Sustainability — Human Factors

Public Exchange™

Sustainable Energy & Materials

An ECOSYSTEM of Innovation

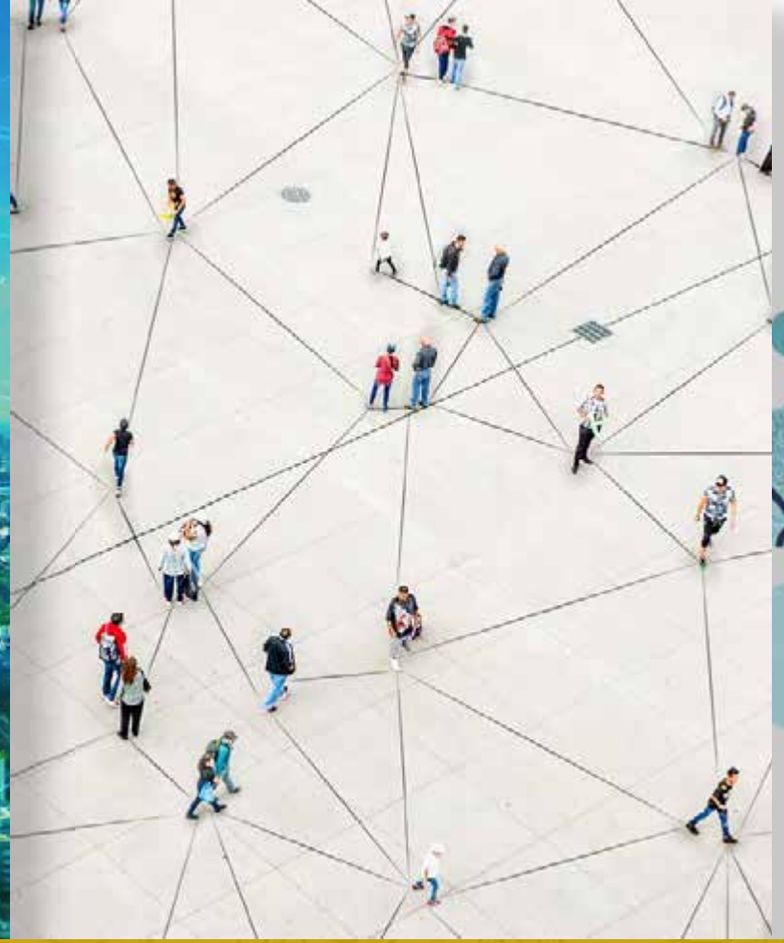
USC Dornsife

AN ECOSYSTEM OF INNOVATION

The window is still open. We have opportunities to change our trajectory from one in which climate change brings disastrous effects upon the natural environment, our global economy, and human health to a future that thrives on clean energy, ingenuity, and boundless opportunity.

But we need radically different thinking.

It will take the full range of academic expertise to tackle what is arguably the most pressing issue ever faced by humankind. USC Dornsife College of Letters, Arts and Sciences is investing in research to drive technological innovation, as well as the systems, policies, and mindsets that must drive societal transformation. And to maximize our impact, USC Dornsife is streamlining collaboration with the policymakers and business leaders who are tasked with implementing solutions.



Sustainability — Human Factors
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SUSTAINABILITY — HUMAN FACTORS

> ***Effective technology already exists to shape a new energy economy, cultivate healthier communities, and protect vulnerable ecosystems. We are limited today not by innovation, but by human choices.***

The challenge is to figure out how we as a society can implement what is available more quickly, equitably, and at scale.

Through our school-wide initiative, USC Dornsife grapples with complex questions related to the human dimensions of sustainability — the economics, politics, and mindsets that continue to stand in the way of making critical progress in this short window of opportunity. We're also tapping our experts in history, culture, narrative, and philosophy to offer new frameworks for understanding how humans interact with the environment.

Working together, along with leaders in the public, private, and nonprofit sectors, USC Dornsife is carving out a distinctive leadership role that emphasizes our collective responsibility and limitless opportunities to safeguard our planet for future generations.

USC Wrigley Marine Science Center

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USC Wrigley Institute for Environmental Studies

Because sustainability challenges are as complex as the people and social structures that create them, the USC Wrigley Institute has expanded its mission to connect our natural and marine science researchers more deeply with our academic strength across the social sciences. Working under one umbrella, USC Wrigley develops new strategies for using the knowledge we have about human motivation, economic systems, and political structures to shorten the road from innovation to impact.

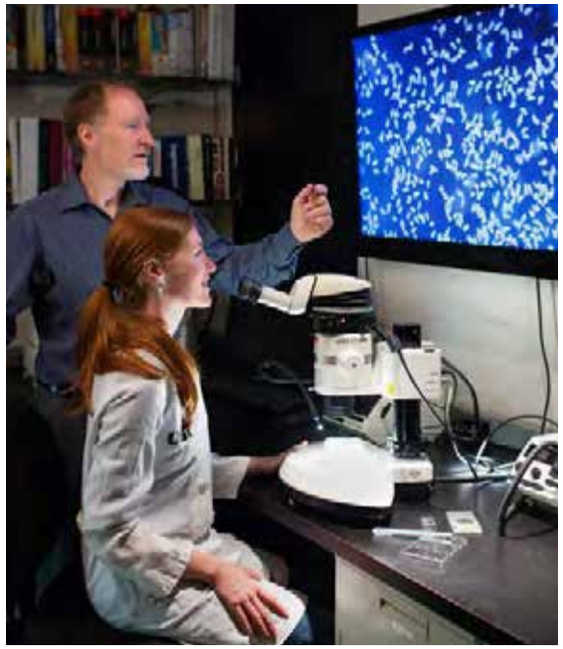
Behavioral Psychologist Joe Árvai

Director, USC Wrigley Institute for Environmental Studies

Led by Dr. Joe Árvai, an expert in decision-making under conditions of risk, the USC Wrigley Institute is also making public outreach a top priority. Faculty and students work directly with community leaders, organizations, businesses, artists, and many others to fulfill its mission as both an educator and a model for sustainable practice in daily life.

Environmental Studies (ENST)

Now integrated with the Wrigley Institute, the USC Dornsife Environmental Studies program approaches environmental problems from many angles — from geosystems, biology, and chemistry to economics, political science, and international relations. Because nearly every career in the future will connect in some way to sustainability, students from every major across the university are encouraged to take ENST courses.



USC Wrigley Marine Science Center on Catalina Island

An unmatched resource among institutions of higher education, the Wrigley Marine Science Center (WMSC) is USC Dornsife's "branch campus," located on Santa Catalina Island. While the WMSC has long stood as a hub for scientists studying ocean life and systems, it has transformed into a dynamic learning environment for all faculty and students who want to connect their academic interests with sustainability. Students can take courses and conduct research on the island campus, where the wonders of nature become a constant reminder of what is at stake for our planet.

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THE BLUE ECONOMY

It doesn't have to be a zero-sum game. We can use ocean resources to spur economic growth and improve livelihoods without harming marine ecosystems. With longstanding strength in marine biology, Earth sciences, chemistry, and related fields, USC Dornsife is positioned to lead innovation focused on the Blue Economy.

Kelp Elevator

What if fuel derived from common seaweed could power our cars, ships, and airplanes?

Just off the Wrigley Marine Science Center on Catalina Island, USC Dornsife researchers piloted a new aquaculture technique for growing kelp — an algae that can be converted to biofuel. By raising and lowering the underwater kelp farm to depths that optimize exposure to sunlight and nutrients throughout the day, growth accelerated exponentially compared to natural processes. Beyond scientific innovation, the project demonstrated vast potential for this renewable energy source when cultivated at scale.

Sea Grant Program at USC

A federally funded partnership that integrates research, education, and outreach with a specific focus on the "urban ocean," USC Sea Grant explores better ways to manage people and natural resources along an intensely developed coastline. Sea Grant is recognized as a leader in coastal hazard planning, environmental workforce training, and conservation stewardship.

L.A.'s Opportunity to Define the Blue Economy

#1
busiest seaport in the Western Hemisphere
(Los Angeles / Long Beach)

~$35 Billion
in regional economic output

200,000+
total jobs in L.A. County

126,000
new jobs in L.A. County by 2030

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The Green Economy

In a Green Economy, employment and income growth are driven by investment in assets that reduce greenhouse gas emissions, enhance energy efficiency, and prevent the loss of biodiversity.

These efforts are guided by environmental and energy economists, including those at USC Dornsife — experts who help society devise new "rules of the game" to spark green economic growth and adapt to the effects of climate change, while shining light on the vast opportunities to create new wealth, stable governments, and equitable communities.

USC Dornsife Environmental Economics Initiative

A team of USC Dornsife economists design and model which incentives are most effective in motivating the free market and governments to work together to improve our environmental quality of life. Whether they're using "green data" to inform carbon tax proposals or exploring how to make global supply chains more efficient, environmental economists are helping us adapt and succeed on a warmer planet.

Partner With Us: Environmental Economics Consortium

Companies grappling with the regulatory and physical risks of climate change are invited to partner with USC Dornsife environmental economists who design field experiments that help organizations cost-effectively tailor interventions.

Environmental Economist Robert Metcalfe

Economics as Technology

Working with Virgin Airlines, Professor Robert Metcalfe developed a study in which airline pilots were encouraged to choose more efficient flight speeds and fuel volumes that reduced emissions by roughly 15%. This percent reduction, which could be scaled throughout the airline and marine freight industries, is similar to what we expect from new iterations of technology like better engines or improved fuels.

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Sustainable Cities

What will it take to make urban environments greener, more affordable, more equitable, and healthier for everyone? At USC, spatial scientists, sociologists, urban planners, and policy experts help decision makers navigate competing tensions to shape a future where growing urban communities can thrive in an ecologically meaningful way.

USC Dornsife Spatial Sciences Institute (SSI)

Among a large portfolio of sustainability-focused projects, SSI maps environmental health across L.A. neighborhoods and, through the Carbon Census project (in collaboration with USC Dornsife Public Exchange and the Department of Earth Sciences), it is installing carbon dioxide monitoring stations across the city to correlate tree coverage with health and quality of life.

Center for the Study of the Urban Critical Zone (UCZ)

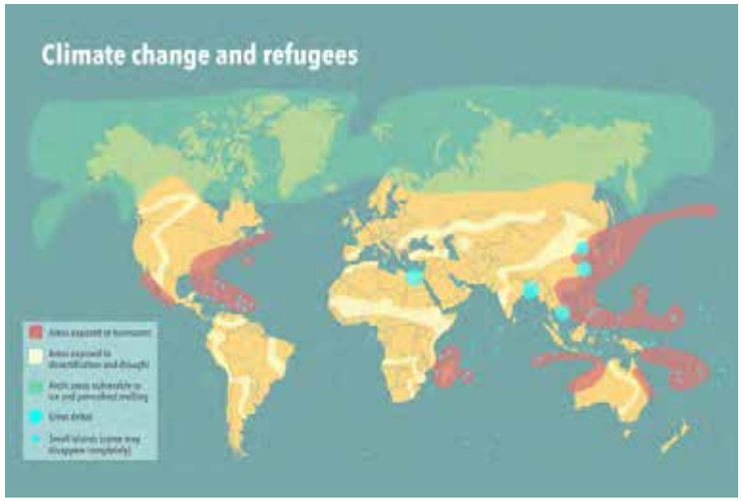
UCZ leverages big data to examine the complex environmental and infrastructure systems of Los Angeles. By interpreting this data, it develops an experimental model for achieving a smaller carbon footprint.

1 *Earth scientist William Berelson installs a network of devices designed to create a detailed map of greenhouse gases and other noxious emissions in L.A. neighborhoods.*

2 *USC Dornsife students in the Geographic Information Sciences and Technology program conduct field research along the Southern California coast.*

A.I. in L.A.

Creating faster, more accurate climate models could help leaders anticipate and mitigate some of the effects of climate change. Using algorithms designed to learn from experience, Professor Sam Silva leverages artificial intelligence to study the chemical makeup of clouds — information that helps us better understand changes in air quality, the amount of sunlight reflected back into space, and global water cycles. What we learn from the sky above Los Angeles will take on greater relevance as conditions of other cities are increasingly becoming more like those in Southern California.



Climate Migration Research

USC Dornsife experts in migration, human rights, and the global economy explore ways in which cities can better prepare for the changing social and economic dynamics that will come with a growing number of climate refugees.

Department of Middle East Studies

As the first university department of its kind to focus specifically on sustainability issues across the Middle East, USC Dornsife's Department of Middle East Studies provides students with a distinctive framework through which they can explore more traditional topics such as urbanization, politics, and religion.

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Environmental Justice & Climate Equity

Success in building a sustainable society requires that all people can realize their highest potential without interruption by environmental racism or inequity.

USC Dornsife Equity Research Institute (ERI)

Under the leadership of Distinguished Professor Manuel Pastor, ERI uses data analysis to power social change with an emphasis on the impacts of climate change, air pollution, and urban heat zones on communities of color. Among ERI's projects, researchers use geographic information systems to visualize and analyze demographic and economic shifts that inform state policy and "Green Zone" initiatives. Additionally, the institute engages students and local communities in social movement building.

Sociologist Manuel Pastor

Precarious Ecologies

The Mellon Foundation has awarded USC Dornsife a prestigious Sawyer Seminar for *Precarious Ecologies: Science and Social Justice in the Production of Environmental Knowledge*. Co-hosted by the Center on Science, Technology, and Public Life and the Center for Latinx and Latin American Studies, the initiative addresses policy debates concerning potential mitigation measures for the disproportionate environmental hazard exposure among low-income communities and communities of color.

American studies and ethnicity expert Juan De Lara

Working on urban ecology and environmental justice issues with communities near the Port of L.A. and nearby coastal areas, Professor Juan De Lara aims to build a dynamic, modern data infrastructure that enables marginalized communities to participate in data-driven decision making related to environmental policy.

Eco-Design in an Age of Water Scarcity

The standard design of flush toilets involves a regular expenditure of water that fits poorly with growing populations in arid environments. Recent initiatives have sought to "reinvent" an alternative design, but in Cape Town, South Africa's disadvantaged settlements, such sanitation solutions primarily target marginalized populations. Anthropologist Peter Redfield and colleagues are exploring the entangled problem of the need to eco-design sanitation systems and the political aspirations of citizens in the post-apartheid state for equitable access to modern infrastructures.

Sustainability | Human Factors

Accelerating Policy

Sustainability issues do not appear in shades of red or blue. As a national leader in practical politics and public policy, USC provides an intellectual environment in which policymakers, business leaders, and academic researchers can work together to break through political roadblocks that stall the adoption of sustainability and environmental solutions.

Renowned political strategists Democrat Bob Shrum and Republican Mike Murphy serve as CPF co-directors.

USC Dornsife Center for the Political Future (CPF)

Designed to promote civil debate and evidence-based solutions to America's pressing challenges, CPF breaks through partisan rancor and misinformation. Many of the Center's signature events relate to sustainability, including the annual *Climate Forward* conference in partnership with the USC Wrigley Institute for Environmental Studies

Security and Political Economy (SPEC) Lab

SPEC Lab researchers conduct policy-relevant research into the causes of prosperity and peace, with an emphasis on the intersection of climate change, security, and economic development.

"Science has been screaming at us, exhorting us to act."

— Hon. John Kerry, former Secretary of State, at USC Dornsife's 2019 Climate Forward conference

The West on Fire

At the Huntington-USC Institute on California and the West, a team led by Professor William Deverell places western wildfire in historical context and broadens public awareness of the region's relationship with fire. Pulling together ecologists, Indigenous fire practitioners, U.S. Forest Service personnel, Earth scientists, economists, political scientists, journalists, and many others, The West on Fire initiative is a timely opportunity to develop new ways of thinking about fire in the region.

PUBLIC EXCHANGE™

Tapping the full range of expertise at a top research university, USC Dornsife Public Exchange is growing an impressive portfolio of project partnerships that move the needle on sustainability.

The first-of-its-kind program, Public Exchange connects our academic researchers with policy, industry, and nonprofit partners. Our goal is to amplify social impact by making academic expertise more easily accessible than ever before. Managing projects from start to finish, Public Exchange provides partners with the data, analysis, and evidence-based recommendations they need to break through complex problems.

PUBLIC **EXCHANGE**™

Image courtesy of Outsideonline

Nearly 20% of the trees in Los Angeles can be found across just five census blocks — home to 1% of the population.

USC Urban Trees Initiative

Planting trees is one of the lowest-cost and most effective means to cool down cities, clean the air, and reduce energy usage. Unfortunately, in most urban centers like Los Angeles, low-income communities of color are disproportionately more likely to live in areas with less shade.

To improve health and climate equity, the USC Urban Trees Project — a collaboration between Public Exchange and the City of Los Angeles — guides the growth of an urban forest of more than 90,0000 shade trees.

With USC experts in spatial science, Earth science, architecture, and many others helping to carefully identify the best locations and species of trees to plant, the USC Urban Trees Project will provide profound, even life-saving benefits, particularly within under-served neighborhoods.

Behavioral scientist
Wändi Bruine de Bruin

Words that Work

In partnership with the United Nations Foundation, USC Dornsife Public Exchange assembled a team of behavioral scientists to determine how well the general public understands climate change terminology. Their findings are helping scientists more clearly communicate the effects and urgency of a warming planet, even informing terminology used in reports by the Intergovernmental Panel on Climate Change.

Reducing Water Use in Southern California

Public Exchange collaborates with the Santa Clarita Valley Water Authority (SCVWA) to reduce water usage and increase participation in the agency's Lawn Replacement Program. Leveraging behavioral science research, the partnership is uncovering better ways to inform and motivate SCVWA customers to make more sustainable choices.

Charging Ahead

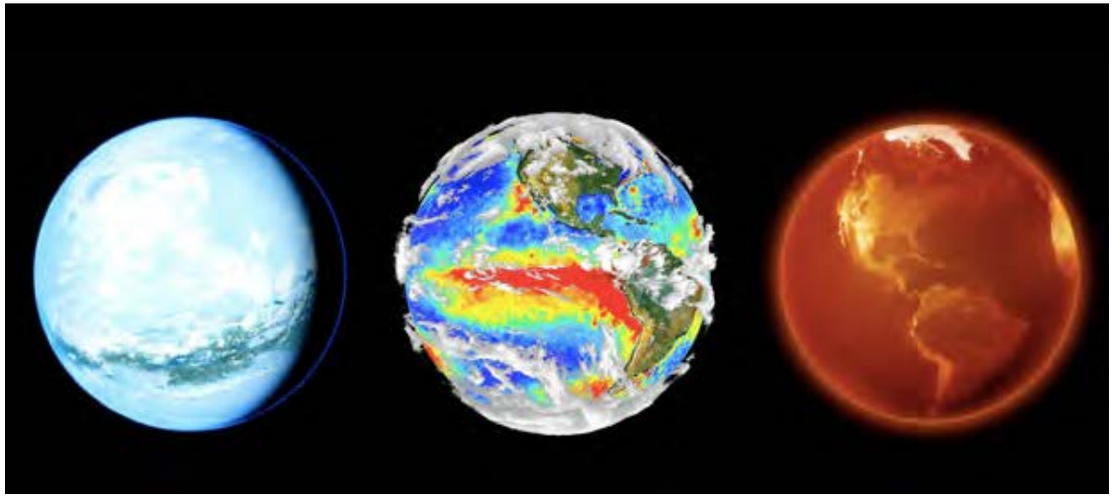
While we see an increase of electric vehicles on Los Angeles' roadways, many complex issues continue to slow this transition. That's why Public Exchange brought together USC economists with partners at the L.A. Cleantech Incubator to study both policy and industry-led solutions for stimulating growth in vehicle electrification. Together, they are exploring ways to make EV ownership more affordable, charging stations more accessible, and the design of a robust EV infrastructure.

SUSTAINABLE ENERGY & MATERIALS

> ***The evidence is overwhelming. A transition to clean energy will do more than help preserve the natural environment and combat global warming. This transition is vital to a robust economy and 21st century job market. It's vital to national and global security. It's vital to human health and social justice.***

In short, the transition to clean energy is arguably the single most important step society can take toward solving many of the world's most complex challenges.

USC Dornsife brings longstanding strength in physics, chemistry, biology, and their converging subfields to drive innovation that will help us meet the urgency of the moment while providing a foundation for sustainability technology of the future.



Sustainable Energy and Materials

Materials for Electrification and Carbon Capture Technologies

It is unlikely that a "perfect" source of clean energy will be discovered in the small window of time that we have to avoid environmental catastrophe. Instead, we will need to rely on improving existing technologies and the discovery of brand-new materials that will support next-generation energy and carbon capture technologies.

Department of Earth Sciences

Bringing world-leading expertise in geochemical and mineralogical characterization, deep ocean biospheres, and the development of new carbon capture solutions, USC Dornsife Earth scientists are helping us interact in more sustainable ways with the planet.

Biophysics and Microbiology

USC Dornsife researchers are at the cutting edge of discovering natural and synthetic microorganisms that may open new avenues for biomining, and they already collaborate with this emerging industry sector.

Department of Chemistry

USC Dornsife's world-class chemistry department offers significant expertise in creating new photovoltaic, fuel cell, battery, carbon capture, and recycling technologies based on critical materials.

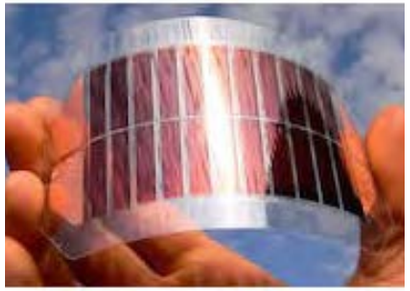
Our impact has gone beyond the confines of the lab, leading to energy efficient OLED lighting (Universal Displays), CO2 adsorbents (CO2onTap), energy storage (Staq Energy), and microbial waste-to-energy conversion (AquaCycl), to name a few recent examples.

Sustainable Energy and Materials

Research Highlights

Towers of Power

Imagine every skyscraper in the world's fast-growing urban centers doubling as solar power plants. It might not be as far off as it sounds. World-renowned chemist and inventor Mark Thompson is unlocking new possibilities in organic photovoltaics — research with the potential to significantly lower solar electricity costs and to be used as high-efficiency solar films for windows.

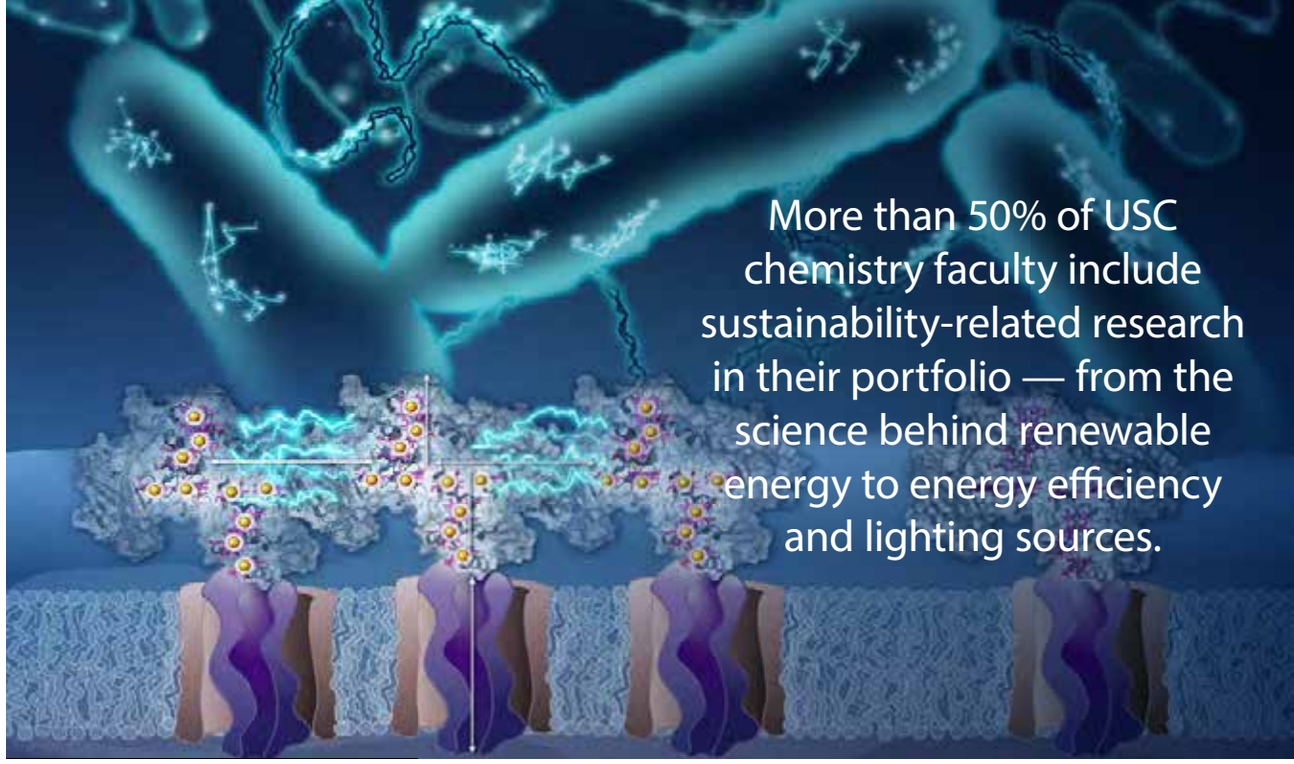


Electrifying Discovery

Professor Moh El-Naggar and his team at the NanoBio Lab have discovered how a unique bacterium's process of metabolism creates electricity. El-Naggar's team is exploring the remarkable potential for a new category of hybrid fuel cells and wastewater treatment systems that harness the power produced by these microorganisms.

Loker Hydrocarbon Research Institute

Since 1979, Loker researchers have studied alternative hydrocarbon sources and chemistry for renewable energy. Led by Professor Surya Prakash, the team has demonstrated innovative techniques for capturing and converting CO2 from the air into clean-burning and renewable methanol, which can be used in place of fossil fuels.



Electrochemist Sri R. Narayan

Building Better Batteries

A number of USC Dornsife scientists focus on overcoming the challenges to storing renewable energy and improving battery capacity. Among the most promising work is research led by Professor Sri R. Narayan, who has delivered on federally funded projects worth over $20M during the last 20 years. His efforts have led to commercialization of fuel cell technologies, lithium-ion batteries for the Mars rovers, and fuel cell power sources for the military.

Sustainability Education

> ***There are so many reasons for optimism. For many of our students, sustainability is the issue they care about most.***

While they learn from some of the world's top subject matter experts, USC Dornsife students put their curiosity to work. Whether it's an environmental policy internship, inventing a new way to recycle PVC, or advocating for climate justice in neighborhoods around campus, our students are actively shaping their future.

Sustainability Education

USC Dornsife educational opportunities in sustainability

17
sustainability-related majors and minors, including Environmental Studies

6
sustainability-centered Problems Without Passports courses

More than
30 GE COURSES

More than 100
other undergraduate course offerings in climate and sustainability

USC Wrigley Institute
Residential College

- Several Maymester and Julymester courses offered on topics in sustainability
- Undergraduate internships
- Student research in sustainability
- Climate change communication workshops
- Scientific diving and SCUBA certification

USC Dornsife is home to two prestigious environmental awards:

Tyler Prize for Environmental Achievement

The premier international award for environmental science, environmental health and energy that confer great benefit upon humankind, the Tyler Prize for Environmental Achievement is administered by USC Dornsife.

USC Wrigley Sustainability Impact Prize

The USC Wrigley Sustainability Prize, now hosted by the USC Marshall Lloyd Greif Center for Entrepreneurial Studies, inspires and supports the development of student-led entrepreneurial businesses focused on the environment.

1 *The USC Wrigley Institute Scientific Diving Discovery Program helps students from underrepresented minority groups get certified as professional science divers.*

2 *Through a creative endeavor called Cool Globes: Hot Ideas for a Cooler Planet, USC students help communicate the urgency of the climate crisis by using art and design to appeal to emotion.*

3 *The USC Wrigley Institute Storymakers training intensive helps scientists become more proficient in the art of environmental storytelling.*

4 *Marine biologist Carly Kenkel explores the potential for coral reefs to survive warming ocean temperatures by leveraging a complex, symbiotic relationship with algae.*

5 *Katelyn Michael (left) and Carlos Navarro developed a way to recycle a carbon fiber from discarded aircraft parts. The idea took first place at a recent USC Wrigley Sustainability Prize competition.*

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