law and Faculty Co-Director of the Emmett Institute on Climate Change and the Environment, UCLA School of Law)
- “The UC Carbon Neutrality Initiative aligns perfectly with the core mission of these world class academic institutions. Our research and educational accomplishments influence campus practice and policy, and our campus culture and physical space provides a real world laboratory for examining changes suggested from that research.” (Thomas Peterson, provost and executive vice chancellor, UC Merced)
- “The Carbon Neutrality Initiative is critical to the future leaders and global problems solvers we are training in the UC system.” (Sandra Brown, vice chancellor for research and a distinguished professor of psychology and psychiatry, UC San Diego)
- “The Carbon Neutrality Initiative efforts embody the university’s mission through teaching about climate change, researching renewable energy sources and efficiencies and engaging the community in actions to reduce carbon emissions.” (Juan Gonzalez, vice chancellor of student affairs, UC San Diego)
- “As a public university, UC has a central and pervasive mission to discover and advance knowledge to serve society. ... These obligations demand that we focus our education, research and public service on enabling sustainable paths for the state, nation and global community.” (Roger Bales, distinguished professor of engineering, UC Merced)

“In the face of the existential challenge posed by climate change in our students’ lifetimes, intergenerational equity and climate justice align with the common core of the UC’s mission toward our students — the future leaders of California’s communities — and should therefore be placed at the center of the goals of the Carbon Neutrality Initiative. This initiative, like the UC itself, is a commitment to foster the leadership potential of this generation in service of future generations.”

*John Foran, professor of sociology,
UC Santa Barbara*

Students also make a clear connection between the initiative and the university’s core mission, as shown in these survey responses from Carbon Neutrality Initiative student fellows who participated in our research:

- “The initiative directly interacts with every facet of the mission statement.”
- “The initiative is about integrity, moral values and the legacy for future generations — that aligns with the core UC mission.”
- “Campuses are becoming living laboratories through the initiative.”
- “CNI can demonstrate how decarbonization efforts can be pursued by a large, complex organization, and its lessons are applicable and scalable to the state of California as a whole and even globally.”

CM3. Engage the Support of the UC Regents

The Task Force believes that the UC Regents will benefit from a “deep dive” presentation on the Carbon Neutrality Initiative and the recommendations of this report at an upcoming regents meeting.

As leaders of the university and as statewide thought leaders, it is critical that the regents are able to articulate the business case and value of the Carbon Neutrality Initiative and the recommendations of this report. Since many capital plans and funding mechanisms rely on the support and approval of the regents, they need to have a better than average understanding of the scope of the initiative and the strategies necessary to reach carbon neutrality by 2025.

Providing a presentation on carbon neutrality at an upcoming regents meeting is the recommended next step for keeping them informed. The goal of the presentation will be to help them better serve and represent the university by ensuring that carbon neutrality is factored into the university’s major planning and financial decisions going forward.

In addition, the Task Force plans to develop a presentation about the challenges facing medical centers for the Regents’ Health Sciences Committee. Because the medical centers face unique challenges, it is essential that the regents are well informed of these specific barriers and how to help overcome them.

CM4. Continue Support for Faculty Engagement in the Initiative

Consistent with the university’s mission and its principle of shared governance, we recommend continuing the strongest possible support for the Faculty Engagement and Education Working Group and the Applied Research Working Group of the Carbon Neutrality Initiative.

Broad-based faculty engagement is key to establishing carbon neutrality as a core value and campus priority. The Task Force believes that continued support for the Faculty Engagement and Education Working Group and the Applied Research Working Group is consistent with the university’s teaching and research mission and the principle of shared governance, and necessary to achieving carbon neutrality.

To date, many important faculty engagement programs have come out of the Carbon Neutrality Initiative. Campuses have named faculty climate champions to showcase engaged research and innovation in applied climate education. Curriculum-building workshops involving faculty from more than 160 different academic units have facilitated the inclusion of climate change and sustainability into existing courses. A systemwide online climate and sustainability education resource library has been created for rapid dissemination of teaching resources. They have placed UC into a new national network of centers for sustainability in the curriculum and convened a statewide network of 33 UC and CSU faculty members

mobilizing for transformational carbon neutrality education at the K-12 level as well as the college level. In addition, a Climate Solutions Course is expected to be offered at all undergraduate campuses in 2017.

The Global Climate Leadership Council's Applied Research Working Group has produced several projects to engage faculty and students in research contributing to carbon neutrality, including the Water-Energy Nexus workshop (spring 2015), the Bending the Curve Summit (fall 2015), the UC-Industry Battery Workshop (fall 2016) and the UC-TomKat Carbon Neutrality Project (in process).

CM5. Recognize and Facilitate Students in Advancing the Carbon Neutrality Initiative

Student participation is critical to the success of the Carbon Neutrality Initiative. Students tend to be early adopters of innovation, and UC students have a long history of driving institutional and social change. In addition to shaping and advancing the Carbon Neutrality Initiative, students gain invaluable educational benefits from applied research, committee work and leadership opportunities they are involved in.

Despite involving students in every aspect of the Carbon Neutrality Initiative, including this Task Force and its work groups, our research revealed that students who care deeply about the initiative can sometimes feel distanced from administrative decision-makers or unappreciated for activism that is motivated by the same values the initiative promotes. We suggest the following approaches to engage students and ensure that they understand the important role they play in achieving the university's carbon neutrality goal.

Provide Ongoing Support for Carbon Neutrality Initiative Student Fellowships

We recommend providing ongoing support for the UC President's Carbon Neutrality Initiative Student Fellowship Program.

The UC President's Carbon Neutrality Initiative Student Fellowship Program funds student-generated projects that support the carbon neutrality goal. Begun in spring 2015, the program is open to undergraduate and graduate students and administered at each location to ensure that student efforts align with local needs. This program exemplifies the initiative's connection to UC's teaching mission and also fosters strong student leadership for the initiative.

Sponsor Student Forums with GCLC Members

We recommend hosting campus-level forums with participation by Global Climate Leadership Council members to give students a direct voice and connection with UC's carbon neutrality leadership.

Students have indicated that they do not have enough access to campus administrators and the Office of the President. A series of campus-level student forums would help inform and engage students. By ensuring that appropriate GCLC members attend, the Office of the President can bridge a perceived gap between student voices and campus and university leadership.

Acknowledge the Student Influence in Fossil Fuel Divestment Decisions

We recommend exploring appropriate ways to acknowledge, engage and support student organizations that are urging the university toward divestment in fossil fuels.

Fossil Free UC is a student coalition that advocates for investment in “community-led solutions and the low-carbon economy.” It has called on the university to divest all of its fossil fuel holdings and reallocate assets toward sustainable energy sources. In 2015, when the university sold off its \$200 million in coal and oil sands investments, Fossil Free UC acknowledged this as only a “partial win.” The leader of the group said in a press release: “This is a hard-fought victory for students ... who have been demanding the (sic) UC truly live up to its big talk on climate change.”

Fossil Free UC, and other student groups and individuals committed to fighting climate change, will continue to be a vocal and engaged presence, holding the university accountable to its expressed values and goals. These highly energized students should be acknowledged, engaged and supported to ensure that they are positive thought leaders in the Carbon Neutrality Initiative.

CM6. Continue Programs that Reward Energy Savings and Other Behaviors that Reduce or Eliminate Carbon

We recommend continuing to sponsor programs, such as the Cool Campus Challenge, that educate, encourage and reward individuals and groups for adopting behaviors that reduce their individual and collective carbon footprint.

Sociological research demonstrates that attitudes tend to be driven by behavior, not the other way around. Many studies show that if you get people to do one small action, their engagement increases significantly. Therefore, it is important to give members of the university community concrete actions in support of carbon neutrality.

The first Cool Campus Challenge engaged tens of thousands of students, faculty and staff across all 10 campuses in taking action to reduce their carbon footprint. We recommend repeating the challenge with new outreach strategies and objectives to build on that success. We also recommend that organizers of such events develop reasonably accurate metrics in order to reward participants appropriately and also provide reliable data for reporting and communication purposes.

Many campuses have ongoing programs to motivate individual and departmental action toward energy savings and carbon reduction. Examples include UC Davis’s Campus Energy Education Dashboard, and its Green Leaf Awards and Aggie Green Pledge. The green lab certification programs that are now required by UC policy also have the potential to scale up for significant carbon savings.

Energy Supplies

How campuses source their energy dramatically affects their carbon profile. Each campus requires a different energy mix and faces different challenges relating to funding, campus activities, staffing resources, growth, etc. Our recommendations for energy supplies are intended to serve the individual needs of campuses while also supporting proven collaborative strategies that offer carbon reduction potential with significant cost-savings.

ES1. Factor Energy Planning into Campus-Specific Climate Action Plans

We recommend that the Sustainability Policy Steering Committee modify existing policies to better integrate energy planning into campus-specific existing Climate Action Plans and ensure that carbon and energy considerations are integrated in Long-Range Development Plans.

As each campus embarks on the transition to net-zero carbon operations, campus-specific energy master planning can help guide energy procurement and generation decisions. Rather than add a new planning requirement to campuses' already-stretched resources, we recommend augmenting Climate Action Plans (CAPs) to include energy planning that supports decision-making related to achieving carbon neutrality.

Since December 2008, all UC campuses have been required to maintain CAPs as part of achieving the following emission reduction targets:

- a) year 2000 levels by 2014
- b) 1990 levels by 2020.

The CAPs were updated in 2016, but additional work is needed to map out campus-specific actions for achieving carbon neutrality by 2025. Subsequent updates to our CAPs should be an integrated element of campus long-range development plans and facilitate decisions about the balance between direct emissions reductions from new buildings and offsets from energy reductions elsewhere on a campus.

The transition away from fossil fuels will be feasible in the near future for some campuses, but for others it will be a longer-term project. For campuses that operate natural gas-powered combined heat and power plant facilities, moving away from fossil fuels will take longer and be more costly. Biomethane could serve as a bridge fuel. We optimistically hope that researchers can eventually develop cost-effective systems to capture and sequester carbon emissions from central plants, which would help accelerate progress toward carbon neutrality.

ES2. Continue and Expand Existing Energy Supply Programs

We recommend continuing and expanding on-site renewable energy, the Wholesale Power Program, the Biomethane Program and the Cap-and-Trade Program.

On-Site Renewable Energy

Generating renewable energy on campus lands or buildings is a proven and cost-effective way to reduce greenhouse gas emissions relative to the purchase of grid power. Since most of the barriers for these solutions have already been addressed, we did not evaluate or make formal recommendations regarding on-site renewables. However, we encourage all campuses to continue implementing such projects wherever feasible. Some stakeholders have suggested a more coordinated approach to contracting for these projects, perhaps led by the Office of the President, depending on the scale and number of future projects.

Wholesale Power Program

UC's Wholesale Power Program has proven effective and popular with the participating campuses. Expanding it would allow for more direct control of UC's energy and would facilitate an earlier shift to renewable sources. The challenge is that expanding wholesale power service to campuses that do not have Direct Access rights would require legislative action to reopen the Direct Access program or to

enable Community Choice Aggregation (CCA) provisions to apply to the UC system. CCA allows local governments to procure electricity for customers within their boundaries in an arrangement similar to direct access service. UC Davis has a unique contract with the Western Area Power Administration (WAPA) that might allow them to be directly served by UC's Electric Service Provider (ESP). Campuses not directly served by UC's ESP could still take advantage of its programs to reduce reported campus emissions. For example, Riverside Public Utilities has agreed to accept Renewable Energy Certificates that UC Riverside purchases through the ESP, as a means to reduce the carbon footprint associated with the campus's electrical use. Similar strategies are possible for other campuses, including UCLA.

Biomethane Program

The existing Biomethane Program is functional, though it remains controversial due to cost and the nature of the projects that generate biomethane. We did not address those issues in detail, but we are comfortable with the governance model that is in place for the program, which requires campus administrative executives to review and approve all major procurement decisions.

Cap-and-Trade

As UC develops strategies to make investments in off-campus carbon abatement actions through the purchase of offsets, the scope of the Cap-and-Trade Steering Committee might logically be expanded to support those purchasing decisions. Centrally coordinated actions will continue to ensure optimization of prices and transactional costs.

ES3. Develop A Coordinated Approach to Natural Gas Purchases

We recommend that the Office of the President develop a systemwide, coordinated approach to natural gas purchases.

The university currently purchases the vast majority of its natural gas through California's Department of General Services (DGS). Campuses independently make purchasing decisions that are implemented by DGS. The historical price spread among the campuses has been quite large due to varying market philosophies and/or perceived risk profiles. By developing a coordinated approach to natural gas purchases, the Office of the President could help leverage systemwide resources to decrease long-term costs. In addition, savings or cost avoidance from this approach can be redirected to other actions that reduce carbon emissions. Our medical centers have expressed particular interest in this approach because UC Health already promotes this type of action. This program is envisioned as a cooperative program staffed by the Office of the President under the direction of campus leaders, likely through expansion of the Energy Services Unit Governing Board.

Medical Center-Specific Recommendations

Many of the above recommendations apply to UC medical centers as well as campuses. The medical center leaders we consulted while developing this report listed six as high priorities:

- Integrate Purchased Utilities and Carbon Management as a Stand-Alone Financial Unit
- Track Campus and Medical Center Energy Efficiency Goals
- Develop a Comprehensive Financing Plan for Energy Efficiency Projects
- Create Systemwide Collaborative Projects

- Strengthen Design Standards and Incentivize Low-Energy Design
- Engage the Support of the UC Regents

Other campus recommendations that also apply to medical centers include:

- Implement an Internal Carbon Charge
- Factor Energy Planning into Campus-Specific Climate Action Plans
- Develop Coordinated Approach to Natural Gas Purchases

Yet medical centers also face unique challenges stemming from their focus on patient care and their unique regulatory and financial environments. As a result, achieving carbon neutrality across UC medical centers will be particularly difficult and require strategic planning to ensure patient care remains a top priority while reducing energy consumption and moving to renewable energy sources. For this reason, we provide additional recommendations specific to UC's five medical centers with the most important one listed here and other recommendations in Appendix I.

MC1. Perform Cost-Benefit Analyses of Scenarios for Achieving Carbon Neutrality

We recommend that UC Health engage a consultant to work with all five medical centers to develop an estimate of the total costs and benefits, and different potential scenarios, for the medical centers to achieve carbon neutrality by 2025.

Barriers particular to medical centers could make certain paths for achieving carbon neutrality infeasible. UC's medical centers have recently begun considering energy efficiency and other carbon abatement measures, but more assessment is necessary to understand how all five medical centers can continue to prioritize patient care and comply with increasingly stringent OSHPD regulations while moving toward carbon neutrality at minimal cost. Leaders at our medical centers have emphasized their concerns about costs of carbon abatement measures. Because these costs and corresponding benefits are not yet well understood, a consultant with expertise in design and cost-benefit analysis will be useful in identifying and evaluating different pathways and options for achieving carbon neutrality at each medical center. The differences across the medical centers necessitate location-specific analysis to accurately capture the costs at each medical center.

4. ROLLING OUT THE REPORT

We will ask the communication staff of the Office of the President to update existing communication materials with information about the report, talking points and other tools that communicators systemwide can use. The communication toolkit will be further revised, as necessary, when the findings and recommendations of the TomKat Communications Strategy Working Group are published.

The following table summarizes the activities that have and will be undertaken to share the report and communicate its findings. Additional steps will be added as needed.

Audience	Communication Activity	By	Timing
January–June 2017: Circulation of Draft Report for Discussion and Feedback			
Campus operations staffs and leadership	Preliminary drafts of relevant sections shared at meetings and workshops to gather feedback on feasibility and overcoming barriers to implementation	UCOP Energy & Sustainability staff	January/February 2017
President's Executive Office staff	Preliminary summary of approaches and recommendations presented for feedback	UCOP Energy & Sustainability staff	February 2017
Global Climate Leadership Council	Provide draft report and workshop recommendations at GCLC meeting	Task Force	March 2017
Campus Sustainability Directors	Workshop report findings and recommendations on regular bimonthly conference call including sustainability staff from each campus	UCOP Energy & Sustainability staff	March 2017
Faculty	Provide briefings to the Academic/Faculty Senate and ask GCLC members to brief their campus faculty groups	UCOP Energy & Sustainability staff and GCLC members	April–June 2017
Campus Architects and Capital Planners	Conduct workshop to present recommendations and shape into potential policy statements	Key Task Force members and UCOP staff	May 2017
Med Center CFOs and CEOs	Present key Med Center recommendations during monthly UC Health meeting	Paul Watkins and David Phillips with Dr. Stobo	April (CFOs) and May or June (CEOs) 2017

Audience	Communication Activity	By	Timing
Executive Vice Chancellor-Provosts, Vice Chancellors for Planning and Budget, Vice Chancellors for Administration, and Vice Chancellors for Student Affairs	Present key recommendations during systemwide meetings and/or by email	GCLC and Task Force members	June 2017
August 2017: Publication and Communication of Report and Recommendations			
COVCA, etc. and other systemwide groups of administration leaders (HR, Budget, Capital, etc.)	Present report findings and recommendations at meetings Emailing executive summary with link to full report	UCOP Energy & Sustainability staff	July–Dec. 2017
Regents	Present a “deep dive” on Carbon Neutrality Initiative and recommendations at a regents meeting	UCOP Energy & Sustainability staff	First half of 2018
Students	TomKat group student surveys and focus groups Campus-based forums Cool Campus Challenge	UCOP Energy & Sustainability staff, GCLC members, campus sustainability staff	April 2017–April 2018
Faculty	Provide briefings to the Academic/Faculty Senate and ask GCLC members to brief their campus faculty groups	TomKat Communications Strategy Working Group; UCOP staff and GCLC members	April–Dec. 2017
Staff	Staff Assembly meetings Campus newspapers (with local angles) Employee newsletters Departmental staff meetings	Campus-based administrative, operations and sustainability staff with UCOP Energy & Sustainability staff	July–Dec. 2017

5. CALL TO ACTION

The ambitious goal of achieving carbon neutrality by 2025 has catalyzed campuses to accelerate their efforts and make admirable progress in the areas of energy efficiency and carbon reduction. Having communicated with many, if not most, of those who will be responsible for making carbon neutrality a reality for the University of California, we are confident in the energy-saving technologies and methodologies currently available, in the UC faculty and scholars working to improve upon them, and in the operations personnel who implement them. Still, our task force has concluded that 2025 is a target for which the university is not fully prepared. Reliance on natural gas, competition for funding, limited financing options, carbon-blind budgeting and planning procedures, and, above all, absence of a universally shared vision of the high priority of carbon neutrality, make the Carbon Neutrality Initiative an enormously difficult undertaking.

Yet the recommendations in our report make good business sense even in the absence of a carbon-related objective. While the recommendations will reduce carbon, they also stand to improve the quality of campus operations and business processes. In keeping with UC's three-fold mission, they leverage UC's ongoing applied research and provide our students with innumerable learning opportunities, while serving the global public by leading the way to a sustainable climate future. We therefore urge the Office of the President and all campuses and medical centers to begin exploring how to put them into practice immediately.

APPENDIX I: ADDITIONAL RECOMMENDATIONS

The following recommendations were judged to be non-controversial or relatively straightforward to implement.

Energy Efficiency and Conservation

EE5. Implement Energy Saving Performance Contracting

We recommend establishing systemwide Energy Saving Performance Contracts (ESPC) as an option for the implementation of energy efficiency projects.

Energy Savings Performance Contracting is often a budget-neutral solution for energy efficiency project funding. This partnership approach has been compared to design/build construction contracts. It was developed to address the needs of large buildings or groups of buildings such as city, county and state buildings; schools; hospitals, etc. Although there has been some confusion about whether UC campuses may enter into ESPCs, Public Contract Code § 10500-10506 and Government Code § 4271 can be interpreted to authorize this approach.

Under an ESPC, the building owner contracts with an energy service company, which provides some or all of the services required to design and implement a comprehensive energy efficiency project at the customer facility. The contract may cover the entire project, from initial energy audit through long-term monitoring and verification of project energy savings. It includes a comprehensive set of measures tailored to the needs of the particular facility. Such contracts can include energy efficiency, renewable energy, distributed generation, water conservation, sustainable materials and operations. The energy service company may also arrange for long-term project financing provided by a third-party financing company. Finally, the energy service company could provide a guarantee that the savings produced by the project will be sufficient to cover the cost of project financing for the life of the project.

When presented to UC's facilities executives and energy managers, this recommendation was not enthusiastically received. Generally, they consider this to be an option of last resort. This will be a low priority for implementation until one or more campuses express a clear interest in the mechanism. If implemented, the proposed ESPC projects should be evaluated on a comparative basis with other financing mechanisms to give campuses an informed choice.

New Buildings

NB4. Modernize Systemwide Space Databases and Publish Space Use

We recommend developing systemwide space databases and publishing space use to increase accountability and promote space conservation values.

Utilizing existing space as effectively as possible is a proven way to avoid emissions from campus growth. By reducing the new space required to support activities, campuses can save energy and reduce carbon emissions from lighting and HVAC. At this time, however, the system of space assignment on campuses does not support the adoption of new requirements for reusing existing space.

On campuses, the costs of most space, either in rent or utilities, are not charged to the users, and occupants lack incentives to use space as efficiently as they might if rent and utilities were being charged. There are a number of valid reasons why campuses do not charge for space, including the following circumstances:

- In cases where costs cannot be attributed to specific users because the use of space is only loosely tracked, or where utility costs are captured on a broader basis than individual departments.
- When the free use of space facilitates research and creativity enterprises and gives academic departments the ability to compete for faculty via space allocations.
- When charging to use space places a disadvantage on departments with lower income-generation potential, such as humanities.

It should be noted that some campuses are implementing effective space solutions that can serve as a model for other campuses. For instance, some academic departments at UC Davis self-govern through published space inventories. At UCSF, data capture and reporting are seen as a first step toward accountability for income-generating spaces. UCLA has opted for promoting best space management practices by focusing on space needs and promoting equipment sharing. All campuses are encouraged to pursue similar strategies in support of better space management and carbon neutrality.

Although more aggressive measures, such as imposing space rental requirements, could improve the efficiency of space use, the Task Force has decided not to recommend such measures due to concerns about how costs would be measured, and because of the disparities in income generation among departments. Doing so could promote values not aligned with the university's research mission. For this reason, we support development and use of new accessible systemwide space databases as a means of increasing accountability and promoting space conservation values. A related effort to catalog and assess existing facility information using the Integrated Capital Asset Management Program (ICAMP) is already underway. Once implemented, ICAMP enterprise software could be used to support this recommendation.

NB5. Create Systemwide Tools to Support Low-Carbon Construction

We recommend creating systemwide tools to support low-carbon construction, including, but not limited to, life cycle costing models and platforms that facilitate sharing of design best practices.

The purpose of this recommendation is to provide increased support for campus administrators to incorporate and prioritize carbon neutrality considerations in their capital projects. Standardized metrics across all UC campuses will facilitate life cycle cost analysis, operational forecasting in debt models, selection of design professionals with strong low-carbon design capabilities and more efficient use of existing space.

NB6. Train Staff and Building Occupants in High-Efficiency Systems Design and Maintenance

We recommend offering workshops to train design professionals and project delivery staff when UC's design standards are updated.

It is essential that all design professionals, operations and energy staff and building occupants be trained in how to implement, maintain and operate high-efficiency systems. During the design phase, operations and energy staff should be included in decision-making about building system selection. Staff and occupant training on building systems and energy-efficient features prior to occupancy is also critical for building performance. Once occupied, ongoing building performance monitoring, commissioning, staff training and occupant education help sustain energy efficiency benefits. Formal training workshops are recommended after the Sustainability Policy Steering Committee brings forward updated design standards.

Communication and Change Management

CM7. Consider How Scope 3 Commuter Emissions Reductions Can Help Engage the Campus Community

We recommend further consideration of the way that Scope 3 commuter transportation emissions reductions can help engage the campus community and contribute to overall university emissions reductions.

There was considerable discussion in the communication workgroup about whether and how to include Scope 3 commuter transportation emissions reduction strategies as a recommendation. Many students, faculty and staff believe they are making a material contribution to the Carbon Neutrality Initiative's 2025 goal when they use public transportation, walk or bike. These carbon savings are already reported as part of the university's greenhouse gas emission inventories. Encouraging personal action to reduce emissions could build stronger support for the Carbon Neutrality Initiative. However, considerable effort would need to be expended to evaluate and set the parameters for Scope 3 commuter emissions in the context of the initiative, to develop communications, monitoring and reporting systems, and to collect data from the presumably thousands of individuals participating. For this reason, we defer to the TomKat Communications Strategy Working Group for research and recommendations for including Scope 3 commuter transportation emissions reduction programs in the Carbon Neutrality Initiative.

Medical Center-Specific Recommendations

Two of the additional recommendations described above also apply to UC medical centers, including:

- Implement energy saving performance contracting
- Train staff and building occupants in high-efficiency systems design and maintenance

The Task Force also identified four additional recommendations specific to medical centers:

MC2. Support Blanket OSHPD Approvals for Standardized Carbon Abatement Projects

We recommend that the Office of the President and UC Health support blanket approvals for standardized energy efficiency and other carbon abatement projects by leveraging existing OSHPD pilots, relationships and forums.

Speeding up the OSHPD approval process for carbon abatement projects nearly identical to those already implemented at other medical centers will facilitate a transition toward carbon neutrality across UC's medical centers. In particular, the university can capitalize on existing OSHPD pilot programs and relationships between OSHPD and UC architects, engineers and staff to help streamline the approach for systemwide projects.

MC3. Build Stronger Partnerships with Kaiser Permanente and Other Peers

We recommend that UC Health and the medical centers partner with Kaiser Permanente and other medical center peers to facilitate sharing of best practices and to support new solutions to carbon neutrality challenges.

Kaiser Permanente has been aggressive in its efforts to reduce its greenhouse gas emissions. Its HVAC retrofit projects have resulted in average energy savings of 25 percent and an average return on investment of 15 percent, making Kaiser an industry leader in environmental stewardship and sustainability. Its success has been largely due to its leadership buy-in and an explicit tie between its health care missions and emissions reductions.

By developing partnerships with Kaiser and other peer institutions, UC medical centers can learn from and adopt certain best practices that will result in more effective and efficient progress toward carbon neutrality. Partnerships with these organizations will also support communication with OSHPD to refine regulatory requirements and ensure they maximize opportunities for carbon abatement without compromising patient health care.

Connecting Sustainability and Health

In May 2016, UCSF held a Climate Neutrality Initiative Workshop that highlighted UCSF's many successes incorporating sustainability and climate change into the curriculum.

Examples of how UCSF is incorporating sustainability and climate change into its courses include:

A "Women's Health, the Environment, and Health Professional Activism" elective looks at environmental exposures and pregnancy, and the ecology of breast cancer.

The School of Pharmacy is teaching sustainability as it relates to pharmaceutical lifecycle, inventory management, formulary selection, dispensing and disposal.

The Global Health Sciences course covers climate change, food security, and extreme weather scenarios, emphasizing health policy development.

An introductory statistics class includes a discussion on how climate data can be distorted to manipulate public opinion.

A Climate Change Inquiry Course asks "What should physicians know and do about climate change, sustainability, and health?"

The Health and Society course, which is required for all first year medical students, now includes an inquiry case on global climate change.

MC4. Fund Curriculum Workshops to Engage Faculty and Students at Each Medical Center

We recommend that the Office of the President and UC Health fund curriculum workshops at each medical center in order to engage health sciences faculty in the Carbon Neutrality Initiative and connect the initiative to the core mission of the medical centers.

The Carbon Neutrality Initiative commissioned a curriculum workshop that has been held at each UC campus to support faculty across various disciplines who have chosen to augment existing course curricula with relevant climate and sustainability-related concepts. Because of the impact of climate change on individual and public health, this curriculum development effort is equally important for medical schools.

This recommendation would bring climate change and sustainability curriculum workshops to each medical center. It calls for Carbon Neutrality Initiative funding, ideally with matching funds from UC Health. The goal would be to support professional school faculty in integrating climate change and sustainability into the core curriculum while also engaging them in the goals and objectives of the Carbon Neutrality Initiative.

MC5. Improve Healthcare Value As a Way to Reduce Carbon Emissions

Identify treatment protocols that improve patient care while reducing carbon emissions.

It is possible to improve patient care while reducing greenhouse gas emissions. For example, inhaled agents used in certain interventions are potent greenhouse gases. Adopting simple modifications, such as consistent application of lower fresh gas flows, minimizes waste and lowers the drug cost per case. In addition to the economic impact, this approach aligns with the Carbon Neutrality Initiative while maintaining the desired clinical effect. Medical Centers are encouraged to explore ways in which healthcare value and carbon reduction go hand in hand.

APPENDIX II. SUMMARY OF ALL RECOMMENDATIONS

Funding and Financing	
FF 1	Integrate purchased utilities and carbon management as a stand-alone financial unit.
FF 2	Implement internal carbon charges.
Energy Efficiency and Conservation	
EE 1	Develop a comprehensive funding plan for energy efficiency projects.
EE 2	Improve staffing for energy efficiency programs.
EE 3	Track campus and medical center energy efficiency goals.
EE 4	Create systemwide collaborative projects.
EE 5	Implement energy-saving performance contracts.
New Buildings	
NB 1	Prioritize net-zero carbon for new buildings and all-electric designs for new housing.
NB 2	Strengthen energy performance standards and incentivize low-energy design.
NB 3	Base capital project design decisions on life cycle cost analysis (LCCA).
NB 4	Modernize systemwide space databases and publish space use.
NB 5	Create systemwide tools to support low-carbon construction.
NB 6	Train staff and building occupants in high-efficiency systems design and maintenance.
Communication and Change Management	
CM 1	Position carbon neutrality as a campus and systemwide priority.
CM 2	Emphasize the connection to the UC mission.
CM 3	Engage the support of the UC regents.
CM 4	Continue support for faculty engagement in the initiative.
CM 5	Recognize and facilitate students in advancing the Carbon Neutrality Initiative.
CM 6	Continue programs that reward energy savings and other behaviors that reduce or eliminate carbon.
CM 7	Consider how Scope 3 transportation emissions reductions can help engage the campus community.
Energy Supplies	
ES 1	Factor energy planning into campus-specific climate action plans.
ES 2	Continue and expand existing energy supply programs.
ES 3	Develop a coordinated approach to natural gas purchases.
Medical Center-Specific Recommendations	
MC 1	Perform cost-benefit analyses of scenarios for achieving carbon neutrality.
MC 2	Support blanket OSHPD approvals for standardized carbon abatement projects.
MC 3	Build stronger partnerships with Kaiser Permanente and other peers.
MC 4	Fund curriculum workshops to engage faculty and students at each medical center.
MC 5	Improve healthcare value as a way to reduce carbon emissions.

APPENDIX III: ISSUES ADDRESSED BUT NOT RECOMMENDED

Our process generated many ideas that were not deemed feasible to recommend at this time. Some are obvious, such as the inevitable question, “Why not fund carbon neutrality centrally?” The following ideas led to considerable discussion and lively debate, but were tabled for the time being.

Centrally Funding Carbon Neutrality

The Task Force quickly dismissed the suggestion to have the Office of the President centrally fund carbon neutrality. The university’s budget model influences the nature of our recommendations. Historically, revenue flowed to the Office of the President, which then allocated it to each of the campuses. These allocations followed a formulaic approach with specific allocations for specific items. Since 2008, however, revenues go directly to the campus from which they originated, leaving the Office of the President to be funded through assessments on each of the campuses. That assessment depends on expenditures, total number of employees and total number of students. Thus, Office of the President funds are actually campus funds. As a result, the Task Force dismissed the overly simplistic proposal to have the Office of the President centrally fund carbon neutrality because to do so would either take money from other UCOP programs or require an increase in campus assessments.

Increasing Campus Assessments for the Office of the President

The Task Force examined but decided not to recommend this funding option because campus-specific carbon abatement costs are not correlated with existing inputs in the model used to determine the assessment. Increasing the assessment would only raise funds indirectly. Creating a centrally-managed fund might lessen campus control and ownership in reducing carbon emissions.

Increasing Federal Indirect Cost Recovery Rates to Include Carbon Charges

The Task Force examined but decided not to recommend this funding option because rate recovery negotiations occur on a long cycle, and cost recovery for utility expenses may already be maxed out. Higher indirect rates serve to decrease funding available for research. Finally, it is unlikely that the federal government would approve an internal unbundled carbon cost as a new allowed expense.

Imposing Departmental Space/Energy/Carbon Charges

The Task Force examined but decided not to recommend this funding option because utility costs are captured on a broad scale, and space use is only loosely tracked, making costs difficult to attribute to specific users or even departments. In addition, space charges could put pressures on certain departments and hamper research and creativity enterprises or make the university less competitive in recruiting and retaining faculty. This option is addressed in more detail in the existing space discussion in Appendix I under New Buildings.

APPENDIX IV: LETTER FROM THE COUNCIL OF VICE CHANCELLORS

UNIVERSITY OF CALIFORNIA, LOS ANGELES

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO



UCLA

SANTA BARBARA • SANTA CRUZ

SCOTT L. WAUGH
EXECUTIVE VICE CHANCELLOR AND PROVOST
OFFICE OF THE CHANCELLOR
2147 MURPHY HALL, BOX 951405
LOS ANGELES, CALIFORNIA 90095-1405

July 26, 2017

Chair Ann Carlson
Carbon Neutrality Finance and Management Task Force
Shirley Shapiro Professor of Environmental Law, UCLA School of Law

Dear Ann:

At a recent COVC meeting, the UC EVC/Provosts applauded President Napolitano for establishing the University of California system as a leader in defining a comprehensive goal of carbon neutrality. The Carbon Neutrality Finance and Management Task Force's draft report provides productive and substantive recommendations in a number of areas critical to achieving that goal. Our achievements in this effort as a system, as well as the specific ways they can be demonstrated on each campus, will certainly serve as a role model for other institutions of higher education in this important endeavor. Because each UC campus is unique, they will address this challenge in substantively different ways. Nevertheless, we believe that overall there is broad support for the goal of carbon neutrality.

We strongly believe, however, that the timeline itself needs to be re-examined in the context of the financial and management analysis of the project. Quite simply, what are the costs of meeting the deadline of 2025 and what might be the overall cost benefit to extending the endpoint beyond 2025 to achieve carbon neutrality? The timeline clearly has financial implications which, as you can appreciate, significantly impact our ability to support other critical campus issues, especially our academic mission. While our view as EVCs/Provosts obviously focuses primarily on academic impacts, the timeline will certainly pose financial challenges to other aspects of campus management as well.

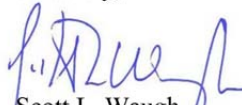
We respectfully ask that in the final report from the Carbon Neutrality Finance and Management Task Force, some consideration be given to the advantages and disadvantages to extending the endpoint of that timeline beyond 2025. This is not in any way a suggestion to shy away from our objective for carbon neutrality throughout the University of California system. Rather, it is an acknowledgment that a slightly longer timeline for achieving that goal may present more financially feasible trajectories and, by so doing, engender a higher level of overall campus and university support. Flexibility in the timeline would allow for individual campuses to take into account their local environment and make decisions that will not have adverse effects on operations. Moreover, individual campuses or groups of campuses could consider pursuing specific accomplishments (such as conversion to solar power, increases in energy efficiency and

Chair Ann Carlson
July 26, 2017
Page 2 of 2

the number of LEED buildings, etc.) that would demonstrate the seriousness of our commitment as much as setting a narrow timeline.

Thank you for considering our concerns.

Sincerely,



Scott L. Waugh
Executive Vice Chancellor and Provost
Convener, Council of Vice Chancellors

cc: Provost and Executive Vice President Aimée Dorr
Executive Vice President – Chief Operating Officer Rachael Nava
Associate Vice President David Phillips

APPENDIX V: ENERGY EFFICIENCY WORKGROUP RESEARCH

The Task Force's Energy Efficiency Workgroup explored barriers and potential solutions to achieving deep energy efficiency in existing buildings. Many of the challenges and opportunities in existing buildings also apply to new construction. Research pertaining to new construction is discussed in the New Buildings Workgroup Outreach section.

Background

Over the past decade, UC has invested more than \$271 million in completed energy efficiency projects. Of that, \$69 million was funded by utility-sponsored incentive programs, while the university financed another \$140 million. This returned a savings of 170,000 metric tons of greenhouse gas emissions and avoidance of \$166 million in energy costs since 2004.

It is well known that energy efficiency projects present the most cost effective opportunities to significantly reduce a campus's carbon footprint. In addition to the cost savings, energy efficiency projects offer many co-benefits, including:

- Energy efficiency retrofit projects help reduce the large and growing backlog of deferred maintenance across the system.
- The information systems inherent in "smart" energy retrofits provide very detailed data that can be used to make buildings safer and to detect mechanical systems problems sooner.
- Reducing loads on building mechanical systems can reduce wear-and-tear by as much as 75 percent, which reduces maintenance expense, defers the need for repairs and extends the useful lifespan of building systems.
- Substantial capital costs are deferred or totally avoided, including chiller expansion and expanded combined heat and power generation.
- Carbon emissions are reduced, which represent a significant social cost savings and an anticipated future carbon dollar savings.

For these reasons, energy efficiency projects should be prioritized across campuses. However, they are not. One of the most significant barriers to making the most of this carbon reduction strategy is funding.

The Statewide Energy Partnership (SEP) has been a significant source of financing for energy efficiency projects since 2004. It provides financing for energy efficiency projects such as HVAC and lighting retrofits and building controls upgrades. Utility company incentives are provided for qualifying projects to reduce project expenses and widen the range of projects that can be implemented with acceptable paybacks. Incentives are based on projected first-year energy savings. (See Section 2 for more details.) Although the SEP program has been largely successful to date, the number of projects being completed has been dropping dramatically. A changing regulatory landscape and varying interpretations of California Public Utility Commission requirements by utility companies are creating uncertainty about project eligibility and levels of financial incentives from project planning phases to project completion. The

administrative cost (staff time, metering) to quantify opportunities and apply for and justify incentives can be prohibitive for many projects.

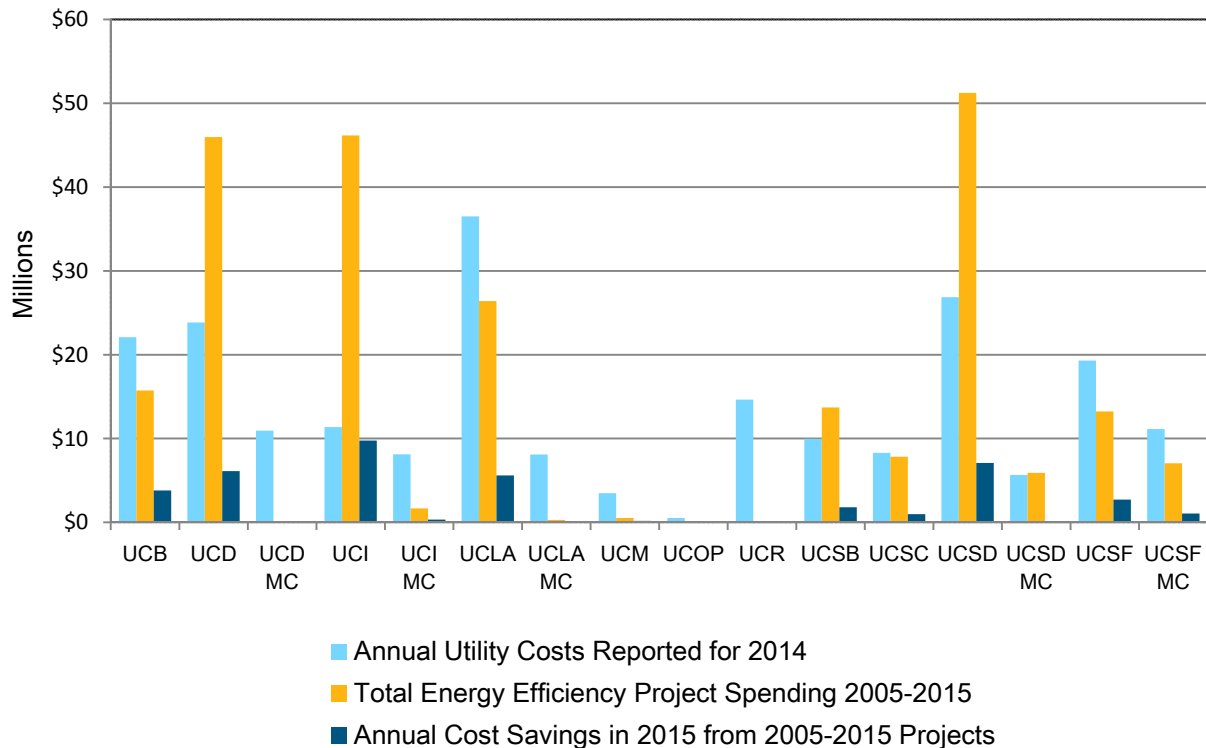
In addition to the dwindling SEP funding, energy efficiency projects face other significant barriers:

- **Long payback cycle.** Most energy efficiency projects have high up-front costs, with savings accumulating over time. For complex infrastructure or deep energy efficiency projects, the payback could be up to 30 years or more. This long payback cycle is often a deterrent to leadership support of the large up-front investment in these projects. It is critical for campuses to consider the co-benefits of energy efficiency projects when evaluating payback periods. When co-benefits like improved maintenance and operations are considered along with the life cycle cost of the project compared with other carbon reduction approaches available at a premium (such as most offsets that will never pay back), energy efficiency emerges as the easy first choice.
- **Limited debt capacity.** The university's growing debt and its limited debt capacity represent a challenge to accessing additional financing for investments that will be needed to achieve carbon neutrality. With the state's disinvestment in its capital programs, the university has increasingly utilized debt to finance projects that are core to its mission. Debt capacity refers to the debt that an institution can incur at a particular credit rating level, which in part determines the rates at which the university can issue debt. Since FY 2008, the university's long-term debt has grown by almost \$11 billion, reaching approximately \$17 billion in 2015. The university's current ratings may come under pressure due to its declining net asset position in relation to its liabilities, including pension and Other Post Employee Benefits (OPEB). In the last several years, operations have not been in equilibrium, and revenue sources such as tuition and fees, state appropriations, grants, contracts and medical centers will face continuing pressures in the coming years. As a result, available debt capacity for use on energy efficiency projects has been increasingly restricted, and instead held for mission-critical campus initiatives.
- **Competing budget demands.** With many competing initiatives, campus administrators are under pressure to capture and redirect any savings to many other pressing needs. However, reinvesting in energy efficiency programs can result in greater long-term savings and carbon reductions. For instance, if the SEP program had been managed as a true revolving fund and used all project energy savings to fund new energy efficiency projects (versus capturing the savings from utilities budgets to fill needs elsewhere and continuing to finance new projects), by 2025 those savings could have funded \$350 million in additional projects. Therefore, it is important to establish campus practices that re-invest all purchased utility savings back into energy efficiency programs.

There is wide variability in campuses' ability to implement deep energy efficiency projects as shown in Figure 5.

Figure 5: Key Performance Metrics by Site

Showing variability in utility costs, energy efficiency investment and energy cost savings across UC locations.



Workgroup Outreach

The Task Force's Energy Efficiency Workgroup conducted a survey among campus energy managers to better understand the issues that stand in the way of achieving carbon neutrality by 2025. This outreach took place in July 2016. Their survey was designed to elicit details about barriers to implementation of energy efficiency projects. Questions focused on the aggregate rather than campus-specific barriers. Twenty-one representatives from energy management teams on all sites participated in the survey.

Findings

Issues identified by respondents clustered into three broad themes: funding, staffing and administrative support.

- Funding.** Consistent with the finance workgroup findings, respondents identified as a key issue the broken funding loop in which energy cost savings that could be paying for additional energy-related projects are typically directed to other uses. Other funding issues cited in the survey included unavailable/decreasing SEP incentives, debt capacity limitations, constraints or competing priorities for cash spending, and uncertainty regarding cap-and-trade funding.

- **Staffing.** Many campuses have struggled to recruit and retain high-performing energy managers with the right mix of technical, organizational and communication skills. Low staffing numbers contribute to inefficient project delivery, which increases costs and slows progress. UC's highest performing campuses have about 0.6–1.0 full-time energy management staff per million square feet of space or contracts in place that provide those services via external partners. However, most UC campuses currently fall far short of the staffing levels necessary to achieve carbon neutrality by 2025.
- **Administrative support.** Many respondents expressed concern that energy efficiency is not given adequate support at the campus level. This seems to stem from the fact that campus leaders have not been sufficiently informed about the return on investment, deferred maintenance and other benefits of energy efficiency projects. In fact, co-benefits of these projects are typically not itemized in project justifications or approval decisions.

APPENDIX VI: FUNDING AND FINANCING WORKGROUP RESEARCH

Background

The Task Force evaluated financial and budget strategies in light of what we already know about the SEP program, the Wholesale Power Procurement program, the centrally-coordinated cap-and-trade program and the biomethane program. These four programs have already facilitated the funding of considerable carbon reduction across campuses. But additional financing barriers remain that make these programs alone insufficient, especially when the savings are directed to fill shortfalls in other operating budgets. Without the ability to capture savings to fund the aspects of carbon neutrality that entail increased costs, carbon neutrality can be seen as a cost burden rather than a goal with potential financial benefits.

Workgroup Outreach

During September and October 2016, the Task Force's Funding and Financing Workgroup reached out to members of UC's Council of Vice Chancellors for Planning and Budget (VCPBs), the top-level financial administrators from each of the 10 campuses. The goal of this outreach was to explore and evaluate financial and budgeting strategies to support the transition to carbon neutral operations by 2025.

The workgroup surveyed members of the Council of Vice Chancellors for Planning and Budget. Survey questions were designed to assess awareness and knowledge of the Carbon Neutrality Initiative and to elicit ideas and opinions about funding sources for campus energy programs, current carbon emission reduction funding mechanisms, drivers of energy purchase decisions, and any barriers to funding carbon neutrality.

The seven respondents represented seven campuses and all expressed high awareness of the Carbon Neutrality Initiative.

Findings

More than half of the funding for energy costs comes from the state and student tuition. Approximately 20 percent each comes from indirect cost recovery and auxiliaries, and the remaining 10 percent comes from external campus clients.

Campuses currently fund their carbon emission reduction projects in multiple ways depending on the type of program. For instance, campuses fund energy efficiency projects through the SEP program. Small solar installations and other similar projects are often covered by student funds. Other common funding sources include green revolving funds, direct funding via purchased utilities budgets and surcharges on auxiliary utility rate charges.

Campus financial decisions regarding energy purchases reflect a wide range of approaches. Some campuses favor energy purchases intended to minimize costs over the long term while others prefer lower risk profiles that provide more certain near-term pricing.

Survey respondents suggested several types of solutions to address carbon neutrality funding constraints, including:

- Securing more financial support from the state or external sources.
- Establishing new policies that address and fund cost-effective design changes for new capital projects.
- Creating a centralized funding program to implement large projects.
- Engaging campus leadership, faculty and students by sharing plans and demonstrating progress.
- Moving to a funding model that recognizes utilities as a stand-alone business, as student housing or parking services do.
- Internalizing the future cost of carbon abatement through new financial policies.

In addition, respondents recommended pursuing Carbon Neutrality Initiative-related development opportunities. They expressed that the Office of the President should drive accountability and play a strong role in sharing and promoting favored practices across campuses while maintaining campus authority to develop, implement and fund their own plans. Respondents expressed mixed views about implementing an internal price on carbon.

APPENDIX VII: NEW BUILDINGS WORKGROUP RESEARCH

Background

As California grows, UC will also continue to grow. With the projected influx of students will come more housing, classrooms and other facilities, including energy-intensive laboratories and medical center facilities, which typically use five times the energy of housing and other academic buildings. Based on the capital plans of UC's 10 campuses, total campus building space may increase by as much as 30 million square feet by 2025. Even if all these new buildings meet UC's current energy performance standards, this will not be sufficient to achieve carbon neutrality but will, instead, add carbon emissions to our systemwide total. Unless more aggressive energy efficiency and carbon abatement standards are adopted, the systemwide increase in carbon emissions from growth would be roughly equivalent to adding a campus the size of UC Riverside. To fulfill campus and medical center growth plans while also becoming carbon neutral by 2025, the university must dramatically cut carbon emissions from all new construction and better utilize existing space whenever feasible.

UC campuses have successfully met and exceeded green building policies that have reduced the climate and other environmental impacts of new and renovated campus buildings since 2004. From 2004 to 2007, UC policy required new construction and major renovations to be LEED certified or "equivalent." Since 2007, policy has required all new construction and major renovations to achieve LEED Silver certification. In addition, projects are required to outperform the current version of California's Title 24 Building Energy Efficiency Standards by at least 20 percent. As of 2016, projects can satisfy this requirement by meeting energy performance targets instead of a percentage threshold. Smaller renovation projects must achieve LEED-CI (Commercial Interiors) certified ratings, but have no energy efficiency requirements beyond those required for LEED-CI certification. Even with these ambitious standards, new buildings continue to produce carbon emissions. Moving beyond today's requirements to more aggressive energy efficiency standards that support carbon neutrality will require all those involved in capital planning, design and construction to include consideration of carbon impacts at every step of the capital process.

Capital planning includes many steps where carbon neutrality could be factored in, and decision-makers at all levels of the university are involved in this process.

- **Planning.** Chancellors or regents approve budget, scope and schedule.
- **Design approval.** Chancellors or regents must approve project designs. The Board of Regents approves capital projects with budgets greater than \$70 million. Chancellors approve all other projects, with requisite endorsements from UCOP and the Office of General Counsel for projects with budgets greater than \$10 million.
- **Working documents.** Design teams complete working documents.
- **Construction.** Multiple suppliers, vendors and trades are involved in construction.
- **Occupancy.** Energy management staff, maintenance personnel and building occupants affect building performance over time.

Workgroup Outreach

To develop recommendations for how to assure that campuses can achieve carbon neutrality while growing, the Task Force's New Buildings Workgroup investigated opportunities and barriers to reducing the emissions associated with new construction. During August and September 2016, they interviewed 17 experts across all 10 campuses. Interviewees included directors of sustainability and energy, campus architects, capital planning directors and other senior administrators in design, construction and capital asset management functions. Interview questions were designed to gauge knowledge and familiarity with the Carbon Neutrality Initiative, understand funding mechanisms and policies governing capital programs, identify best practices, and explore barriers that prevent carbon neutrality from being a higher priority in capital planning, design and construction decisions.

Findings

This research process revealed a number of challenges, including the fact that, in new construction, the inclusion of energy efficiency measures beyond those required by the university or the state is not typically a priority because of competing building requirements and other factors. In addition, even though reusing and sharing of existing space is the most cost-effective way to avoid emissions from growth, there are many valid reasons why this is often not possible.

Variability of capital programs from campus to campus is also a consideration for developing recommendations for new buildings. The degree of difficulty to achieve net-zero carbon emissions from new buildings differs by campus, type of facility and energy source. New building strategies that are cost-effective for some campuses may not be for others. Campuses, therefore, face different tradeoffs when deciding to renovate or retrofit existing facilities or build new ones.

In general, responses reflected a low level of awareness of the Carbon Neutrality Initiative and a low priority given to carbon impacts throughout the capital planning, design and construction process. Sustainability professionals expressed higher levels of awareness, although they often serve only in an advisory role, on a case-by-case basis, and do not have a high level of authority in most capital projects. Those with greater involvement and authority in the capital planning process expressed a moderate awareness of the Carbon Neutrality Initiative. Representatives from almost all campuses admitted that carbon neutrality has low to moderate influence on capital projects.

In addition to the lack of collaboration with knowledgeable on-campus sustainability and energy management professionals in the capital planning process, respondents pointed out numerous barriers to prioritizing carbon neutrality in new construction:

- **Initiative competition.** Carbon neutrality competes with many other priorities. Many interviewees said that their interest in carbon neutrality had to take a back seat in the face of accommodating thousands of new students or meeting seismic retrofit and other building safety requirements.
- **Need for existing-space efficiency incentives.** Currently, campus departments have very few incentives to maximize efficient use of existing space. Maximizing existing space use through better scheduling and multiple-use planning would reduce the need for new buildings and facilities.

- **New facilities are considered essential to campus success.** Campuses compete with other universities to recruit and retain students and faculty. Updating campuses with new facilities is considered essential to campus success.
- **Carbon neutrality pathway confusion.** Many interviewees expressed general support for the Carbon Neutrality Initiative but were uncertain about the specific steps necessary to reach the goal.
- **Need for more tools.** In addition to needing clarity about the path to reach the goal, campuses also seek tools that facilitate each step of the way.
- **Donor preference for new buildings.** Donors prefer to see their names on new buildings, rather than renovations, even though renovations are often more cost-effective in terms of energy efficiency and efficient use of space. This creates a challenging disconnect between funding sources and effective use of funds.
- **Insufficient existing green building policies.** Current policies help mitigate increases in emissions by requiring an energy performance standard, but fall short of what is needed to achieve carbon neutrality. The university has to go beyond mitigating increases to dramatically decreasing emissions.
- **Prolonged capital design timeline.** Capital projects take a long time to plan and design. Capital projects already in the pipeline have not incorporated carbon neutral design standards.
- **Pressure to minimize construction cost.** Even though low-carbon design choices are cost-effective in the long run, the immediate need to minimize construction costs often outweighs future operating cost savings.
- **Staff qualifications to operate high-performance facilities.** Buildings with sophisticated energy-efficient systems require well-trained maintenance and operations personnel to achieve optimal energy savings. Facilities staff need to be trained to effectively operate these facilities.

APPENDIX VIII: COMMUNICATION AND CHANGE MANAGEMENT WORKGROUP RESEARCH

Background

To ensure that carbon neutrality becomes a reality, the university needs to effectively communicate the goals, benefits and methods of reaching it in such a way that all stakeholders are well-informed and motivated to achieve it. Well-planned strategic communication and change management efforts are needed to:

- Foster acceptance for the recommendations of this Task Force among those directly responsible for implementing them.
- Garner broad support among students, faculty and staff, who exert a critical influence upon leadership to make carbon neutrality a priority.
- Elicit participation in individual behaviors that contribute to carbon reduction goals and personal attitudinal change.

Since the Carbon Neutrality Initiative was announced, the university has disseminated information via multiple websites and printed materials, sponsored promotional events, and formed a student coalition to foster awareness of and engagement in the initiative across all campuses.

To date, the Office of the President has developed a range of materials to communicate the importance and goal of the Carbon Neutrality Initiative, including:

- **Carbon Neutrality Initiative Engagement Plan.** A strategic communication program that broadly targets external audiences with the goal of expanding the ranks of UC allies who value and can further UC efforts toward carbon neutrality. Key messages focus on UC's global leadership on climate change solutions and clean energy, UC's 2025 carbon neutrality goal and accomplishments to date, and UC's standing as a model for similar efforts by other institutions and municipalities.
- **Communication toolkit.** This includes fact sheets, fliers, logos and branding assets for use by students, faculty and staff to promote the initiative to their internal and external constituents. Together, these materials constitute a toolkit that can be tailored to specific audiences. Two web pages have been developed to support Carbon Neutrality Initiative communications to external and internal audiences:
 - Internal Carbon Neutrality Resources Website provides background information, sustainability reports, links to UCOP energy and sustainability resources, links to campus sustainability websites and downloadable communication materials.
 - Public Carbon Neutrality Resources Website promotes the work of campuses on scalable solutions and highlights the university's commitment to "bending the curve on climate change" for the benefit of California and the world.

- **Campaigns and Events.** Campaigns and events have been used to build awareness and engagement in the Carbon Neutrality Initiative:
 - In fall 2015, the Cool Campus Challenge provided a fun and friendly online competition that involved almost 20,000 staff, students and faculty in reducing their carbon footprints. It helped create a sustainability culture across all campuses. A communications consultant developed a strategy and toolkit for the Challenge. Organizers used community-based social marketing, put on events and offered swag. Participants received weekly emails with raffle prizes. Overall, more than 450 teams participated in the Challenge, and 1,500 people were named Cool Campus Heroes in the process. (The Cool Campus Challenge report is available at http://www.coolcampuschallenge.org/wp-content/uploads/2016/08/Cool-Campus-Challenge-2015-Program-Summary-Evaluation_May2016.pdf.)
 - The 2016 Carbon Slam was a judged competition that brought students from all 10 campuses together to present climate science and carbon reduction research in 3-minute pitches and posters.
- **Curriculum development.** Curriculum-building workshops have brought together faculty representing more than 160 different academic units across the university to facilitate inclusion of climate change and sustainability concepts in existing courses. The Global Climate Leadership Council has emphasized faculty engagement projects such as the UC Carbon Slam, Faculty Climate Action Champions and a Climate Solutions Course, which began as a pilot at UC San Diego and is expected to be offered at every undergraduate UC campus in 2017.
- **Research and engagement projects.** The Global Climate Leadership Council's Applied Research Working Group has produced several projects to engage faculty and students including the Water-Energy Nexus workshop (spring 2015), the Bending the Curve Summit (fall 2015), the UC-Industry Battery Workshop (fall 2016) and the TomKat UC Carbon Neutrality Project.

Workgroup Outreach

The Task Force's Communication and Change Management workgroup was asked to explore the communication issues and challenges that will impact the Carbon Neutrality Initiative. The workgroup audited existing Carbon Neutrality Initiative communication efforts to date.

The workgroup also conducted a survey to assess student awareness and understanding of the Carbon Neutrality Initiative and elicit feedback on the connection between the Carbon Neutrality Initiative and the UC mission. The audience for this survey, conducted during November and December 2016, was students with a high interest in sustainability or carbon issues representing all 10 campuses. The survey targeted members of student environmental groups and recipients of Carbon Neutrality Initiative Student Research Fellowships. Most respondents were enrolled in environmental science and management or engineering programs. All respondents were asked about their awareness of the Carbon Neutrality Initiative, what excites them about it, and how to engage other students. The Carbon Neutrality Initiative fellows were also asked to characterize the relationship between the initiative and the university's mission statement.

A further resource regarding student awareness was an earlier study conducted by Carbon Neutrality Initiative fellows at UC Berkeley in April 2015. The findings of this report are available at http://sustainability.berkeley.edu/sites/default/files/berkeley_carbon_neutrality_student_engagement_report_spring2015.pdf.

Findings

In the course of its fact-finding, the communication workgroup identified numerous reasons why the Carbon Neutrality Initiative does not yet have broad-based support:

- **Scarce resources.** Many other staff and funding needs compete with carbon neutrality.
- **Knowledge gap.** Uncertainty about which actions to take to reach carbon neutrality results in stagnation and deprioritization of the goal. Uncertainty about costs and funding options for moving toward carbon neutrality add to this stagnation.
- **Values not activated.** The connection between carbon neutrality and the university's mission is unclear and distances the initiative from the community's values.
- **Branding.** "Neutrality" as a goal is uninspiring.
- **The goal seems impersonal.** Technical methods for achieving carbon neutrality, such as electricity and gas purchase strategies, do not engage the broader stakeholder audience. The social cost of carbon and social benefits of carbon neutrality need to be more effectively communicated.
- **UC divestment experience.** The university's response to the student-led Fossil Free UC campaign has made some student groups wary of participating in future campaigns and climate change efforts.
- **Offsets.** Many students are dismissive of carbon neutrality plans that include the use of offsets.

Most of the respondents to a survey conducted in April 2015 among UC Berkeley students had never heard of the Carbon Neutrality Initiative, its focus, or its goal year. Despite low awareness of the formal Carbon Neutrality Initiative, however, most respondents held strong positive attitudes toward the importance of carbon neutrality. Respondents included carbon neutrality among issues of high concern, although many pointed to academic pressures, lack of information, or other important issues as reasons they put other priorities ahead of carbon neutrality. The perceived importance of carbon neutrality will encourage students to encourage campus leadership to make decisions consistent with the goal.

The study conducted by the workgroup among student sustainability leaders and Carbon Neutrality Initiative Student Fellows revealed that despite self-identifying as highly aware of the initiative, and being active participants in sustainability and environmental activities, about a third of respondents were not able to correctly define it. Many misunderstood the timeline, believed it was a student initiative only, believed the goal was a reduction of emissions rather than net-zero, or believed that the initiative was limited to business practices or research and practices.

An encouraging finding was that many respondents found aspects of the initiative energizing, including:

- The UC system as a California, U.S., and global leader for other educational and corporate institutions. (As one respondent put it, "If a massive university system can achieve carbon neutrality, then who's to say that other large organizations cannot do the same?")

- Young people, students, faculty and staff all working together.
- The critical state of the environment and the benefit of carbon neutrality to future generations.
- The ambition of the initiative, including its technical and policy challenges.

The research by the Communication and Change Management Workgroup helps to inform the communication recommendations in this report. Further research is being conducted by the TomKat Communications Strategy Working Group, and their findings and recommendations will be published in September 2017.

APPENDIX IX: MEDICAL CENTER WORKGROUP RESEARCH

Background

The university's medical centers represent a substantial component of the UC system. UC Health, which encompasses the medical centers on five UC campuses (Davis, Irvine, Los Angeles, San Diego and San Francisco), includes 18 health professional schools in dentistry, medicine, nursing, optometry, pharmacy and public health. These schools train half of the medical students and medical residents in California. In addition, UC Health's 10 hospitals make up the fourth-largest health care delivery system in the state and employ 40,000 medical center professionals, including 12,000 nurses and 5,000 faculty physicians. Each year, these hospitals see 147,000 inpatient admissions and 4 million outpatient visits, including 297,000 emergency room visits.

To keep these hospitals running and serving so many patients, UC Health faces high energy consumption and has an outsized impact on UC's greenhouse gas emissions. In addition, the mission, organizational structure, financial circumstances and culture of UC's medical centers are different from those of our campuses. Therefore, reducing emissions from medical centers will require strategic measures targeted at their specific challenges. Any efforts to achieve carbon neutrality must be consistent with medical centers' top priority of providing the highest quality patient care.

Because the medical centers provide patient care, they must comply with more stringent regulations issued by the California Office of Statewide Health Planning and Development (OSHPD) and the Centers for Disease Control and Prevention in order to protect patient health and public safety. OSHPD regulations for patient care facilities limit the medical centers' flexibility in implementing energy conservation and efficiency projects. These regulations apply to medical spaces based on certain classifications. Forty-six percent of UC medical center space is categorized as OSHPD 1 space, which includes hospital patient care areas and is the most tightly regulated. An OSHPD 1 space designation covers an entire building. Another 20 percent of medical center space is categorized as OSHPD 3, which includes licensed clinics and is also highly regulated but self-monitored. The OSHPD 3 categorization covers only the qualifying suite within a building. Therefore, medical centers may find more flexibility in energy efficiency project implementation in these buildings. Approximately 10 percent of medical center space includes other clinics that do not qualify under OSHPD 3 but still face some specialized requirements. Finally, the remaining 30 percent of medical center space does not face these stringent requirements.

To date, the university has not prioritized energy efficiency in its medical centers. In fact, the UC Sustainable Practices Policy currently exempts new "acute care" facilities from certain Energy Use Intensity (EUI) targets and indicates that energy efficiency standards for these facilities "will be developed in consultation with campuses and medical centers." But the medical centers are already planning for growth and replacement of existing hospital buildings. To comply with 2030 seismic requirements, some hospital buildings at all five medical centers will need to be replaced. Without EUI targets in place, planning and design for these buildings may not maximize their potential for energy conservation and efficiency.

In addition to regulatory pressures, our medical centers face significant financial challenges. In a presentation to the regents in April 2016, this situation was described as follows:

“UC Health now finds itself in a daunting financial and clinically competitive environment. Year-over-year increases in expenses (8 percent) are outpacing year-over-year increases in revenue (5 percent). This, in turn, has a dampening effect not only on the ability of the medical centers to capitalize new initiatives but also on the ability of the medical centers to provide financial support for the programmatic growth in UC’s schools of medicine.” (John D. Stobo, M.D., executive vice president, UC Health)

With revenues not matching expenses, medical centers lack the financial capital to invest in carbon neutrality approaches.

Findings

To better understand the barriers that impede medical centers’ efforts to achieve carbon neutrality, the Task Force workgroup interviewed 12 internal stakeholders representing all five medical centers. Interviewees were asked about their awareness of the Carbon Neutrality Initiative, progress to date, barriers and opportunities.

Respondents expressed varying levels of awareness about the initiative. Fifty percent claimed high levels of awareness, while approximately 20 percent had only slight awareness at most. Respondents indicated that, in general, medical center leadership has low levels of awareness of the initiative.

Consistent with this low awareness, respondents indicated that there has been slow to no progress toward carbon neutrality due largely to funding constraints, uncertain funding future, conflicting priorities and a lack of leadership buy-in, except where there are demonstrated cost savings.

Despite these responses, there are some initial signs that the medical centers are beginning to prioritize the initiative. For instance, at UCLA, once staff had developed a plan and made the case for a project, their approach was approved. And at UC Davis, new construction needs and pressure from the chief nursing officer and chief operating officer have led to planning exercises to address carbon neutrality in new construction. Davis also has draft EUI targets for outpatient space. But in the limited circumstances where leadership has bought into these efforts, they have high expectations for prompt financial paybacks of six months to two years (in contrast to three to eight paybacks for most projects in the SEP Program).

Interviewees noted multiple key barriers to prioritizing carbon neutrality at medical centers, including:

- **Competing priorities.** Patient care is the medical centers’ top priority. Maintaining a facility for patient care precludes scheduled interruptions that might be necessary for certain carbon abatement projects.
- **Lack of leadership support.** Leadership is not engaged in the Carbon Neutrality Initiative, and the links between climate change and their mission are undeveloped.
- **Inadequate funding and business case for carbon neutrality.** Like the campuses, medical centers have limited debt capacity. In addition, they expect significant budget challenges in the future, and other investments have higher returns than carbon abatement measures.

- **Space growth.** The medical centers will be replacing hospital buildings and growing. But new capital projects face long planning and implementation timelines.
- **Stringent regulatory environment.** As discussed above, medical centers face stringent OSHPD and other requirements aimed to protect patient health and wellbeing.
- **Inadequate staff levels.** Medical centers need more qualified staff for large-scale changes in energy consumption.
- **Lack of time and financing for energy efficiency projects.**
- **Existing combined heat and power plants.** Like many of the campuses, the medical centers are still paying debt service for existing combined heat and power plants, which makes it more costly to shift away from natural gas and toward renewable energy sources on a short timeline.

Despite this large number of barriers, interviewees also highlighted a few opportunities for making better progress toward carbon neutrality. Suggestions focused on linking carbon neutrality efforts to the medical centers' mission, identifying funding mechanisms and working with OSHPD and peer hospitals, among others. Four key opportunities are worth highlighting here:

- Use Alternative Method of Compliance (AMC) to go above and beyond code with different approaches
- Implement LED lighting and HVAC occupancy controls
- Leverage CEC plan to enforce T24 in hospitals
- Team with peer hospital systems and engage OSHPD directly on new ideas/approaches in existing forums

In addition to conducting interviews, the workgroup also researched effective approaches by peer hospitals:

- **Fuels and sensors.** Presbyterian/Queens Hospital in New York successfully reduced its emissions and EUI by 36 percent over five to seven years by replacing gas with an electric chiller, replacing fuel oil with a natural gas boiler, installing smart sensors and controls for both lighting and ventilation systems and launching a large education campaign.
- **Competitive upgrades.** Emory University Hospital Midtown successfully reduced its hospital energy use by 31 percent in two years through efficiency upgrades that save them \$365,000 annually. Their lighting upgrades earned them \$15,000 in rebates from an energy utility.
- **Utility rebates.** John Muir Medical Center, Concord, addressed aging equipment and rising energy costs with multipronged facilities efficiency and upgrade efforts that successfully reduced energy use from 284 to 212 kBtu per square foot per year and resulted in \$680,000 in savings annually. They also received over \$1.4 million in rebates from their utility.
- **Baselines and blunders.** After Memorial Hermann Health System realized one of its two new identically designed hospitals was reporting 50 percent higher energy loads than the other, it established an energy baseline, tracked use and discovered that construction issues, training gaps and poor use of smart technology accounted for the large difference. Using this information, the hospital successfully repaired existing equipment and trained staff to competitively strive for efficient use.

- **HVAC retrofits with return on investment.** Kaiser Northern California has successfully completed or begun 24 HVAC retrofit projects that aim to bring together patient health care and energy efficiency. To date, the projects have achieved average energy savings of approximately 25 percent and an average return on investment of 15 percent. At a recent UC Davis workshop, participants highlighted this program as a potential best practice for UC Davis to adopt.

The workgroup also researched how hospitals have connected carbon neutrality to their health care missions. Kaiser Permanente has emphasized the importance of reducing greenhouse gas emissions for many years. Its emissions reduction efforts have been successful largely because of leadership buy-in and an explicit tie between its health mission and carbon neutrality. In 2012, Kaiser's CEO Bernard J. Tyson said, "Kaiser Permanente is committed to creating healthy communities, and we all take pride in our focus on prevention, and that includes taking a stand to reduce our greenhouse gas emissions."

UC medical centers can learn from Kaiser's effective messaging to better align the Carbon Neutrality Initiative with their missions. UCSF has taken a step in this direction, using health messaging videos and other materials to connect climate change and health. Likewise, UC San Diego Health's mission "to create a healthier world" could extend to sustainable infrastructure design and operations.

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We deeply appreciate the expertise and commitment of many professionals from across the UC system who participated in our five Task Force workgroups. Together with Task Force members, these individuals did exceptional work reaching out to stakeholders on all our campuses, conducting research and evaluating and sharing what they learned in order to develop our recommendations. This list is by no means complete, and any omissions are entirely inadvertent.

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