Union of Concerned Scientists

Catalyst

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A Healthy Democracy Is At Stake

Ensuring every voice counts

Greener Batteries For Electric Cars

In Memoriam: Kurt Gottfried

[Union of Concerned Scientists

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The Union of Concerned Scientists puts rigorous, independent science to work to solve our planet's most pressing problems. Joining with people across the country, we combine technical analysis and effective advocacy to create innovative, practical solutions for a healthy, safe, and sustainable future.

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An Unwavering Commitment

Johanna Chao Kreilick surveys the landscape of Greenland during a research trip in September, where she witnessed firsthand how global warming is affecting one of the planet's most vital ecosystems.

This September, I had the opportunity to visit one of the most starkly beautiful spots on our planet, accompanying my colleague Brenda Ekwurzel, senior climate scientist, to Greenland on a brief research and learning trip with 24 women climate scientists, activists, and philanthropists.

In many ways, Greenland is ground zero for climate change, as the entire Arctic has been warming four times faster than anywhere else on Earth since 1980. Its melting ice sheet puts the world at risk of catastrophically high sea levels should we keep warming the planet by burning fossil fuels.

> ***A visit to Greenland yields a new sense of urgency in the fight to combat climate change and an appreciation for UCS's vital role.***

Witnessing the dramatic and noisy "calving" of the majestic ancient glaciers in Ilulissat and Eqi, I felt renewed urgency and appreciation for the vital role that the Union of Concerned Scientists plays in the climate fight. And for the first time in a long time, as an American, I felt hopeful that my country might fulfill its promise to the world to do our part.

One motivator in my surge of hope has been the recent passage of the Inflation Reduction Act (IRA), which was signed into law this summer. This massive bill contains many hard-fought, long-overdue climate and energy policies and investments that UCS scientists and advocates have been essential in shaping and advancing.

(continued on p. 20)

Photo: Brenda Ekwurzel/UCS

WHAT OUR SUPPORTERS ARE SAYING

Here's a sampling of recent feedback from the UCS Facebook page (www.facebook.com/unionofconcernedscientists). Find us also on Instagram (www.instagram.com/unionofconcernedscientists) and Twitter (www.twitter.com/ucsusa).

RESPONSES TO THE CLIMATE-RELATED PROGRAMS IN THE INFLATION REDUCTION ACT PASSED THIS SUMMER

K. Greg Murray:
This is great news! Renewing our commitment to climate action will be good for the US economy, good for the climate and everything that it affects, and good for the status of the United States in the world.

Carmen Ann Gonzales:
Hope this is not just lip service with money for endless adaptation planning. Now is the time for action.

Herman Diaz:
All the more reason to #VoteScience, #FightForDemocracy . . . and get even more done.

Sharon Twardowski:
[It's] about time—I would like to see all governments in North America give people incentive grants to switch to solar/wind power. Florida has many commercial buildings with solar panels all over the roof, so why not houses?

Norm Morrison IV:
This means that anyone who voted against this bill is *not* on the side of science. And people should be asking why.

Tania K Lash:
The [corporations] responsible for the pollution should also foot the bill.

ON THE ABILITY OF THE US POWER GRID TO ACCOMMODATE MORE ELECTRIC VEHICLES

Bob Cope:
Demand for electricity has always increased, from the first electric street-lights in New York City to today with air conditioners and so on. As long as there is profit, businesses will produce electricity. Overhauling our electric grid is long overdue, however.

Noel Rendleman:
Is there a choice? No. Get busy with improving and decentralizing the grid now.

Kevin Theobald:
Those who have profited from [gasoline] vehicles are scared they will not have big profits in the EV age. What good is big profits if humankind dies off? . . . It is amazing to see the pace of EV innovation, solar innovations, and so on. The funding for R&D of green tech is at record levels and we are seeing results from it.

Richard Craig:
We are in the first generation of EV cars and batteries and I would challenge anyone to accurately predict the state of EV car and battery technology 5 to 10 years from now. Think about this: in 1940 could anyone have predicted that by 1953 there would be a two-seat sports car [Corvette] powered by a six-cylinder fuel-injected engine that would usher in a generation of cars lasting over 60 years?

[IN THIS ISSUE]

New Climate Law Gives Sustainable Agriculture a Boost

Among the promising elements of the Inflation Reduction Act (IRA) passed over the summer are a series of investments into sustainable agriculture and farming.

"Our team had worked hard to get versions of these agricultural provisions into the Build Back Better Act—an earlier iteration of this legislation—so their inclusion in the IRA was a big win," says Karen Perry Stillerman, deputy director of the Food and Environment Program at the Union of Concerned Scientists.

The IRA invests $20 billion to help the nation's farmers respond to climate change—the largest investment in farmland conservation since the 1930s Dust Bowl. Many of those dollars will flow into proven US Department of Agriculture (USDA) programs over the next four years—including $3.25 billion annually for the federal Conservation Stewardship Program and $1.3 billion annually for climate-focused technical assistance for farmers. These investments are designed to encourage farmers to plant perennial and cover crops and diversify crop rotations—science-based practices that store carbon in the soil and build resilience against flood and drought.

The bill President Biden signed included more than $5 billion in aid for economically distressed farmers and those who have experienced discrimination from the USDA. This action is a fix for previous debt relief for farmers of color, which passed as part of the 2021 American Rescue Plan Act but was quickly stalled by legal challenges relying on ludicrous charges of reverse discrimination. Providing compensation for the USDA's long and ugly history of discrimination is long overdue and could be critical to keeping Black farmers and other farmers of color on their land.

The bill also includes $300 million for a USDA-led "carbon sequestration and global warming emissions quantification program" that will enable the department to better track and measure the benefits of healthy, carbon-rich soil. Although scientists have shown the value and potential for soil-carbon sequestration, they caution that it is challenging to measure, monitor, and verify accurately. Moreover, soil-carbon gains during one growing season can be lost the next, if practices aren't maintained, making the newly funded USDA initiative critical.

"Climate change is already affecting our farmlands and the way we grow food," says Stillerman. "The IRA is an investment in a more sustainable future for agriculture and our nation's farmers."

Photos: Yuri Arcurs/Alamy (farmer); Nicholas Doherty/Unsplash (wind turbines); Cana Tagawa/UCS (concert)

Big Wins for the Climate and Clean Air on Both Coasts

UCS science, strategy, and advocacy have helped secure victories on climate change and clean transportation in California, Massachusetts, and Washington State. In the Golden State, UCS helped secure the most ambitious zero-emissions vehicle standards to date. We provided the technical leadership for a large coalition of groups, modeling ambitious scenarios for electric car and truck adoption, and our advocacy with the state's legislature and air quality board led to a more ambitious program. The standards now require that 35 percent of vehicles sold in California be electric by 2026, reaching 100 percent by 2035—resulting in at least 700,000 and as many as 1.5 million more EVs on the road by 2030 than the initial proposal. Currently, 14 other states follow California's previous standards; Washington quickly adopted the new standards and others may as well.

Meanwhile, in Massachusetts, UCS staff who'd been working for years to model how the state could transition to clean energy and transportation made one final push this summer to advocate for the passage of major climate legislation. Working with local coalitions comprised of environmental justice allies, climate and energy groups, and offshore wind advocates, our staff carried out analyses and promoted smart climate solutions, met with legislators, and organized supporters to contact their elected officials. The pressure campaign paid off as the legislature voted to pass the bill before ending its session, and the governor signed it into law. Among other benefits, the legislation removes barriers to access for rooftop solar, bolsters responsible offshore wind and solar, makes EVs more affordable with up-front rebates, and requires 100 percent electric public transit buses by 2040.

Fighting for Justice on Nuclear Weapons' Front Lines

Nuclear "frontline" communities are those that have been directly harmed by the extraction, production, testing, cleanup, and storage of nuclear materials and weapons. People in these communities, who are often Indigenous, people of color, and/or have low incomes, continue to grapple with historical and ongoing exposure to radiation and toxins. In almost every case, these communities were not notified about this exposure and had little say in the decisions that have affected their health and well-being—a textbook example of environmental racism.

One set of reparations critical to addressing this injustice is the Radiation Exposure Compensation Act (RECA), a federal program that provides one-time compensation to individuals with illnesses caused by nuclear testing and uranium mining. Established in 1990, RECA was set to expire in 2022. To advocate for the bill's extension, UCS led a working group comprised of coalition partners and community members affected by weapons testing and production, sharing their stories in dozens of meetings with members of Congress and their staffs.

These meetings contributed to a 40 percent increase in the number of co-sponsors for RECA—and to legislation that extended the program for two years. UCS also organized input from community members on a June National Academy of Sciences report that recommends involving affected communities in the planning and implementation of low-dose radiation research. These developments are promising but there is more to be done: UCS advocates are now working in coalition to expand eligibility for RECA benefits.

A Modern Grid Rocks

Grammy-nominated singer/songwriter Andrew Bird generously donated one dollar from each ticket sale on his recent "Outside Problems" US tour (with Iron & Wine and Meshell Ndegeocello) to UCS for our work on modernization of the electricity grid. The show made a stop at Chicago's Salt Shed, where UCS staff and local environmental justice partners attended, and UCS President Johanna Chao Kreilick (above) had the opportunity to rally the crowd.

What the Inflation Reduction Act Means for Electric Vehicles

THE ACT PRESERVES A **$7,500 TAX CREDIT** FOR ELECTRIC VEHICLES AND ADDS PROVISIONS THAT WILL **LOWER UP-FRONT COSTS** FOR SOME CONSUMERS.

Among the climate-focused policies in the IRA are significant changes to the electric vehicle (EV) tax credit for consumers. While the maximum credit of $7,500 for new EVs remains the same as before, many of the details have changed. Most importantly, the tax credit was formerly capped once a manufacturer reached 200,000 sales. This meant that consumers buying EVs from General Motors and Tesla could no longer take advantage of the credit. The new version of the tax credit removes this cap and instead sets the credit to expire after 2032 for all EVs regardless of manufacturer. Plus, starting in 2024, the credit will be transferable to dealers, meaning that buyers could benefit from a lower up-front cost instead of having to wait to claim a credit on their income tax return. And, for the first time, the new legislation adds a credit of up to $4,000 for some used EVs.

Some of the new provisions limit which vehicles and buyers are eligible for the tax credit. Changes to the credit include requirements for final assembly in North America and critical mineral and battery-component sourcing and manufacturing requirements. The new credit will also have a price cap that will make many luxury EVs ineligible, and an income cap that excludes high-income earners from the credit starting in 2023.

In the short term, the new restrictions mean fewer EV purchases will qualify for the federal tax credit, making it harder for some to buy an EV. However, as manufacturers increase their North American production capacity, the new credit will help many more drivers make the switch from gas to electric. This will be important as we accelerate the transition to EVs this decade, aiming to meet President Biden's national goal of having zero-emissions vehicles make up half of all new car and truck sales by 2030.

Photo: baona/iStock

"Danger Season" Resonates across the Country

With climate impacts such as heat waves, wildfires, droughts, and hurricanes colliding during the summer months with often devastating effects in the United States, UCS has renamed this time as "Danger Season."

Such climate-driven events have become more frequent, intense, and longer-lasting. As a result, an increasing number of communities are at risk. During the 2022 Danger Season in the lower 48 states, some 85 percent of US counties experienced at least one heat alert; nearly half of all US counties (49.1 percent) faced at least one flood alert issued by their local National Weather Service office; 40 percent of the total land area saw at least one fire weather alert; and 116 counties in the Great Plains, Southwest, and Northwest grappled with multiple types of alerts simultaneously. Nine counties in eastern Kentucky were devastated by floods one week and a heat wave the next.

A school bus was destroyed in floodwaters that ravaged eastern Kentucky this past July. With flooding and other climate impacts getting worse across the United States during the summer, UCS has renamed these months "Danger Season."

As the Danger Season impacts piled up, media outlets picked up on our framing and shared it, from AccuWeather to the *San Francisco Chronicle* and *Washington Post*. Learn more about how these extreme weather events are tied to climate change and how we can build resilience at https://blog.ucsusa.org/series/danger-season.

UCS Supports Calls for Zero Nukes

When Russian President Vladimir Putin invoked the threat of nuclear war to prevent interference in his invasion of Ukraine, he brought the world closer to nuclear confrontation than at any other time in recent history. The war in Ukraine reinforces the fact that, ultimately, the only way to eliminate nuclear risks is to eliminate nuclear weapons. Nine countries continue to possess roughly 13,000 nuclear weapons, most of which are 20 times more powerful than the bombs dropped on Japan during World War II. The world's current arsenal of nuclear weapons could destroy humanity many times over.

Lilly Adams (right), with the UCS Global Security Program, educates attendees about nuclear weapons at the Amnesia Atómica event in May.

The UCS Global Security Program joined Times Square Arts and the Bulletin of Atomic Scientists in May at Amnesia Atómica NYC, a public exposition in Times Square centered around artist Pedro Reyes's ZERO NUKES, a 30-foot-tall inflatable sculpture that focused on the zero as a universally recognizable symbol. The sculpture and event called for global unity around nuclear weapons abolition. UCS hosted a busy table educating and engaging participants about the nuclear threat and commonsense policy solutions for minimizing the risk, and our staff at the event led a "takeover" of the UCS Instagram account, providing live coverage for online viewers.

Follow our Instagram page (@unionofconcernedscientists) to see event photos and learn more about what UCS is doing to lessen the nuclear threat.

Photos: Timothy D. Easley/AP Photo (flooding); Jake Roche/UCS (Amnesia Atómica)

WANTED: TO

YOUR HELP PROTECT OUR DEMOCRACY

UCS is working to build a political system where every voice counts. Step one: show up to vote and make sure your colleagues, friends, and loved ones do, too.

BY SETH SHULMAN

The Union of Concerned Scientists has long worked to combat the threats of two of the planet's deadliest problems: nuclear war and climate change. But these days, when UCS President Johanna Chao Kreilick speaks to audiences about the organization's work, she has taken to adding a third item to the list of existential perils UCS addresses: the threat to US democracy.

As she explains: "As science advocates, it's not enough for us to push for science-based solutions to public health and environmental challenges. We also need to protect—and sometimes even fix—our democracy so those solutions become more achievable and so our voting system empowers people to fully participate in decisions that affect their lives."

Many states are making it harder for people to vote—and to have their vote count—by redrawing districts, closing polling stations, restricting voting by mail, and stiffening voter ID requirements. And in some states, lawmakers are pushing for changes that would subvert or override the electoral process.

Put another way, a healthy participatory democracy is foundational: we can't possibly achieve the science-based solutions we so desperately need without it. And right now, there's no escaping the fact our democracy is in peril. An NBC News poll this summer found that voters on both sides of the political aisle ranked "threats to our democracy" as the *single most important* issue facing the country, ahead of jobs and the economy. Even beyond the unprecedented January 6, 2021, armed insurrection at the Capitol, there's a raft of evidence from across the country of threats to our democratic system.

ANTI-DEMOCRATIC FORCES

Since the last election, 19 states have enacted 34 laws restricting access to voting—more than any year in the past decade, according to the nonprofit Brennan Center for Justice, a UCS partner. In Texas, the legislature passed a law restricting voting by mail, limiting drop boxes and polling places, and reducing protections against voter intimidation. New legislation in Florida stiffens voter ID requirements and makes it harder for people with disabilities to cast a ballot. And Georgia even made it illegal to provide food or water to voters waiting in the state's often hours-long lines to cast their ballots. All these measures are blatant attempts to stop people from voting.

Perhaps even more troubling, though, is the evidence of an ongoing assault in many states on the mechanics of our electoral system—efforts that could make it easier to subvert the results of fair and transparent elections. The Georgia law mentioned above, for instance, removes the secretary of state (an elected official) from chairing the state election board, allowing the state legislature—now led by Republicans, many of whom have falsely claimed the 2020 election results were fraudulent—to appoint the chair instead. Meanwhile, anti-democratic candidates are on the ballot in many states for key positions such as secretary of state that have the authority to potentially override the electoral process. In the Arizona primary this year, Republicans nominated an entire slate of candidates—including candidates for governor and attorney general—who are calling for President Biden's clear 2020 win in the state to be de-certified, even though there is no precedent or legal basis for rejecting the will of the state's voters.

"Make no mistake," warns Michael Latner, an expert on electoral systems and a senior fellow at the Center for Science and Democracy at UCS. "We haven't seen this kind of an organized threat to our democracy in our lifetimes, and the evidence is increasingly clear that the insurrection of January 6, 2021, is not over. This November, we could well face attempts to subvert the election through voter intimidation, violence, and the induced chaos that ensues. There's also evidence that many of these anti-democratic forces view the 2022 election as a dry run for the next presidential election in 2024."

Latner cites reports that Trump loyalists and partisan operatives are now organizing volunteers to challenge voters and potentially disrupt vote counts at Democratic-majority polling places during the upcoming election. They are targeting large cities such as Atlanta, Detroit, Milwaukee, and Philadelphia that have a high concentration of voters of color and are in so-called battleground states, with the intent of initiating legal challenges at polling places as a pretext for later rejecting those precincts' vote counts.

Photos: Rawpixel Ltd./Adobe Stock (p. 8); Washington Post/Getty Images (gerrymandering); Jon Shapley/Houston Chronicle (voting lines)

FIGHTING BACK SMARTER

In light of these and other troubling developments, UCS and its Center for Science and Democracy have been working hard with partners to fight back on a variety of fronts.

Among these efforts, the Center convened a task force of leading organizers, scholars, and activists on how best to strengthen our democracy. The high-powered group kicked off its work at a day-long meeting at the American Political Science Association conference in September 2021 and, this July, UCS published *Achieving Multiracial, Multiparty Democracy*, the group's report and recommendations (available at www.ucsusa.org/resources/achieving-multiracial-multiparty-democracy).

One of the task force's key findings is the vital importance of engaging people currently disenfranchised from our democratic system—those chronic nonvoters who are mostly invisible to today's modern, data-centric political campaigns and who often don't participate because they simply don't feel as though their vote counts.

As Latner explains, "We absolutely should and must fight voter suppression laws. But what the task force recommendations say is that the effect of a 3 to 5 percent turnout difference caused by these voter-suppression provisions is actually a lot smaller than the sheer number of people out there who could—and should—be voting but aren't." In other words, Latner says, bringing more people into our electoral system is the most important task before us.

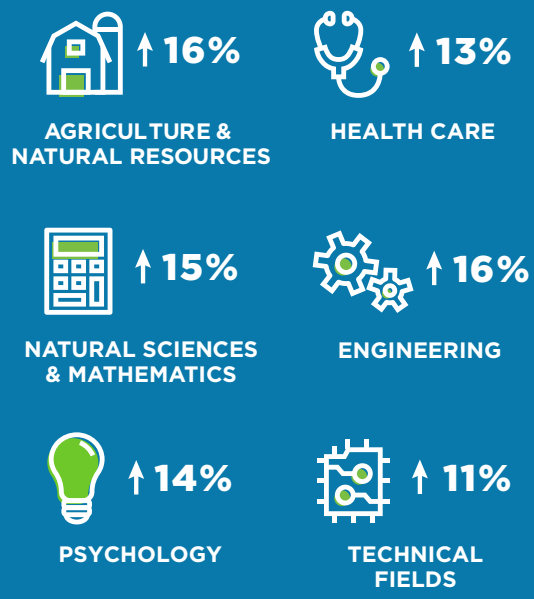
Equally notable, the task force found that this goal can't be achieved through electoral reforms alone. "It says a lot," Latner notes, "that after having had an armed insurrection, Congress hasn't yet been able to pass even a watered-down version of commonsense electoral reforms."

What's needed, the task force argues, is to energize and protect our democracy via a community-based movement on the ground. Accordingly, the task force recommends that local election agencies partner with community organizations to

(continued on p. 21)

Illustration: Nick Iannaco/UCS

STEM VOTER TURNOUT RISES (WITH HELP FROM UCS)



Just as science is needed to help inform governmental decisions, a healthy democracy is needed to ensure those decisions are fair. Toward that end, UCS has been actively working with partners across the country to encourage STEM students to vote. The sad truth is that, even among all students eligible to vote, students in STEM fields have tended to turn out in particularly anemic numbers.

To help combat this state of affairs, UCS, the Students Learn Students Vote Coalition, and others teamed up to produce a *Science and Civics Guide* co-written and distributed by STEM students themselves.

Targeted at campus leaders including faculty and administrators, the guide includes discussion topics, examples of how science disciplines and democracy interact, and practical information about registering to vote and encouraging others to participate.

Thanks at least in part to similar organizing efforts by the Science Rising coalition (which includes UCS and 21 partner groups) in the 2020 election, turnout among STEM students increased 14 percent above 2016 levels. Still, turnout was lower than that for students in general, so there's plenty of work left to be done.

The *Science and Civics Guide* is available at https://sls.vote/science-and-civics.

Challenges—and Hope—on the West Coast

INTERVIEW WITH JULIET CHRISTIAN-SMITH

After spending the past four years as a senior program officer at the Water Foundation, Juliet Christian-Smith, former UCS senior climate scientist, has returned to UCS in the role of western states regional director. She is leading our efforts to address climate change in California, Oregon, and Washington.

What drew you back to UCS?

JULIET CHRISTIAN-SMITH: At the Water Foundation I helped obtain the first public funding in California and the country for the human right to water. It is called the Safe and Affordable Drinking Water Fund and it launched a national low-income rate assistance program for water. I received an amazing political and philanthropic education.

But the thing that always stood out to me about UCS, and made me want to return, is how this organization combines scientific and technical expertise with the ability to sit at decision-making tables, understand the politics at play, and advance solutions that decisionmakers can get behind. No one does that better than UCS.

This is a critical time for the United States and the world to finally take the steps needed to address climate change and its impact on communities. How we spend the funds from the Inflation Reduction Act will be a big conversation at all levels because our choices will dramatically change our future, our children's future, and our children's children's future. Science must have a voice and be at the table and I'm thrilled to be back representing UCS in those conversations.

As an environmental scientist and a water policy expert, what are the biggest challenges and opportunities you see on the West Coast in the next few years for climate action?

JULIET CHRISTIAN-SMITH: California, Oregon, and Washington are on the front lines of so many of the impacts of climate change, from historic droughts to unprecedented wildfire destruction to extreme heat that prevents people from working. Because most people in the western states are personally touched in some way by climate change's impacts, we must be a laboratory of innovation here for advancing solutions. The good news is we have a political environment conducive to supporting strong climate leadership.

Is California still an innovator on climate and environment?

JULIET CHRISTIAN-SMITH: Yes, it's still an innovator because the state is willing to experiment and take the first bold action. However, what we are seeing is that California needs more than targets. It needs strong implementation and enforcement of its ambitious plans. One thing UCS is known for is getting the receipts: our experts research and report on how well state agencies, investor-owned utilities, and local governments are implementing their plans for clean transportation, renewable energy procurement, and sustainable water management. That is the kind of watchdogging work necessary to make good, sound policy that actually improves people's lives. UCS is doing it, and we need to do even more.

In the four years since you left UCS, much has changed in national politics and discourse, with increased attacks on science and democracy and unprecedented levels of disinformation. How does a science-based organization like ours thrive in an environment that is increasingly anti-science?

JULIET CHRISTIAN-SMITH: We must stay focused on the fact that we are in the middle of a once-in-a-generation investment in climate solutions. We have important decisions to make about the future of our vehicles, energy, water, farms,

JULIET CHRISTIAN-SMITH is an expert in water, climate, and sustainability issues. She received a Fulbright fellowship to study the implementation of the European Water Framework Directive in Portugal and was a Murray Darling Basin Futures Fellow in Australia. She earned a PhD in environmental science, policy, and management from the University of California–Berkeley and a bachelor's degree from Smith College.

Photos: Scott Saraceno (Juliet Christian-Smith); Char Beck/Unsplash (ad)

> ***Because most people in the western states are personally touched in some way by climate change's impacts, we must be a laboratory of innovation here for advancing solutions. The good news is we have a political environment conducive to supporting strong climate leadership.***

and forests. Decisionmakers need and want good information. As long as UCS can answer the right questions at the right time, we can be influential. We *are* influential.

As headlines grow more dire about water supplies in the West, what do people here and across the country need to understand about this drought?

JULIET CHRISTIAN-SMITH: This is the worst drought in a millennium. The droughts that we are having now are much worse than the ones we had in the past because it's not just drier, it is also hotter. And it turns out that heat and evaporation are huge parts of what creates very dry conditions, the same conditions that exacerbate wildfire and lead to what UCS calls "Danger Season." *[Editor's note: see p. 7 for more on "Danger Season."]*

The water sector is severely behind on climate adaptation. The good news is, today, most water agencies know they need to plan for climate change, but the bad news is most are not yet incorporating climate science into their water plans.

Often in the media, water news focuses heavily on urban water use. But that's a misdirection. California is dominated by export agriculture. Irrigation for agriculture accounts for 80 percent of the water used in the West, and that water use will increase as conditions become drier and hotter.

We have a series of choices to make about our dwindling water supplies, and how we adapt agricultural water use is an important one. Whatever path we choose will transform a vast region, so we have to pick solutions that create healthy communities and stay within the constraints of the water we have.

With so much to worry about, what gives you hope and courage to keep pushing for a healthier planet?

JULIET CHRISTIAN-SMITH: The best news in years is that now there is federal funding through the Inflation Reduction Act to address our biggest national challenges related to climate change, and in California there is increased funding thanks to a state budget surplus. We're in a mad dash in California to see who can think up and push for the biggest and boldest climate solutions that were completely off the table a few years ago. It's a race to the top!

Also in California, we passed the Advanced Clean Cars rule, the most progressive clean cars target in the country, requiring 100 percent of vehicle sales be electric by 2035. UCS and other groups advocated for this for years, and the rule will strengthen zero-emissions vehicle standards and drive up electric vehicle sales—that gives me hope. The governor and legislature's commitment to ambitious climate action gives me hope. That UCS experts are at the table and can push for science-based solutions gives me hope. That we are part of a coalition of groups who are centering the voices and experiences of frontline communities gives me hope. That we can speak for science in a way that is understandable and helpful to solving our toughest problems gives me hope.

Thanks to so many people's dogged climate advocacy over the past decades, we now can shift from defense to offense. We can drive faster and push harder to address the most difficult problems facing the West. And that gives me the courage to keep going. {C}


adaptronic

TOWARD A GREENER ELECTRIC CAR BATTERY

As the transition to electric vehicles speeds up, the need for sustainable technologies moves to center stage.

BY ELLIOTT NEGIN

The United States currently lags far behind Europe and China in its transition to electric vehicles (EVs), but that may be about to change. US EV sales hit a record high between April and July even as overall new vehicle sales slowed, and about half of the respondents to a recent *Consumer Reports* survey said they would be encouraged to buy an EV with a tax rebate—which Congress just extended. What's more, the Inflation Reduction Act that President Biden signed in August includes $36 billion to incentivize EV purchases over the next decade.

More EVs on the road would certainly be good news for the climate and for public health. After all, the transportation sector is the largest US source of global warming pollution and also currently accounts for more than half of the country's toxic air pollution; more than 20,000 people in the United States died prematurely in the latest year for which data were available as a result of tailpipe emissions, which have been linked to asthma, birth defects, cancer, and heart disease. EVs have no tailpipe emissions, and as a new Union of Concerned Scientists analysis shows, their life-cycle global warming emissions are dramatically lower than that of gas- and diesel-powered vehicles.

For all the good news about EVs, however, the materials used in their batteries—including cobalt, lithium, manganese, and nickel—come with their own public health, environmental, and human rights challenges. So, despite EVs' considerable benefits, the burgeoning industry needs to clean up the material sourcing process for its batteries to ensure a sustainable supply chain as countries worldwide transition to an electrified transportation system.

One source of lithium for EV batteries is underground pools of lithium brine. Pumping brine to the surface for evaporation (as shown here in Chile) requires a lot of water, which is already in short supply in many communities. A new facility in California hopes to mine lithium in a more water-friendly way.

REDESIGNING BATTERIES

Fortunately, scientists are on the case. They are altering batteries' chemistry to reduce reliance on some of these metals and devising ways to recycle and repurpose batteries to minimize the need for new raw materials altogether.

The Biden administration, which wants half of all new vehicles sold in the United States to be electric by 2030, has taken notice. In June 2021, it called for cobalt and nickel to be engineered out of batteries. In addition, the bipartisan infrastructure law that Congress passed last November recognized the need to recover key materials from EVs and dedicated funds to support battery recycling.

Automakers, too, are paying attention. Last fall, Nissan announced plans to introduce cobalt-free batteries by 2028, while Tesla said it will outfit two of its EVs with lithium-iron-phosphate batteries, which do not contain cobalt or nickel.

UCS is also playing a role. Our Clean Transportation Program, which has been documenting the benefits of EVs for years, recently added battery expert Jessica Dunn to the team. Dunn earned her doctorate in energy systems at the University of California–Davis, where she served as a co-facilitator for a group that advised the California legislature on battery recycling.

EXTRACTING LITHIUM

Environmental issues related to EV batteries begin with the current processes for obtaining lithium. Nearly all the lithium worldwide is produced by either hard-rock mining or salt-flat brine extraction (i.e., solar evaporation). Hard-rock mining involves excavating rocks containing lithium and transporting them for crushing, heating, and processing to recover lithium carbonate. These processes produce toxic wastes including sulfuric acid, uranium, lime, and magnesium, which threaten nearby wildlife and communities.

Brine extraction also emits toxins, but its main problem is that it requires fresh water in places where there is not enough to begin with. The process requires developers to pump brine from underground pools called salars to shallow pools where natural evaporation occurs. Because of the need for evaporation, facilities are generally sited in arid climates such as Salar de Atacama in Chile, often robbing local communities of their already taxed water supplies.

The United States has some of the world's largest lithium reserves, but it is not currently a leading lithium producer. That could change significantly due to a major new development in the works: a brine extraction facility at California's Salton Sea that investors are calling "one of the most promising and environmentally friendly lithium prospects" in the country. The California Energy Commission estimates there's enough lithium in the lake to meet 40 percent of worldwide demand.

Also called Lithium Valley, the Salton Sea project has the potential to supply 600,000 tons of lithium per year. The process would extract lithium as a by-product of geothermal energy, which has never been done at an industrial scale. Compared with pit mining and typical brine extraction, it would use less water and land, and emit less carbon pollution.

"If done right, the Salton Sea project has the potential to revive the local economy by providing sorely needed public resources and high-paying jobs," says Dunn. "But Salton Sea residents must have a seat at the decisionmaking table. It won't be successful without them."

REUSE AND RECYCLING

The Salton Sea's prospects notwithstanding, Dunn says the best source of lithium—and of all other battery materials—is what industries can recover through reuse and recycling.

The current generation of EV lithium-ion batteries will likely last 10 to 15 years, and some experts predict they could last even longer. But, when they reach the end of a typical EV's life span, they are still expected to have roughly 80 percent of their original capacity.

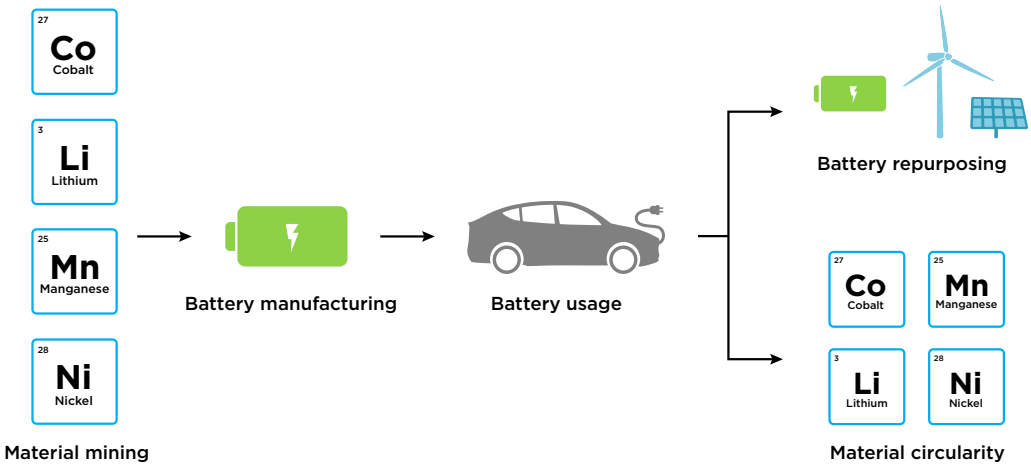
"All those batteries could be recycled," Dunn says, "and if they aren't damaged, they also could be repurposed for stationary storage, which is a less-demanding application that doesn't require higher storage capacity."

Repurposed EV batteries could provide backup for variable renewable energy, such as solar or wind power, which is vital for transitioning from fossil fuels. Manufacturers wouldn't have to produce brand-new batteries for the same purpose.

Photos: Stefan Warter/AUDI AG (p.14); John Moore/Getty Images (lithium brine pool); Illustration: Nick Iannaco/UCS

THE LIFE OF AN EV BATTERY

Reusing battery materials —a process known as "material circularity"— reduces the need for new minerals to be mined, and could also reduce battery-related global warming emissions by 30 percent.



The key materials in EV batteries, including cobalt, lithium, manganese, and nickel, also can be recycled. This "material circularity" could significantly reduce the EV's environmental impact. A recent study found that reusing materials recovered through hydrometallurgical processing (separating the cathode materials through leaching chemicals) could cut battery-related global warming emissions by 30 percent. Considering the problems associated with mining, using recycled material is a much preferable option.

Some EV batteries are already being recycled in the United States. Redwood Materials, for instance, a hydrometallurgical recycling plant in Nevada, reports it has been able to recover 95 percent of the materials from used consumer electronic and EV batteries. The company also plans to use recovered materials to manufacture new batteries.

According to a 2021 study Dunn coauthored, under optimal conditions, recovered materials could meet more than half of worldwide lithium-ion battery material demand by 2040. That would certainly make EVs greener.

THE PROMISE OF NEW TECHNOLOGIES

Researchers are also working to develop alternatives to the lithium-ion battery. In January, for example, chemical engineers at the University of Michigan announced that they have designed a lithium-sulfur battery that could quintuple EV ranges on a single battery charge. Meanwhile, the National Science Foundation recently awarded a grant to research sodium-ion batteries, because sodium is considerably cheaper and more widely available than lithium. And Solid Power, a Colorado company that has partnered with BMW and Ford, recently started a pilot project to produce solid-state batteries, which promise to significantly extend EV ranges.

Dunn is most excited about solid-state batteries because of their energy density—their ability to store more energy while using less material than lithium-ion batteries. "If solid-state batteries are commercialized, EVs would use fewer metals than they do now," she says. "That could be a win-win: less mining and the prospect that battery manufacturers could use a higher ratio of recycled materials." {C}

NOT YOUR PARENTS' DIEHARD

Lithium-ion batteries are the most popular type of battery in use today. First commercialized in 1991, their cost has declined by a remarkable 97 percent over the last three decades, enabling the rapid growth of mobile phones, laptops, and more recently, electric cars. Global demand for these batteries is projected to increase dramatically by the end of this decade as EVs are adopted around the world.

The lithium-ion EV battery is very different in function, materials, and size than the battery in a gasoline-powered car or truck. A vehicle with an internal combustion engine typically uses a 12-volt lead-acid battery whose main purpose is to provide power to start it. Weighing between 30 and 60 pounds, lead-acid batteries can be easily replaced when they wear out. By contrast, the lithium-ion battery powering an EV typically takes up the entire base of the vehicle and weighs about 1,000 pounds.

A lead-acid battery mainly contains lead sulfate and sulfuric acid, relatively inexpensive materials that don't result in a very "energy-dense" battery, meaning they cannot store much energy per unit of material. In the early 1900s, electric car prototypes were powered by lead-acid batteries. They could only travel short distances and had long charge times. Conversely, lithium-ion batteries contain various materials that, while more expensive, give the batteries higher storage capacity, greater efficiency, and a longer life span. That's why they—and the materials they use—are in such demand.

Will Your Utility Cause the Next Blackout on Purpose?

By Mark Specht

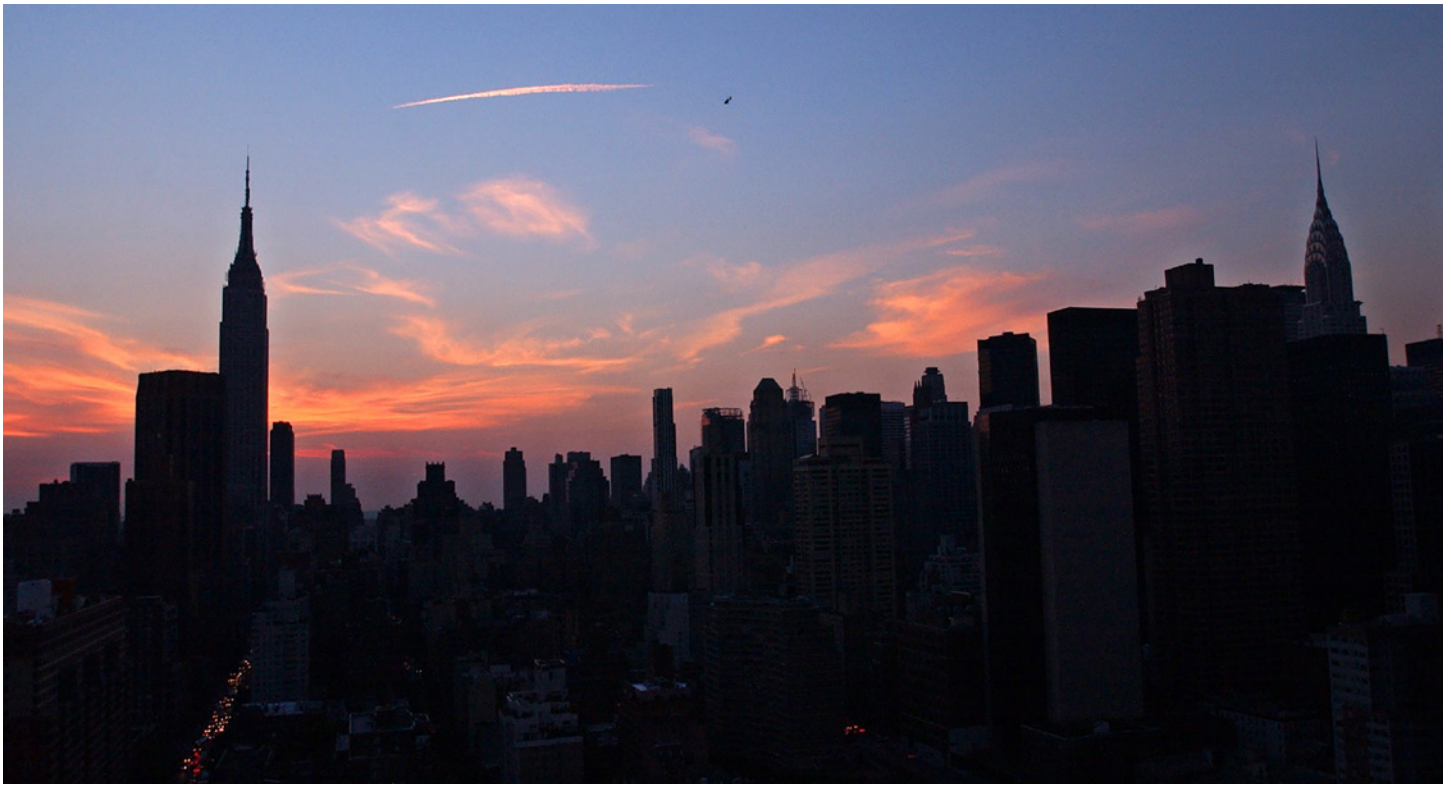
In the middle of a 2020 heat wave, people living throughout California endured a series of blackouts for a troubling reason. There simply was not enough electricity to meet the demand, so utilities cut off the power to tens of thousands of people—and their air conditioners—for hours at a time.

There are many reasons why blackouts can occur, but California's self-imposed rolling blackouts—the state's first in nearly two decades—are a sign of what's to come as climate change causes our weather to become more extreme. They should serve as a wake-up call to both policymakers and consumers that long-standing weaknesses in our nation's electricity grid need to be addressed now.

WHERE THINGS CAN GO WRONG

The most common type of power outage results from a problem in the **distribution** network—how electricity gets from high-voltage transmission lines to your home. It can be caused when a storm blows a branch onto a power line or a squirrel explores the deadly corners of an electricity substation (yes, this has happened). Though the damage is typically limited to a few blocks or a neighborhood, and normally lasts for a relatively short time, severe weather can have a much wider impact: Hurricane Ian left more than 200,000 Florida residents without power for more than a week in October.

While much rarer than distribution issues, outages can also be caused by failures in the **transmission** system that moves electricity over long distances. These events can often have enormous consequences. Though weather causes many transmission failures, they can also be the result of human error, equipment breakdowns, or malfunctioning computers. In 2003, a combination of factors led to a blackout affecting roughly 50 million people in the Northeast.



A power outage in August 2003 affected roughly 50 million people across parts of the United States and Canada. (Above, the New York City skyline goes dark during the 2003 blackout.) An outdated, vulnerable electricity grid combined with more extreme weather is making widespread outages more common.

Photo: Frank Franklin II/AP Photo

While equipment failures, natural disasters, and even squirrels can cause large-scale power outages, a growing number are due to utilities shutting down portions of the electricity grid intentionally.

Policymakers responded to that event with improved reliability standards.

What has yet to rise to the same level of urgency are problems on the supply side—when there is not enough electricity **generation** to meet demand, which typically happens in the hot summer months. The last time California's utilities resorted to rolling blackouts, in the early 2000s, has been referred to as the California Electricity Crisis, and it affected millions of people. According to widely accepted industry reliability standards, this type of event should only happen once every 10 years; utilities generally try to meet this standard by building more power plants than are needed on any given day—and they pass the costs of this inefficiency on to their customers.

There are other reasons, too, why utilities will cut off power intentionally. They sometimes conduct **planned outages** on certain portions of the electricity grid in order to perform routine maintenance, but the system usually has enough redundancy built into it so that customers don't lose power during these events. On the other hand, **public safety power shutoffs**, when utilities shut down portions of the grid in order to avoid a more catastrophic outcome, are happening more frequently in California due to the risk of wildfires sparked by transmission or distribution lines during dry and windy conditions.

As climate change worsens, the risk of self-imposed blackouts is spreading to other states. In 2019, a Nevada utility announced that it would cut the power to certain communities as a "last resort," and an Oregon utility took that step the following year.

AVOIDING THE NEXT ELECTRICITY CRISIS

The increasing number of disruptions over the past few decades indicates that the US electricity grid is faltering. To keep power outages from happening—whether intentional or not—we need to harden the grid's transmission and distribution infrastructure, and to invest in distributed energy systems such as residential solar power, battery storage, and microgrids that reduce our reliance on widely interconnected transmission and distribution networks. And for those power outages that cannot be avoided, we need microgrids dedicated to supporting critical facilities and people who depend on life-sustaining medical devices.

These measures would go a long way toward ensuring a resilient and equitable electricity grid for the future. {C}

***Mark Specht** is a senior energy analyst in the UCS Climate and Energy Program. Read more from Mark on our blog,* The Equation*, at https://blog.ucsusa.org.*

Photos: Joe Raedle/Getty Images (hurricane); Mike Eliason/Santa Barbara County Fire Department via AP (wildfire); Sarah Hina/Creative Commons (Flickr) (squirrel)

An Unwavering Commitment

(continued from p. 2)

If implemented effectively, the IRA will help the United States meet its obligations under the Paris Agreement to reduce global warming emissions 53 percent below 2005 levels by the end of this decade. It also contains a smorgasbord of investments and initiatives to boost clean energy and transportation, create more sustainable and resilient food and farm systems, and cut emissions on an economy-wide scale (see p. 4 and p. 6). It's a major step in the right direction—but there are many more we need to take to ensure we protect *all* communities from the dangers of climate change and pollution. As I write this, I'm packing for a trip to Washington, DC, where I'll be meeting with White House officials and UCS coalition partners to set this new law up for success.

Because of our *Catalyst* publishing timeline, this issue is being readied before the midterm elections, so I don't yet have insight into whether the incoming Congress will be willing to work on climate change or other urgent issues. What I do know is that UCS is pulling out all the stops to ensure that science is represented at the polls (see p. 8).

I also know that we've readied ourselves to respond on a dime to contribute our proven combination of science and advocacy wherever it can have the most impact: with members of Congress, in city governments, state legislatures, energy utility boardrooms, or Big Oil companies' annual shareholder meetings.

We've spent the past decade adjusting to shifting political climates and seizing all opportunities we can to make science- and equity-centered progress for a healthy planet and safer world. Our commitment is unwavering regardless of who's in office, and whether we're defending progress or demanding more.

In this issue, you can see evidence of this commitment to a healthier, more just and sustainable future, from our exploration of electric vehicle battery sustainability and its effects on local economies (p. 14) to our success in advocating for the rights of "downwinders"—survivors of nuclear testing in the United States (p. 5).

I must close by congratulating my colleagues at UCS who have fought for decades to make sure that policymakers act to address the real and present danger that climate change poses to all of us—and who won such a significant and last-minute victory with the Inflation Reduction Act. Through their efforts, working with a large, diverse coalition against long political odds, we brought the best of science forward on this bill. I'm deeply proud of this accomplishment.

Some of my colleagues have been in the trenches on this legislation for months, if not their whole careers. And you, our members and supporters, have been right there, too. You called your representatives. You organized your communities. And you never gave up on your own commitment to a sustainable future.

Thank you for accompanying us in the fight. I'm excited for what comes next. {C}

Johanna Chao Kreilick *is the president of UCS.*

> ***People are more likely to listen to friends and family than they are to random strangers. By educating others about threats to voting rights, you can help people stay engaged in the process beyond Election Day and build more involvement than simply showing up to vote.***

Wanted: Your Help to Protect Our Democracy

(continued from p. 11)

expand voter rolls. Community organizations and agencies are often well established, and especially well positioned to help lift up underrepresented voices, overcome issues of language access and other barriers to voting, and build participatory networks. Putting community-led political organizations at the center of reform, the task force says, can strengthen our democracy and help create the groundswell of pressure needed for meaningful electoral reforms.

PARTNERING TO ORGANIZE VOTERS

UCS is taking the task force's message to heart and applying lessons learned in the last election to a range of actions—from organizing students in science, technology, engineering, and mathematics (STEM) to using cutting-edge techniques for engaging nonvoters.

In one such effort, UCS held a series of online two-hour "train the trainer" events to encourage STEM students to engage in our electoral process and mobilize others in their communities. The effort has already yielded dozens of students, faculty, and science supporters being trained for the upcoming election cycle and created a new *Science and Civics Guide* written in part by the students themselves (see the sidebar, p. 11).

As Melissa Varga, UCS Science Network community and partnerships manager, explains: "We know that people are more likely to listen to friends and family than they are to random strangers. Plus, engaging voters is a lot more than having them show up every two or four years. By training others, it helps people stay engaged in the process beyond Election Day and helps build more involvement beyond showing up to vote. In this effort, we realized we could have more impact by training people to engage themselves."

In another effort, the Center for Science and Democracy is working with partners in several states to aid with voter registration drives. For example, Sophia Marjanovic, a microbiologist and senior organizer with the Center, is using

relational organizing techniques to connect with Arizonans, such as hosting a resource fair co-sponsored by community organizations where people can register to vote. The Center is also working to enlist members of the UCS Science Network to aid in voter registration drives, matching them with community organizers in Arizona and other states, with a growing number of events as the election approaches.

As Varga puts it, despite the attacks on our democracy, "It's not all doom and gloom. In our efforts, we're finding again and again that, if you give people a way to plug in, they want to engage." {C}

Photos: Dennis Otlink/Unsplash (ad); Bill Cotter/UCS (voter)

The Epitome of a Concerned Scientist

Dr. Kurt Gottfried, physicist, professor emeritus at Cornell University, advocate for peace, and co-founder of the Union of Concerned Scientists, passed away August 25, 2022, at age 93. Throughout his career, Kurt Gottfried encouraged fellow scientists to speak out on issues and to hold their leaders accountable on topics ranging from nuclear arms control to scientific integrity and human rights.

"Those of us involved with UCS do feel that scientists have an obligation to society," Gottfried said in an early 2000s interview. "The notion that scientists can spend their careers doing public advocacy—that from a scientific point of view is still interesting and intellectually honest—is something that we helped to foster."

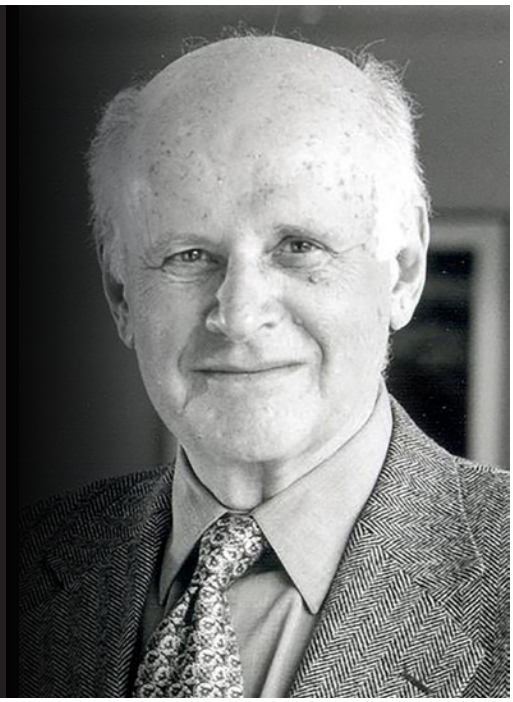
Gottfried was born in Vienna, Austria, in 1929, fleeing the country with his family when he was nine after their home was raided on Kristallnacht, and emigrating to Montreal, Canada. He graduated from McGill University, earned a PhD in theoretical physics from the Massachusetts Institute of Technology in 1955, and was a junior fellow at Harvard.

Gottfried was well known for his scientific work, including as co-author of a classic text on quantum mechanics. In 1964, he became a physics professor at Cornell University. He served on the senior staff of the European Center for Nuclear Research (CERN) in Geneva, as a chair of the Division of Particles and Fields of the American Physical Society, and as a member of the American Academy of Arts and Sciences and the Council on Foreign Relations.

In 1969, concerned about the unchecked exploitation of scientific knowledge for military purposes, Gottfried and his friend and future Nobel laureate Henry Kendall were the driving force behind the founding of UCS. Serving on the organization's board since its inception, including 10 years as chair, he helped expand the scope of UCS work from research on nuclear power and weaponry to climate change, agriculture, transportation, and renewable energy.

"Scientists, like others, need to actively engage and cannot stand apart from the political implications of their work."

KURT GOTTFRIED
1929–2022



In 2004, during the George W. Bush administration, Gottfried led the call for restoring scientific integrity in government with a statement endorsed by some 12,000 scientists that led to the founding of the Center for Science and Democracy at UCS. In retirement, Gottfried continued to advise UCS scientists and inspire the organization with his passionate sense of urgency.

For his work with UCS and his efforts to help release scientists in the former Soviet Union and South America who were imprisoned for expressing views that angered their authoritarian rulers, Gottfried was awarded the Scientific Freedom and Responsibility Award by the American Association for the Advancement of Science in 2016.

"Kurt was the epitome of a concerned scientist and an inspiration to all of us," says Anne R. Kapuscinski, UCS board chair and director of the Coastal Science and Policy Program at the University of California–Santa Cruz. "We will miss his passion, kindness, dedication, and integrity, and we will strive to honor his lifelong dedication to building a safer world."

Gottfried was predeceased by his wife, Sorel, not only his life partner but a thought partner, and is survived by his children, sister, and grandchildren. {C}

Photos: Richard Howard (Kurt Gottfried); Alexandra Tran/Unsplash (ad)

Union of Concerned Scientists

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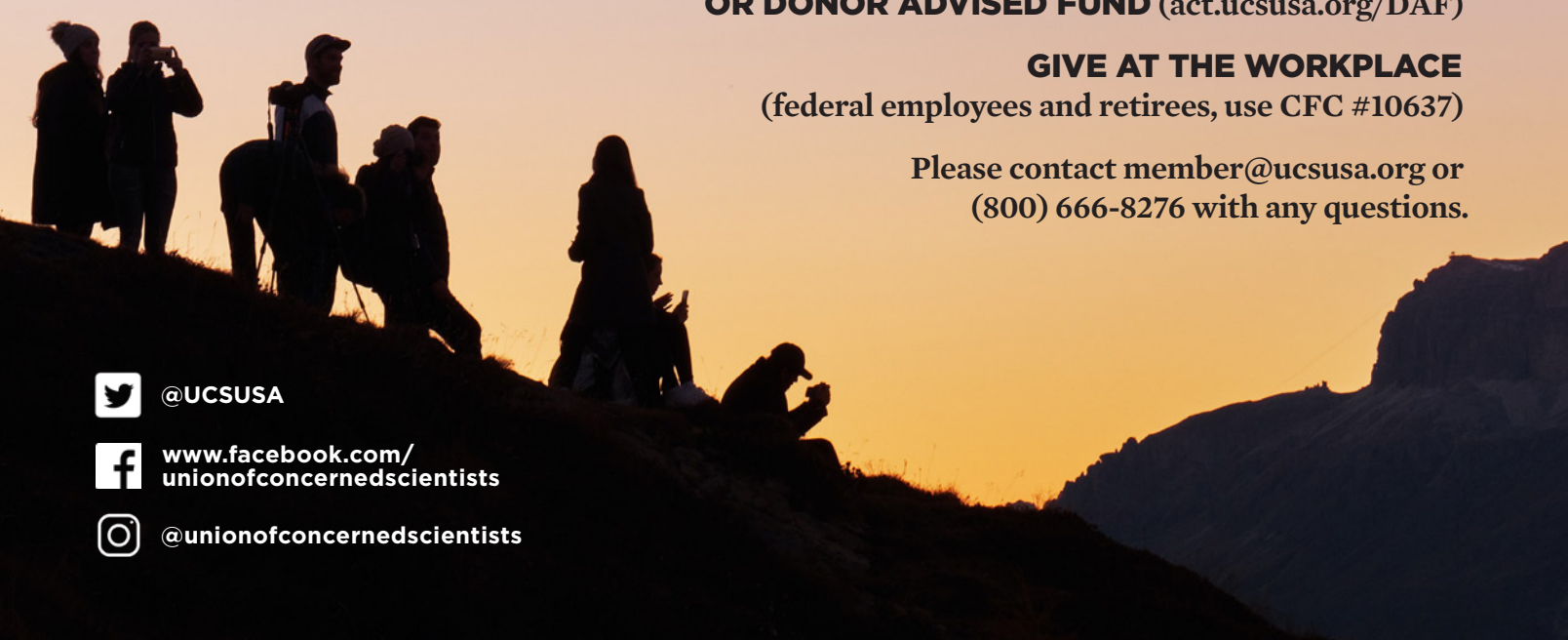

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