The Future of Energy Policy: An Interview With Daniel Kammen

Professor at the University of California, Berkeley and Director of the Renewable and Appropriate Energy Laboratory

Interview by Max Dunsker, Amanda Fong, and Danny Kcomt

Professor Daniel Kammen has established himself as a leading expert on renewable energy through his parallel appointments with the Energy and Resources Group, Department of Nuclear Engineering, and Goldman School of Public Policy. He is the founding director of the Renewable and Appropriate Energy Laboratory (RAEL) and was a coordinating lead author for the Intergovernmental Panel on Climate Change (IPCC), which won the Nobel Peace Prize in 2007.

Kammen's expertise spans climate technology, public policy, global and state contexts, and the public and private sectors. A trained physicist, he has served in roles with the Environment and Climate Partnership for the Americas (ECPA) initiative and the World Bank Group, as well as Science Envoy for Secretary of State John Kerry. He has also advised the California state and U.S. federal governments, including through positions at the Environmental Protection Agency (EPA), Department of Energy (DOE), Agency for International Development (USAID), and Office of Science and Technology Policy.

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Kammen spoke with BPPJ in the fall of 2024, a critical moment for the climate and environmental justice movement, to offer his insight on the intersection of climate science and various levels of decision-making. The discussion centered on how artificial intelligence, Trump's second term, and nuclear regulation will shape the future of renewable energy in the U.S. and around the world.

The following interview was conducted in person. Responses have been edited for clarity and concision.

Berkeley Public Policy Journal (BPPJ): In your opinion, how can California continue to lead the renewable energy transition, and what policies or technologies do you see as essential for meeting the Renewable Portfolio Standard's carbon neutrality goals by 2045?

Daniel Kammen (DK): California's emissions have not been falling as rapidly as people like to say. And so we are not on pace to meet our 2045 goal.

That said, California has pioneered a whole bunch of things that actually have worked very well. California initially said we wanted 1,000,000 solar rooftops, and California met that goal ahead of time. California set a goal with Assembly Bill 2514 that I drafted in 2014 to have a gigawatt of energy storage available. California was the first state in the country to say we would end the sale of new gas powered vehicles by 2035.

California has continued to innovate and has continued to beat standards, but it has not been as aggressive at actually reducing emissions. We're adding a lot of green energy. We're not removing enough dirty energy sources even though we have zeroed out coal.

BPPJ: Do you think there's any high efficacy policy or suite of policies that we need to start pushing to accelerate the renewable energy transition and make it more tangible? And, what level of government do you think needs to be involved in that?

DK: So states make their own policies to a large degree. For California, I think there's a pretty clear road map. We certainly need to fix the disaster over so-called NEM 2.0 net metering so that any property, or collective of individuals—so that there's a social justice aspect—can sell power back to the utilities as well as just buying power from them. And since California has enough distributed solar and storage in the state on the rooftops of homes like mine, small businesses, and the roof of the student center MLK here on campus, California could meet its average power demand just with solar and batteries if it actually just enabled those folks to sell back—which it doesn't.

This is the clear set of individual policies, and then the other one is on the economic side. California is the site where the so-called social cost of carbon is used, not the market price of carbon, to look at what the actual damage to ecosystems and to communities are. And California should absolutely institute a social cost of carbon as a required piece of all project assessments. And we do not, so far, have brave or visionary enough leaders in the legislature sadly. They see lots of private sector pushback. But you can't have a carbon neutrality policy and not choose to align your economics with it. And so far, we have not done that.

BPPJ: To double down on the policy solution of allowing selling back, would we need a lot of infrastructure investment?

DK: The utilities have every argument under the book as to why they can't do it, why it's difficult. It's actually the simplest thing in the world. Every cell phone already has all of the algorithms and all of the data tracking you need so that every single solar panel in this state could be selling power back to the grid when it's not being internally used to either power the building or to charge up a battery. Clean energy can be put into the grid by distributed producers, which I'm going to call "*pro-sumers*," producer and consumer, combined into one site.

We now know that clean energy, mainly solar but some wind and energy storage, has saved the state billions, and has saved the state from blackouts. So the utilities are lying to us, whether we wanna say it more politely than I said it or not. That is not gonna go well in print, but it's the truth.

BPPJ: UC Berkeley is in the Bay Area, a very tech-forward region. Given the growth of the AI technology sector and its comparatively high energy usage—ten times that of a Google search–do you anticipate a major increase in energy needs statewide or even nationally, and what effect will this have on our energy infrastructure?

DK: So everyone loves to highlight the next new thing. Oh, data centers are gonna have this huge demand for extra energy. And it's true. They increase the demand. And the surge in energy demand is actually a good thing, not a bad thing.

It's now very clear that the mantra of "electrify all" is good economics, good for the climate, and takes advantage of a resource that not just California has. A higher demand for dispatchable electricity means a higher demand for solar panels, wind turbines, geothermal energy, offshore wind, and tidal and wave power. Those are all things that we have in abundance, and clean energy projects cost less than fossil projects.

It is now cheaper to build a new renewable energy power plant than it is to operate an existing fossil plant. We also know there are more jobs available. And the one thing that is invariant across democratic and public administrations is the search for jobs. While there are more jobs in clean energy than in fossil, they're not in the right place. We do not have an abundance of clean energy jobs in West Virginia and in Southern Wyoming and in Kentucky.

BPPJ: What does the Trump administration mean for the clean energy transition? And for someone who bridges energy, technology, and policy, how do you approach this challenge of advancing scientific achievement against political will and developing public support?

DK: Trump's second administration has already put in a head of the EPA who is not interested in climate change and the Department of Energy nominee who is a fracking investor, a fracking leader, and they're both serving on a National Energy Commission designed to exert U.S. energy dominance. And so that is a club of fossil fuels in their eyes. That means affecting everything from R&D budgets to removing words like climate change from documents the way it happened in Florida, etcetera. And that's all very bad, not only for the U.S., but it's the reason why a horrifically poor deal for marginalized countries and people was struck in the climate conference in Baku, COP 29.

But because clean energy is such a better deal, you also have the situation that many Republican members of the house who voted against the IRA, the Inflation Reduction Act, campaigned in favor of it in their reelection bids because of jobs in their districts. The numbers and their actions are on the side, even if their rhetoric is not on the [same] side.

BPPJ: So we want to talk about the international work that you've done and are curious to hear what brought you to that work. And secondly, as you alluded to Baku, in this renewable energy transition, what does centering equity on this international stage look like?

DK: Not every country uses the language of equity and justice. In fact, if you talk to a lot of international partners, they don't understand the equity, justice language. China, for example, doesn't use that at all. Berkeley is right now, by a comfortable margin, the university that is number one in the world in putting its money and its faculty hiring where its mouth is in terms of justice and equity. So I co-chair something called the Roundtable on Climate Environmental Justice along with a faculty member, Rachel Morello-Frosch, who's half in the UC Berkeley School of Public Health, half in ESPM (Environmental Science, Policy, and Management). And that effort has led to the hiring of at least 6 new faculty members, all junior, focused on diversity and justice.

That means that my own lab and many of the labs we work with across the U.S. with first nations and overseas governments are able to really do the research so that you're not pushing an agenda. You're acting on emerging data.

And we know very clearly that the poorer you are, the larger percentage of your money you spend on energy and food. We also know so many of our existing technology pathways and policy pathways to enable the green energy transition are ones that are socially repressive. We give subsidies to get clean energy deployed. And we almost only do that for people who are already what they used to call "landed gentry." If you own property, if you're likely to buy a car, if you have a home charger for your EV, we'll lather subsidies on you. And if you're poor and marginalized, you know, we say "too late for you. Maybe in 10 years when the prices drop, you might be interested." But we're not demonstrating that outside of California.

In California, we have something called Justice 35. Thirty-five percent or more of our state cap and trade revenues must go to marginalized communities, fence line communities, high exposure communities. And [former President] Biden, launched Justice 40 (for 40%) that put justice throughout the federal government, and not only for domestic projects, but for a core part of our overseas international perspective.

There will not be a special climate envoy in the new administration. And it means that many of our overseas partners who got busy on clean energy plans, and learning, and adopting, or changing or rejecting Justice 40 and other efforts, are now gonna look at the U.S. as what it is unfortunately, embarrassingly proving itself to be: an unreliable partner. All the places that announced themselves to be net zero world partners are gonna look at the U.S. and say, "I don't trust them." And, unfortunately, they have every right now to say that.

BPPJ: I'm curious to hear about your ideas around how strict controls on developing nations are, in terms of the fact that they have to develop energy systems much cleaner than how developed nations did. Is this just a net positive for humanity? Should there be any considerations [for what] the developed world has to do in that regard?

DK: So the fact that clean energy is now cheaper than fossil energy means that

if you're a cash strapped country, i.e. an Industrializing nation, it would not make economic sense in my view to invest in fossil fuels. That is not what their leaders say. Their leaders generally say, "Wait a second. [Developed countries] just spent 100 years burning every bit of fossil fuels they had and fossil fuels under our country. And now they turn around and say, oh, but you shouldn't do this."

Hypocrisy and double standards are ugly. It's ugly, politically. The challenge is that many industrializing countries get bad interest rates, and they have tariffs on imported electronics, laptops, computer panels, solar panels, batteries, whatever else because they don't have a lot of forms of revenue. I would say they should make the tariff on clean energy imports zero.

Developing countries are in a bad situation because the biggest investor could have been the U.S. That's not gonna be the case now, and that pushes them to other investors. And, of course, the biggest other investor is China. China has a very aggressive program called the Belt and Road program to invest in other countries. The terms that China gives these countries look good upfront. "We're going to build hardware. We're going to build roads and hospitals," but they are not good policies in the long term. And [in] country after country that's the case. And those subsidies, legal and illegal, are very much the landscape of incentivizing fossil fuel projects.

BPPJ: Do you think there is a third option with social entrepreneurship?

***DK*:** No. I don't. I think we'd like to talk about social entrepreneurship and the ability of foundations and rich individuals—but no. I do not believe social entrepreneurship and billionaires are gonna save us. Nor do I believe they are in it for social benefit either. The only thing that's gonna save us is people growing in appreciation of the fact that we live in the environment, not in the economy. The economy is a subset of the environment, not the other way around. This wave of selfish self-interest voting that we are seeing around the planet is partially pushed by social media elevating rich billionaires, and now trillionaires, and really disregarding the rights of the poor.

In the west, we are seeing sustainability through the lens of what benefits us, not what benefits the planet. And so we're a long way from reining in the billionaires and trillionaires or setting regulations that actually internalize so much of these environmental externalities.

BPPJ: One of your appointments is in the Department of Nuclear Engineering. We've talked a lot about decentralized technologies. What do you think the role of nuclear power is in the coming decades? Is that even a time window in which nuclear can be operational?

DK: The Biden administration and the Trump administrations are quite aligned on nuclear. They're pro-nuclear.

I am a professor of nuclear engineering. I do not have the most optimistic view of uranium, plutonium, thorium, or nuclear fission processes. I am fairly skeptical that we have demonstrated the ability to do two critical things. It's not managing the risk; all technologies have risk, nuclear has a risk. When a nuclear accident happens, it's high profile. When an accident happens in other areas, it's lower profile. So I am worried about risk, but that's not my number one issue.

Nuclear has not come down in cost. Nuclear has escalated in cost worldwide. There are about 420 nuclear reactors on the planet

today. All of them are fission reactors, and every single one will have to be closed by mid-century. There is no pathway that the world builds 420 current reactors worth of new capacity with conventional designs. We don't know how to manage and get prices down and safety up. And we also have very, very poor ideas of how nuclear can be a compliment to, not a competitor against, renewables.

I am very bullish on nuclear fusion, but I'm also very biased because I'm part of a nuclear fusion company called Alpha Ring. And I think that fusion is the future. Fusion reactors can be anything from the big machines that we talk about, and then there's a whole raft of these new small nuclear fusion companies like the one I'm part of. And so I actually think that in 2070, the world will be 35% solar, 35% fusion, and the rest, wave, geothermal, whatever else.

And to go from 0% to 35% between 2025 and 2070 is big. That will be seen historically, if humans make it, as the biggest change in the energy system, arguably, since solar, which will also have done this amazing ramp up.

BPPJ: Do you think we need a new governance strategy for utilities? And what is your vision? And is it possible?

DK: Yes. I think, actually, utilities have been working against their own best interests. We are currently trying to give utilities not only their current business, but all of the business from petroleum, and utilities consistently say, "No, we don't want your additional money. We don't want to sell you more of our product." Now, if they were an unregulated, truly private sector business, unlike the managed monopolies that they are, they would all be out of business. And so our utilities are stupid, and they're stupid in terms of not only this environmental mandate, but they're stupid in terms of their own business model because we're basically saying we want to triple the amount of your services we buy, we just want you to start investing in clean energy and stop hanging on to all these corrupt deals. We define lobbying as a legal operation. We define these subsidies, we define massive handouts to fracking companies and others as legal. We have decided that what we really like in the U.S. is socialism for the rich and capitalism for the poor. So, we are demonstrating the many ways that we can be our own worst enemy.

BPPJ: Do you have any hopes or advice for the next generation? If you want to get into this area, but you see the path forward being so riddled with obstacles, what advice would you give for sticking it out and really pushing forward even when it feels like everything is against you?

DK: Well, I think that the other version of your statement is that it is a wide open landscape.

My generation will not go down in history as the greatest generation. We have failed the planet, and we have failed your generation. And I hope you don't spend the next 20 years just simply suing my generation, which you could do totally validly. That would be symbolic, but not very productive. So I think that the interesting feature is that we don't only need help in terms of innovating new tech climate technologies. We need help on social justice. We need help on better market mechanisms. We need help on communicating science to people. So almost anything you want to study.

You don't need to say, how does this fit in? Just get good at something that you enjoy, and there is a place for that skill no matter what that skill is in making this transition.