

Leading the Way to Climate Neutrality Initiative A Whitepaper for the Campaign Steering Committee

THE VISION

The reality of global climate disruption is upon us. No longer is the question how we might prevent climate change, but how quickly we can mitigate, prepare and adapt. In response to this growing crisis, the University of California Office of the President created the Carbon Neutrality Initiative, which commits UC to emitting net-zero greenhouse gases by 2025—something no other major university system has done. Among the ten campuses, UC Davis is uniquely poised to lead the way and set a new standard of climate-smart practices for our sister campuses and for large institutions worldwide.

Since its founding, UC Davis has used its campus as a testbed for solution-driven science. We are a global pioneer in sustainability, with unparalleled breadth and depth of expertise across the disciplines, and the national face of engaged green scholarship and enterprising students. Unique to our university is an ethos-driven collaboration among administration, planning, facilities and operations—one that is building an impressive track record in inspiring students to effect tangible changes in campus energy use. Establishing a platform for these partnerships and providing the structure and resources needed will position UC Davis as a leader in sustainable education and practice.

The *Leading the Way to Climate Neutrality Initiative* will be a first-of-its-kind partnership among faculty, students, staff and industry to make UC Davis a zero-carbon campus by 2025. This transdisciplinary, universitywide initiative will accelerate efforts to pilot, finance and implement carbon reduction projects, the savings from which will be reinvested. Through project-based learning opportunities, faculty, students and staff will collaboratively test and operationalize cutting-edge research and translate this work to the public. In the process, we will spearhead a feasible carbon neutrality model for large institutions worldwide and provide the next generation of energy leaders with the knowledge and hands-on skills to foster global resilience to climate change.

We know that in order to end reliance on fossil fuels, we must simultaneously increase energy efficiency and the share of energy from renewable sources. The challenge is to do so in ways that are large scale, fiscally solvent, and engage stakeholders at all levels, most notably students, in a meaningful way. This initiative will empower students with a dynamic toolset to develop both new financial and decision-making models to attract the capital and broad buy-in needed to drive social-technical solutions for carbon emissions reduction.

The unprecedented cascading effects of climate change demand bold solutions that generate their own cascading effects. This initiative has the people, the resources and the vision to transform how higher education communities address grand challenges, and in doing so, expedite the translation of robust solutions. The urgency of climate change and the charge by UCOP present UC Davis with a game-changing opportunity to lead the way to a cleaner, brighter and fully sustainable future for all.

THE RIGHT TIME AND THE RIGHT PLACE

In 2016, UCOP identified and supported Faculty Climate Champions for each campus, and UC Davis' champion award recipients are Kurt Kornbluth, Nina Claire Napawan, Sheryl-Ann Simpson and Brett Snyder and their Zero-Net-Energy (ZNE) Initiative. This applied research and education collaboration merges the work of the Energy and Transportation Research Center, the Office of Environmental Stewardship and Sustainability, and the Energy Conservation Office to apply project-based learning to reduce campus energy use.

A signature endeavor of the ZNE Initiative is the Path to Zero Net Energy course, in which student groups work on client-based energy projects such as audits, behavioral studies, energy modeling and more. These

projects focus on informing decisions regarding energy efficiency, consumption and supply at UC Davis and each is a concrete step toward a zero-carbon campus. Recent class projects include:

- Performing a "Phasing and Financing" study of the proposed conversion of Davis campus's heating system from hot water to steam. Two student groups evaluated the feasibility and impact of the conversion project in different building types (an estimated energy use savings of 20-48%). By proving that the project would pay for itself and identifying an innovative array of financing models his study helped secure critical buy-in from university leadership. The conversion project, besides cutting heating-related greenhouse gas emissions by almost 50%, is projected to net well over \$100 million in savings over 30 years.
- Working with Facilities Management to analyze the thermal energy storage system operation and optimizing the charging and discharging of the 5-million gallon chilled water tank. A zero-cost, behavioral intervention was implemented that continues to save UC Davis over \$35,000 per year in electricity.
- Conducting data analysis that both the UC Davis Medical Center and the Office of Environmental Sustainability and Stewardship were able to apply toward understanding the magnitude of commute-related emissions at the Sacramento campus.
- Partnering with Unitrans staff on the feasibility of electrifying the bus fleet. Students found that by replacing 13 traditional buses with electric ones, they could reduce emissions by 540 metric tons of CO₂e per year. They published a comprehensive study—including cost/benefit analysis, a technology review, and route analysis—and the students are voluntarily continuing their work with Unitrans with the goal of making electric buses at UC Davis a reality.

High-impact student projects like these have been fostered by a degree of cooperation among faculty, administration and facilities that is truly unique to UC Davis and—along with the exceptional universitywide buy-in represented by our campus's record turnout at the UCOP charrette for the Carbon Neutrality Initiative—rank among our strongest competitive advantages.

The Leading the Way to Climate Neutrality Initiative will expand the scope of ZNE's work to include the Graduate School of Management and thought leaders across the full spectrum of sustainability research, from our top-ranked College of Agricultural and Environmental Sciences and College of Engineering to the College of Letters and Science, among others. Additionally, we will draw upon atmospheric expertise to provide modeling and baseline information about extreme weather events, enhancing our agility in responding to unprecedented weather conditions as they arise.

Synergizing these assets with industry partners and investment networks under the umbrella of the initiative gives UC Davis the capacity to show just what is possible when a sustainability powerhouse focuses its resources on the goal of carbon neutrality. The Leading the Way to Climate Neutrality Initiative will cement UC Davis' position as the global leader on university-based climate action.

THE OPPORTUNITY

Imagine a small graduate student team assessing the carbon sequestration capabilities of the university's regional physical footprint. Their investigation connects them with faculty experts in grasslands ecology, landscape architecture and civil engineering. They deliver a report to their client, Environmental Stewardship and Sustainability, which helps determine better grass species to plant on the Davis and Sacramento campuses. Even more importantly, the students stay in touch with each other long after

graduation, building networks across their respective industries of UC Davis alumni who are committed to collaborating on climate solutions.

Imagine, too, an interdisciplinary faculty and student team partnering with Chevron Energy Solutions to test smart grid usage in a West Village house dedicated to climate neutrality research. Through novel data visualization techniques, the team is able to provide residents with actionable insights into optimizing their energy use.

Imagine UC Davis becoming the world's first zero-carbon university campus—a priceless distinction that sparks new opportunities for cutting-edge research and intellectual property, positions us as the top destination for emerging talent working at the leading edge of sustainability, elevates quality of life for everyone in the region and ultimately propels other communities toward carbon neutrality.

The Leading the Way to Climate Neutrality Initiative will create a model showing that, with the right team, economically sustainable carbon neutrality is possible through four key areas: planning, operations, education and financing.

Smart and nimble planning

Sustainability is an ongoing and complex goal, one that continually challenges us to achieve new benchmarks. Through a holistic framework and an inclusive process, the Office of Environmental Stewardship and Sustainability—representing the administrative and planning arm of the initiative—will provide a clear roadmap toward carbon neutrality.

The roadmap will take the form of an updated Climate Action Plan (CAP) that will identify pathways of action, projects and interventions. The Office of Environmental Stewardship and Sustainability will lead the CAP's update in collaboration with faculty, staff and students. This will allow multiple university community sectors to participate in adaptively managing and implementing the projects and pathways identified in the CAP, including developing financing solutions. Active participation also fosters an increased sense of personal stewardship of the campus and surrounding community.

In addition, faculty, students and staff will tackle the climate change adaptation challenges of a major research campus by studying and incorporating important resiliency actions to ensure a second sustainable century for UC Davis, as it continues to deliver knowledge and solutions for the state, nation and world.

Real-world problem solving

Crucial to achieving carbon neutrality, and to providing students with a wealth of hands-on opportunities, is the nuts-and-bolts transformation of how we use energy on campus. The Energy Conservation Office forms a key operational arm of the initiative and can provide technical support, campus energy data and metrics, energy efficiency-related engineering support in drafting the updated CAP, and real cases for project-based courses. The office will also assist with implementing funded carbon-reduction and other energy projects across the university.

In all of the above endeavors, both the Office of Environmental Stewardship and Sustainability and the Energy Conservation Office will collaborate with faculty, students, Capital and Space Planning, Campus Planning, and Design and Construction Management.

Engaging students

Supporting the initiative's teaching and research mission, faculty in the Energy and Transportation Research Cluster in West Village will coordinate with the Office of Environmental Stewardship and Sustainability and the Energy Conservation Office to investigate project ideas and identify those most

viable for further study or implementation. This cluster includes the Program for International Energy Technologies, Institute of Transportation Studies, the Energy Efficiency Center, the Plug-in Hybrid and Electric Vehicle Center, the California Lighting Technology Center, the Center for Waste Energy Efficiency and the Western Cooling Efficiency Center.

These centers, working with industry partners such as PG&E, Microsoft and Chevron, focus on accelerating the commercialization of low-carbon, energy-efficient technologies and interventions that pay back. They also will provide the expertise and guidance to develop, test and pilot the technical, social and financial innovations that will bring carbon neutrality to UC Davis, including feasibility studies and the creation of sustainable investment models. Research areas will include building efficiency, renewable energy, energy use behavior, transportation and land use, smart technologies and more.

ZNE faculty have demonstrated through several years of energy courses that students are drawn to project-based learning and enjoy working on meaningful projects. We have found that engaging students in real-world projects helps reinforce the relationship between theory and application, and provides opportunities for students to develop a greater sense of how they can use their higher education to contribute to society in meaningful ways.

Under this initiative, faculty from all disciplines will create new learning-by-doing classes and curriculum at undergraduate and graduate levels. The themes will be aligned with the CAP's climate and energy research agenda.

Advancing economic sustainability

Leveraging the ZNE's existing partnerships, and in collaboration with the Graduate School of Management's Child Family Institute for Innovation and Entrepreneurship, the initiative will create new ideas and networks in order to attract needed capital.

The Child Family Institute will guide viable carbon reduction projects through one-day and multi-week Investment Development Clinics (modeled after Andrew Hargadon's groundbreaking Venture Development Clinics) to articulate investment opportunities and identify investor networks to get projects off the ground.

Teams of students, faculty, staff, industry experts and investors will create a portfolio of investments corresponding to the CAP. Investments in energy projects will pay for themselves and bring cost savings back to the university. The money generated from the projects will come back to a new green revolving fund, the Climate Neutrality Fund, and be reinvested in new projects.

Since 2009, UC Davis has invested over \$60 million in energy-saving campus projects, with an average payback timeframe of less than ten years. Accumulated annual savings over this period have now exceeded \$15 million. Leveraging the partnerships and networks of the initiative, savings at this scale are achievable on the campus and will provide excellent investment opportunities and allow savings to be redirected back into the investment portfolio.

MOVING FORWARD

Launching the Leading the Way to Climate Neutrality Initiative will require start-up and seed funding to jumpstart research, curriculum and investments.

Start-up funding of approximately \$16 million will support feasibility studies, pilot projects and their implementation, modeling and forecasting, data visualization, creating an implementation roadmap, annual assessment of performance toward roadmap goals, university community engagement, public outreach, new course development, and publishing and dissemination. Start-up funding subtotals are

estimated to be \$5 million for administration and planning, \$5 million for facilities and operations, and \$6 million for faculty and students.

Seed funding, approximately \$25-40 million, will support new investments and the creation of the Climate Neutrality Fund. This new green revolving fund will allow for investment in a portfolio of low and short payback, as well as longer-term projects. The fund is critical to short-circuiting the first-cost hurdles faced by projects, and a seed capital fund will overcome investment barriers for projects with clear paybacks but high first-cost capital needs.

The total cost is estimated to be \$60 million over five years. Capital support for three climate-neutral houses in West Village—which will provide an exceptional experiential learning environment as well as commercialization opportunities—would add an additional \$6 million to the total cost.