



Testimony of Professor Severin Borenstein
before the California Little Hoover Commission
April 24, 2014

I am the E.T. Grether Professor of Business and Public Policy at U.C. Berkeley's Haas School of Business, where I also serve as faculty director of the Energy Institute at Haas. I am also Director of the University of California Energy Institute. My full curriculum vitae is attached.

I have been invited by the Commission to address California's overarching goals for energy and the environment, and the effectiveness of current policy for addressing those goals. As faculty director of the Energy Institute at Haas, I write regularly on energy issues for the Institute's blog, Energy Economics Exchange. In that forum, I have written on many of the issues that concern me about California energy policy. I reference and summarize these blog posts here and I attach copies of them

I believe strongly that California must be part of the solution to the global problem of climate change, but I think the state's policy has become too focused on meeting state-specific goals rather than creating pathways for the world, including the poorest nations, to reduce greenhouse gas emissions. I addressed these issues earlier this month in "It's Time to Refocus Californias Climate Strategy."¹

In confronting climate change, I think that the state should focus more effort on developing new technologies that can reduce GHG emissions worldwide. I think that means going beyond support for basic science research to also support costly experimentation with new technologies and business models that may turn out to have large spillover benefits outside of California. I explained my views on supporting research, development and deployment in a blog post in March of this year, "In Defense of Picking Winners."²

Part of reorienting California's energy and climate policy must address electricity rate design that has distorted incentives of consumers by charging rates that do not reflect the costs that consumers impose on the system. These rates have created opaque and unfair incentives to install distributed generation that has the effect of raising rates for those who don't or can't do so. I addressed this issue in November 2013, "Rate design wars are the sound of utilities taking residential PV seriously."³

Finally, one of California's most well known efforts to address climate change is our cap and trade market for GHGs. Since 2012, I have been part of a team of outside experts that has advised the Air Resources Board on operation of the cap and trade market. I strongly support putting a price on greenhouse gas emissions and I think the ARB has done an admirable job of implementing a set of complex regulations in the midst of ongoing political battles on these issues. Still, I am concerned that the cap and trade market could be vulnerable to extreme price fluctuations. I believe that the ARB should implement a price ceiling in the market, as I explained in a blog post last September, "California's Cap-and-Trade Market Still Needs a Price Ceiling."⁴

I look forward to discussing these issues with the Commission.

¹ <http://energyathaas.wordpress.com/2014/04/07/its-time-to-refocus-californias-climate-strategy/>

² <http://energyathaas.wordpress.com/2014/03/03/in-defense-of-picking-winners/>

³ <http://energyathaas.wordpress.com/2013/11/12/rate-design-wars-are-the-sound-of-utilities-taking-residential-pv-seriously/>

⁴ <http://energyathaas.wordpress.com/2013/09/30/californias-cap-and-trade-market-still-needs-a-price-ceiling/>

It's Time to Refocus California's Climate Strategy

Posted on [April 7, 2014](#) by [Severin Borenstein](#)

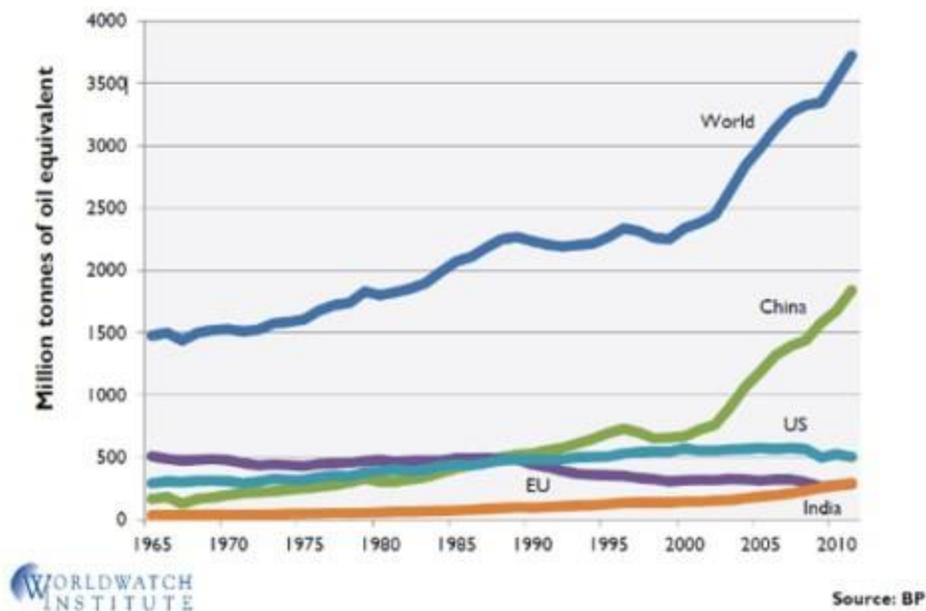
You know this already, but let's review:

- Climate change is a global emissions problem.
- California produces about 1% of the world's greenhouse gas emissions.
- Over the next few decades, the majority of emissions will come from developing countries.
- If we don't solve the problem in the developing world, we don't solve the problem.

And lastly,

- The world is making negative progress on climate change. Evidence of the potential for drastic climate change is growing, but worldwide GHG emissions and concentrations of GHGs in the atmosphere are still rising. Exxon's just-released [Energy Outlook](#), predicts world oil consumption will rise 19% over the next 25 years, while natural gas will rise 66%, and coal will be flat, no decline.

Nearly all of this was known back in 2006, when California passed the Global Warming Solutions Act, though the massive growth in China's coal consumption was just getting momentum. Back then, the argument for California emissions targets was "leadership" and that is still the word one hears most often from defenders of the state's current package of GHG markets and mandates.



Coal Consumption By Region

I've heard many different meanings of leadership in the context of California emissions targets:

1. Showing that the regulations and cap & trade market are logistically feasible, and developing implementation models that could be adopted at national and international levels
2. Showing that people are willing to sacrifice or change their way of life to fight climate change
3. Showing that people won't have to sacrifice because reducing GHGs will improve the economy
4. Recognizing that someone has to move first to start a worldwide movement to reduce GHGs

There is something to each of these arguments (well, maybe not #3. Most economists think addressing climate change will be a small drag on the economy—if you don't count the worldwide economic value of averting climate change).

But it's 2014 now. The U.S. is further from adopting a price on GHG emissions than it was in 2006. Fewer members of Congress than 8 years ago even believe climate change is a problem. The three largest market mechanisms for reducing GHGs (California's cap-and-trade, the EU-ETS, and the eastern U.S. RGGI program for utility emissions) all have very low prices that are doing little to change the course of emissions.

For these reasons, I think it's time to have a frank review of California's climate policy. We need to refocus on how California can realistically contribute to solving the problem of **global** climate change. Reaching emissions targets for California *may* be part of that strategy, but that should not be the singular or even the primary goal.

The primary goal of California climate policy should be to invent and develop the technologies that can replace fossil fuels, allowing the poorer nations of the world – where most of the world's population lives – to achieve low-carbon economic growth. If we can do that, we can avert the fundamental risk of climate change. If we don't do that, reducing California's carbon footprint won't matter.

Focusing on solving **global** climate change would mean that a major test of any policy proposal would be whether it is exportable to the developing world. It's always hard to predict what will work, but “working” in California isn't particularly valuable if the approach doesn't work where most of the planet's emissions will be coming from in the 21st century. GHG-reduction strategies that are very expensive – but bearable for a rich country – only make sense if they have a plausible path for getting to near cost competitiveness in poor countries.

That means less emphasis on numerical measures of California emissions and more emphasis on learning. What more are we likely to know at the end of a program and will that knowledge be applicable in other parts of the world?

Implications of a learning-driven strategy to tackle global climate change include:

- In procuring renewables, California's current “least cost, best fit” approach should be augmented with “most learning.” That means a new technology about which we (and the rest of the world) will learn a lot may get funded even if it is likely to be more expensive than replicating a mature technology.
- We need greater emphasis on technology creation, both in the lab and downstream, where a lot of the learning goes on. California should consider creating a Climate Change Solutions Institute akin to the California Institute for Regenerative Medicine. The goal would be to research and develop approaches that could be applied by a large share of the world's population.

- Every California energy efficiency program needs [rigorous evaluation](#) of what worked and why, and what didn't work and why not. And we need to study where else in the world the same sort of efficiency policies would (or wouldn't) be effective. The greatest value from the state's energy efficiency leadership is likely to be knowledge creation, not GHG reduction.

This does not mean California should abandon pricing GHG emissions. Putting a price on emissions helps boost green technologies across the board. In addition, substituting cap-and-trade revenues (or GHG taxes) for income or sales taxes is a clear move towards improving economic efficiency and welfare.

California's current strategy may eventually allow us to say "we've done our share; now the rest of you need to step up." But that isn't leadership when more than 80% of the "rest of you" are living at less than one-quarter of our standard of living. It's time to make our Global Warming Solutions Act about global solutions.

In Defense of Picking Winners

Posted on [March 3, 2014](#) by [Severin Borenstein](#)

Virtually all economists working on climate change agree that we should price GHG emissions. Doing so creates an incentive to reduce emissions without the government directing specific technology adoptions or activity changes, that is, without “picking winners.”

Nearly as many economists agree that we should subsidize basic R&D. Doing so, accelerates the scientific breakthroughs that will be necessary to avoid even higher concentrations of carbon in the atmosphere. Of course, we can't and shouldn't subsidize all basic R&D regardless of how nutty the idea or indirect the connection to GHG reduction. We should subsidize the best ideas, that is, we should pick winners.

How does an economist hold both ideas in his/her head at the same time without risking spontaneous combustion? Actually, it's not hard. The two policies are designed to solve two different problems. It's no surprise that different problems require different solutions.

Pricing emissions recognizes that the normally efficient system of pricing goods and letting people choose what to buy and sell breaks down when some goods are not priced (negative externalities, for instance). Thus, putting a price on emissions fixes the problem that exists because we currently give away the right to pollute for free.

Pricing emissions is quite attractive compared to “command and control” pollution regulations, because the regulations don't necessarily find the least expensive ways to abate the pollutant. Pricing the emissions gives every polluter the incentive to compare the emissions price to the cost of abatement and then do the abatement that is less expensive than paying the price for emissions. The regulator does not know as well as the emitters which are the most cost-effective abatement strategies. And – critically – there is an alternative to regulation that is almost certainly more efficient: creating a price for emissions.

Unfortunately, such an elegant solution hasn't been discovered for the second problem, incentivizing innovation. The economics of innovation is like the engineering of electricity storage: a tremendously important field where progress has been frustratingly

slow. Innovation is a key driver of the economy, but decades of economic study have revealed few reliable facts or verified theories of how innovation happens and how public policy can enhance it.

Still, it is well known that knowledge creation has huge spillovers that the knowledge creator doesn't capture or profit from. Ironically, this is also an externality problem, but this externality is positive and results in too little innovation, in contrast to the negative externality of greenhouse gases that results in too many emissions.



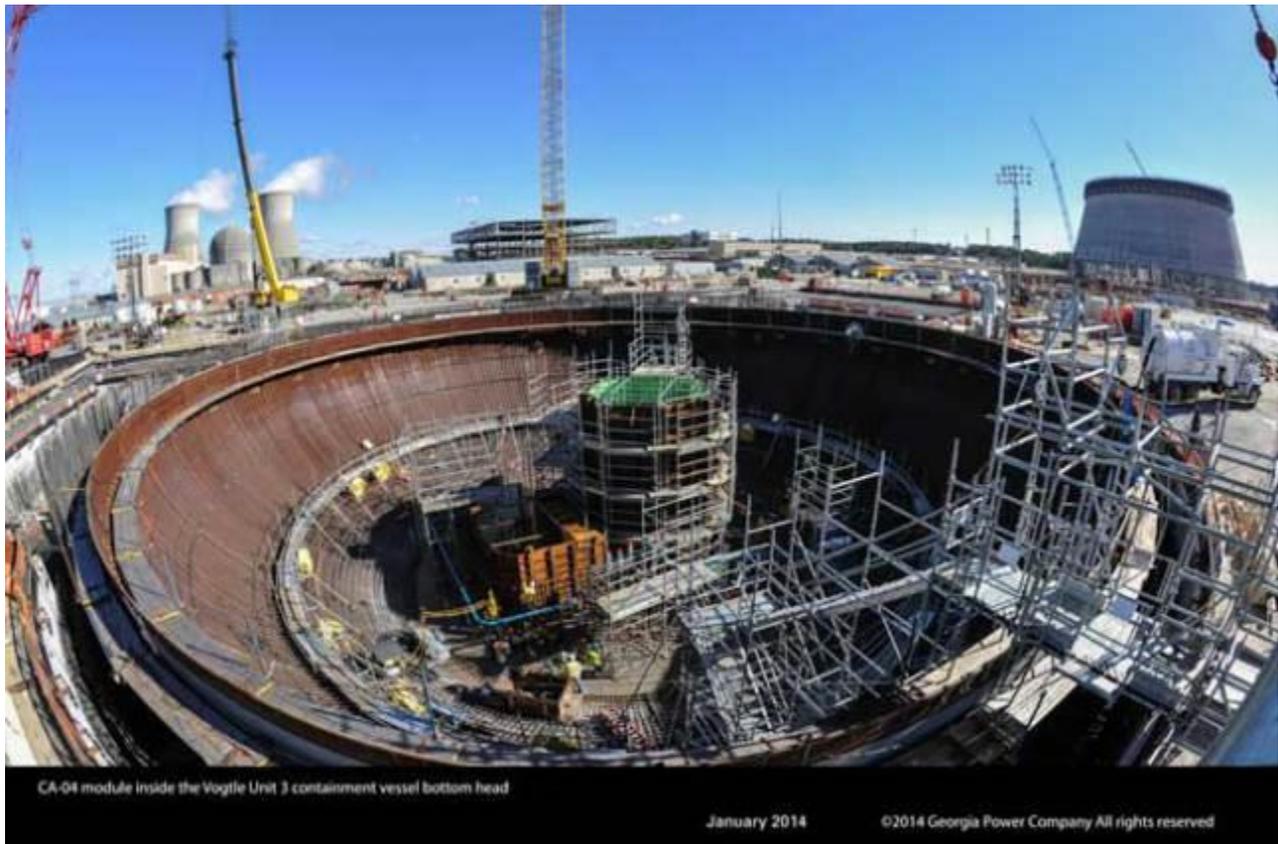
Brightsource's Ivanpah Solar Thermal Generator is one experiment that the U.S. government has picked to support

Intellectual property protection – patents, trademarks, copyrights, etc – are intended to address innovation incentive problems, but they are very imperfect solutions. One problem with IP protections is that they give the creator a monopoly for decades, which is probably not the best policy when we need cumulative innovations in a hurry to address climate change.

That brings us to subsidizing innovation. Among innovation scholars, subsidizing basic knowledge creation – fundamental science – is (you'll excuse the expression) a no-brainer. Yes, it requires picking winners among basic science research proposals, but there isn't an elegant alternative available as there is with the problem of negative pollution externalities. The spillovers from basic science research are huge, hard to measure or control, and almost certainly best left to diffuse without impediments.

More controversial is subsidizing downstream development and deployment, such as tax credits for building commercial-scale compressed-air power storage or a new nuclear reactor design. Some economists argue that firms can capture most of the knowledge created from these sorts of activities and can benefit privately. I used to be in that camp, but two things have changed my view.

First, I'm convinced there are significant knowledge spillovers that can't be feasibly captured by a firm that develops or deploys new technologies. Furthermore, we wouldn't want them to keep that knowledge to themselves even if they could. Importantly, the very fact that a firm is pursuing a new technology and is still in business — or has gone out of business — is a critical piece of knowledge to other firms considering work in the area. Seeing that a firm is making money in a new line of business inspires other firms to investigate the business and to investigate how the first entrant is doing it. Seeing a firm fail in a new venture is also valuable information to others considering similar activities.



Southern Company's Vogtle Nuclear Power Plant — which [Lucas blogged about a couple weeks ago](#) — is another government-supported project

That means that significant value from such experimentation spills over to other firms. It's a problem in all industries, but it is especially a problem in an industry with very high costs of experimentation — building the first small modular nuclear reactor isn't like creating a new social network app — and with very uncertain value of success. What makes the value of success so much more uncertain here than in most industries is the fact that the value will be driven as much by public policy towards climate change as by consumer demand.

The second thing that has changed my mind on subsidizing development and deployment of new energy (and energy efficiency) technologies is the need to solve the problem of **global** climate change. We desperately need the knowledge to spill over to the developing world so they will move out of extreme poverty along a much less carbon-intensive path than we have taken. We need innovations to be adopted as quickly and smoothly as possible around the world, a process that will almost surely be hampered by anything that relies on negotiations over intellectual property rights. Subsidizing innovation can be tied to disclosure and reporting requirements that encourage replication and further innovation.

Just as with fundamental science, this doesn't mean that every technology should be subsidized throughout the development process. There are plenty of bad ideas out there that shouldn't get money. There are also plenty of plans that may work privately, but for which the spillovers are small. Just as with fundamental science, this requires picking winners. And because these should be experiments — the whole point is to do things for which the outcome is uncertain — many “winners” picked will turn out to be failures.

And that's ok. We need to pick, and subsidize, the experiments that have the largest potential to create value in reducing GHG emissions and the largest potential for that value to spill over to other uses, other technologies, and other countries. That's not inconsistent with pricing GHG emissions. It's just recognizing that we face multiple challenges in fighting climate change and multiple strategies will be needed to succeed.

Rate design wars are the sound of utilities taking residential PV seriously

Posted on [November 12, 2013](#) by [Severin Borenstein](#)

Imagine walking into your supermarket with a bag of zucchini from your garden and saying that you'd like to trade them straight up for an equal quantity of zucchini next month.

The store manager would explain that they aren't in the business of making wholesale purchases at such small scale, and that when they do make wholesale purchases it is at a much lower price than the retail price at which they sell.



Swapping zucchini today for zucchini tomorrow

You can, of course, eat the zucchini you grow, the manager might say, but once you start trading zucchinis with the store, you can't expect to get the same price on sales *to* the store as you pay on purchases *from* the store. The margin the store makes between the wholesale and retail price is what pays for the building, heating and cooling, labor, and other costs that are mostly fixed with respect to the amount you buy.

The same economics applies in electricity, only more so. The retail price, especially in California, is covering a lot more than just the incremental cost of providing an extra kilowatt-hour to you. In economic terms price is above the marginal cost of the incremental unit of energy, much further above than for goods you buy at the supermarket. That price gap is paying for past losses from failed deregulation, costly nuclear power, expensive contracts with large scale renewables producers, and local

distribution systems that carry power from the grid to your house, as well as metering consumption, billing and account collection. As a result, when you consume less electricity, the cost the utility saves is much less than the revenue they lose.

Pricing above marginal cost means any decline in energy bought from the utility makes it harder to recover fixed costs, whether the quantity decline is from installing residential solar PV, improving energy efficiency, or just slow economic growth. But buying less electricity for these reasons corresponds to growing your own zucchini (or just eating less zucchini).

Net metering of solar PV is equivalent to forcing the supermarket to take your zucchini on an even up trade for future zucchini. The customer gets a one-for-one credit for electricity it puts into the grid against future consumption from the grid. This expands the customer's opportunity to save money, though in a way that reduces the utility's net revenue.

This risk was largely ignored in the mid-1990s when net metering of residential solar PV was established. It wasn't that utilities or industry analysts failed to understand the simple math. It's that they didn't think the exposure was very large, because solar PV was so expensive and the subsidies were smaller. As recently as a decade ago, the cost of a residential system was still north of \$10/watt, translating to at least \$0.50/kWh. Even with aggressive state subsidies and small federal subsidies, it was difficult to get the end-use consumer cost below \$0.35/kWh. The average retail price for the kWh replaced by a solar system was generally well below that, so very few consumers could really save money putting in solar.

But technology marches forward and PV panel costs have come way down. Politics also marches (assign your own direction to it) and the effective subsidies for PV have increased substantially. The war that is now erupting over tariff design is coming largely from utilities now taking distributed PV seriously.

A decade ago, utilities saw net metering as a small indirect subsidy to a nascent technology that was unlikely to ever be able to compete with even the retail price of electricity. With plummeting prices of solar panels and some progress on installation costs, along with increased federal subsidies that now cover about half the cost, residential PV can now lower the retail energy bill of many California consumers,

particularly customers of the large investor-owned utilities, which have the highest rates.

Two aspects of utility electricity tariffs are major contributors to the attractive economics of residential PV. First, increasing-block pricing (“IBP”, higher price tiers as you consume more during the month) mean that for some heavy users, solar PV makes sense because it is replacing power on the highest tiers, where those consumers now pay \$0.30-\$0.40/kWh. With lower costs and higher subsidies, PV has been able to beat those prices for at least a few years now. That’s a major factor in the utilities pushing to flatten or eliminate IBP.

But the real panic in the industry has set in this year as the net-of-subsidy cost of PV has dropped below even the average retail price. Even if increasing-block pricing were eliminated and the big IOUs sold all residential power for their average price of about \$0.17/kWh, solar PV could beat that for many customers. According to a recent [report from Lawrence Berkeley Lab](#) (and confirmed by other industry studies and media reports), the full cost of a typical residential system has fallen below \$6/watt and may be below \$5/watt by now, which corresponds to \$0.25-\$0.30/kWh. The 30% federal tax credit and what’s left of the California Solar Initiative subsidies cuts that by about a third. A less well-known tax effect – accelerated depreciation for leased systems – transfers another 15%-20% of the cost from the end-user to the federal government. The net cost to the consumer can now be \$0.15/kWh or less.

This is why we are hearing more often the phrase “death spiral” from the utilities. If many customers act on the attractive economics of PV at home, the utility sells less energy and earns less above marginal cost to cover those costs of past sunk mistakes and ongoing fixed costs. To make up the revenue, they would have to raise rates, which makes the economics of PV even better.

So, the utilities are now desperately pushing for tariff changes that a few years ago they saw as only a distant dream. Not only do they want to eliminate increasing-block pricing, they want to further reduce the incremental energy price by implementing a fixed monthly charge on each customer, aimed at covering some of the costs of retail distribution, metering and billing. Most economists support such changes as they move electricity pricing towards a more cost-based system. In fact, the large publicly-owned

utilities – Sacramento (SMUD) and Los Angeles (LADWP) – already have the tariff design the IOUs are now fighting for. SMUD’s fixed monthly charge is \$13, going up to \$20 in a few years.

Not surprisingly, solar advocates love IBP and hate fixed monthly charges. They argue that the proposed changes would hurt the poor – which is true if the changes aren’t accompanied by expanded discounts for low-income customers – though solar PV advocates don’t have a credible track record of protecting poor rate payers. They also assert, with much less support, that solar PV adds so much extra value to the grid – by reducing line losses and the need for infrastructure upgrades – that solar should be favored through the advantages that current tariff design gives them.

What makes the policy debate so difficult to resolve is that tariff design is a very indirect way to support residential PV. In Germany, they’ve gone with feed-in tariffs for solar PV instead – a direct subsidy for every kWh of energy coming from your PV system. Much simpler, and allows a reasoned debate on tariff design apart from solar PV policy. But also makes it easier to see how much they are paying people to eat zucchini, and how that is driving up the bills of the people who prefer carrots (as made clear in a [recent article](#) in the center/left magazine Spiegel).

In the coming months, we are going to hear a lot of talk about tariff redesigns, solar PV penetration, and the utility business model. Unless policy makers can separate rate design from residential PV policy, it’s not going to be easy to follow, or pretty to watch.

California's Cap-and-Trade Market Still Needs a Price Ceiling

Posted on [September 30, 2013](#) by [Severin Borenstein](#)

Back in May, I [blogged](#) about the problem of low GHG allowance prices in the EU-ETS. I explained the sound reasons for having both a price floor and a price ceiling in any allowance market where science doesn't dictate a single do-or-die target for emissions.

At that time, I held up the California cap and trade market as a good example because the market has a price floor and I reported that the regulator (the California Air Resources Board, CARB) was on the way to adopting a price ceiling. As a member of the Emissions Market Assessment Committee (EMAC) that advises CARB on the operations of the cap and trade market, I had participated in a number of meetings on a price ceiling policy.

The CARB has now issued proposed changes to their policy on price containment, which the Board will consider at their October 24-25 meeting. While the proposed changes are a small step in the right direction, they don't go far enough to address the fundamental risk to the market from a surge in emissions that could cause the price of allowances to skyrocket.

First, what the policy does do. The changes that the Board will consider in October would permit allowances from later years (of the 2013 to 2020 program) to be shifted to earlier years if the price rose to a sufficiently high level. This is a useful response to the concern that the first compliance period (2013-14) could have a shortage of supply. In fact, it virtually assures that the price would not rise above the highest price in the Allowance Price Containment Reserve during the first compliance period, which is about \$53/MT (metric ton).

What the proposal doesn't address is the more significant threat that there could be a supply/demand mismatch for the entire 8-year program. If market participants thought that there were not enough allowances over the 8-year period to cover the entire emissions under the cap – which could result from a number of years of strong growth in the economy and in accompanying emissions – then the price of permits for all

remaining periods would soar. If that happened, moving permits from one year to another might temporarily drive down price in the “receiving” year and drive up price in the “giving” year, but that price differential would invite arbitrage through saving a permit this year to use it when it is more valuable in a later year. One market participant likened the current proposal to trying to fill a bathtub by taking water from one end of the tub and pouring it into the other.

The CARB [staff analysis recognizes this](#) (see pages 39-43) and CARB can certainly revisit the issue in the future. Waiting too long, however, raises the risk that later policy changes will come after the possibility of a very tight market has become elevated by higher-than-expected emissions and strong economic forecasts. Action at that point would be much more disruptive to the market – larger price impacts and shifts of wealth among market participants, leading to more political pressures and more lawsuits. It would still be better than no response at that point, but far worse than addressing the risk soon while it is still small.

The policy that I advocated in my earlier blog post, which is endorsed by my colleagues on the EMAC and many market participants ([and by Rob Stavins](#)), is a firm price ceiling. The way CARB would enforce such a ceiling is by standing ready to sell additional allowances at the ceiling price. Such a policy would not only limit the price in the case of exceptionally strong demand for allowances, it would also help deter speculative attacks and attempts at market manipulation. As I laid out in my [May blog post](#) it makes good policy sense to be flexible on the quantity target – rather than sticking stubbornly to what is a fairly arbitrary numerical target – if the cost of abatement is much higher (or much lower) than anticipated.

But, just as important, nearly everyone recognizes that California would not actually stick with the cap-and-trade market in its current form if the price climbed above the price ceiling level that has been discussed, which is about \$50/MT in 2013 and rising at inflation plus 5% in each future year. (For context, an allowance price of \$50/MT would raise gasoline prices about 50 cents per gallon.) Industry, government and some consumer groups have made clear that they don’t think the market would survive if that happened. And such a disruption in California would seriously damage the prospects for a multi-state, national or international cap-and-trade market.

Some opponents say that a price ceiling would undermine the environmental integrity of the program. But a price ceiling would have no impact at all if prices stayed below the ceiling level, so the question is whether the environmental integrity would be maintained if allowance prices soared and there were no price ceiling. The common wisdom, that the government would have to “step in,” suggests environmental integrity would quickly be sacrificed in that emergency situation.

What would happen? The Governor has the power to suspend the market if he (or she) believes that it is harming the economy. How exactly would that work? Your guess is as good as anyone’s.

Market participants can only speculate at how the state would put the brakes on an allowance market with skyrocketing prices. And that’s part of the problem. Regulatory uncertainty undermines market credibility, especially in times of extreme outcomes.

Furthermore, policy made in times of crisis is often driven by political influence more than good analysis. Read any book on the banking crisis, or California’s electricity crisis, for examples. In this case, the emergency policy intervention would have a major impact on the value of every outstanding allowance (as well as the stocks of many firms). The litigation would be endless. Addressing this risk now, before a crisis occurs, allows for development of a plan that minimizes the net impact on GHG emissions while giving market participants reassurance that they won’t be faced with either disruptive allowance prices or disruptive emergency interventions.

Opponents of a price ceiling also argue that it is extremely unlikely that prices would get to the levels at which a price ceiling would have an effect. [Analysis](#) by myself and my EMAC colleagues suggests the probability could be 10%, or possibly higher.

Other analyses conclude the probability is much lower, but ours is the only study that recognizes that there is uncertainty in the “business as usual” (BAU) emissions from which we have to reduce. The other studies take that emissions baseline as a known path for the years of the California program, 2013-2020. That’s equivalent to claiming that we know with certainty how fast the California economy will grow and how emissions intensive that growth will be for the next 7 years absent cap-and-trade.

The EU-ETS thought they knew the BAU emissions and were surprised when a recession delivered much lower numbers. The risk in California is that the economy will take off, causing very high emissions and soaring allowance prices. It *probably* won't happen – in fact prices have been near the floor so far, which our study shows is the most likely outcome. But our analysis also implies that extremely high prices are well within the realm of possibility later in the program.

The ceiling level that has been discussed would only have an effect if prices had climbed to a level that nearly all politicians and market participants think is politically untenable. Until such a credible price ceiling is adopted, there remains a significant risk of disruption to both our economy and our strategy for addressing climate change.

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Teaching and Research Interests:

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- 1983-1990 Assistant Professor of Economics and Public Policy, Department of Economics and Institute of Public Policy Studies, University of Michigan
1989-1990 Visiting Assistant Professor of Economics, Department of Economics, University of California, Davis
1990-1994 Associate Professor of Economics, Department of Economics, University of California, Davis
1992,1993 Visiting Associate Professor of Business Economics (Autumn), Haas School of Business, University of California, Berkeley
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Other Past and Current Professional Positions:

- 1978-1979 Staff Economist, Office of Economic Analysis, U.S. Civil Aeronautics Board
1990-1996 Research Associate, Institute of Transportation Studies, University of California, Davis
1992-2002 Co-Director, Program On Workable Energy Regulation, University of California Energy Institute
1993-2000 Associate Editor of *International Journal of Industrial Organization*

1993-1995	Associate Editor of <i>Journal of Industrial Economics</i>
1995-2000	Editor of <i>Journal of Industrial Economics</i>
1997-2003	Member, Governing Board of California Power Exchange Corporation
1998-1999	Chair, Economic Analysis and Policy Group, Haas School of Business
1999-2000	Member, California Attorney General's Gasoline Task Force
1999-2002	Co-Director, National Bureau of Economic Research Project on E-Commerce
2002-2009	Co-Director, Center for the Study of Energy Markets, University of California Energy Institute
2004-2009	Member, Board of Editors, <i>Journal of Economic Literature</i>
1992-present	Research Associate, National Bureau of Economic Research
1992-2012	Associate Editor of <i>Review of Economics and Statistics</i>
1994-present	Director, University of California Energy Institute
2007-2013	Member, Board of Editors, <i>American Economic Journal: Economic Policy</i>
2008-present	Member, External Advisory Board, University of Michigan Energy Institute
2009-present	Faculty Director, Energy Institute at the Haas School of Business
2010-2011	Member, U.S. Department of Transportation, Future of Aviation Advisory Committee
2010-2013	Member, U.S. Department of Energy, National Petroleum Council, Future of Transportation Fuels Working Group
2012-2013	Member, Emissions Market Assessment Committee, California Air Resources Board
2013-present	Co-Editor, <i>Journal of the Association of Environmental and Resource Economists</i>

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1979-1981	M.I.T. Graduate Scholarship
1982-1983	Alfred P. Sloan Foundation Research Fellowship
1986	University of Michigan Rackham Research Fellowship
1986-1987	University of Michigan Teaching Development Award
1987-1990	National Science Foundation Research Grant #SES-8711576 Principal Investigator, "Efficiency in the Allocation of Operating Licenses"
Fall 1987	Michigan Economic Society Undergraduate Teaching Award
1988-1989	University of Michigan Rothschild Research Fellowship
1991-1993	Universitywide Energy Research Group Research Grant Co-Principal Investigator (with Colin Cameron) "Asymmetric Retail Gasoline Price Responses to Crude Oil Price Changes"
1996-1997	Recipient, Cheit Award for Best Teacher in Haas MBA Program
1996-1997	Finalist, Cheit Award for Best Teacher in Haas PhD Program
1998-1999	National Bureau of Economic Research/Sloan Foundation Research Grant Co-Principal Investigator (with Joseph Farrell), "Why Do Firms Cut Costs?"
2002	Voted Favorite Core Curriculum Professor by Haas MBA Class of 2002
2002	Hewlett Foundation/Energy Foundation Research Grant Principal Investigator, "Price-Responsive Demand in Electricity Markets"
2003-2004	California Energy Commission Research Contract to U.C. Energy Institute Principal Investigator, "Market Power in California's Gasoline Market"
2005	Distinguished Service Award, Public Utility Research Center, University of Florida

2005	Distinguished Faculty Mentoring Award (for graduate student mentoring), U.C. Berkeley
2005-2006	Finalist, Cheit Award for Best Teacher in Haas Daytime MBA Program
2007-2008	Research Grant from Coleman Fung Risk Management Research Center Principal Investigator, “Security of Supply Concerns and Forward Price Premia in Natural Gas Markets”
2001-2013	California Energy Commission Research Grant to U.C. Energy Institute Principal Investigator, “Center for the Study of Electricity Markets”
2009-present	U.C. Office of the President Grant Principal Investigator, “U.C. Center for Energy and Environmental Economics”
2009	<i>American Economic Review</i> Excellence in Refereeing Award
2010	Microsoft Research Gift “The Impact of Dynamic Electricity Pricing on Low-Income Households”
2010-2011	Lawrence Berkeley National Laboratory Principal Investigator, “Smart Grid and Dynamic Pricing”

Journal Publications:

“Price Discrimination in Free-Entry Markets,” *RAND Journal of Economics*, **16**(Autumn 1985).

“On the Efficiency of Competitive Markets for Operating Licenses,” *Quarterly Journal of Economics*, **103**(May 1988).

“Market Incentives for Safe Commercial Airline Operation,” (with Martin Zimmerman), *American Economic Review*, **78**(December 1988).

“The Economics of Costly Risk Sorting in Competitive Insurance Markets,” *International Review of Law and Economics*, **9**(June 1989).

“How to Carve a Medical Degree: Human Capital Assets in Divorce Settlements,” (with Paul Courant), *American Economic Review*, **79**(December 1989).

“Hubs and High Fares: Dominance and Market Power in the U.S. Airline Industry,” *RAND Journal of Economics*, **20**(Autumn 1989).

“Airline Mergers, Airport Dominance, and Market Power,” *American Economic Review Papers and Proceedings*, **80**(May 1990).

“Carrot and Yardstick Regulation: Enhancing Market Performance with Output Prizes,” (with Mark Bagnoli), *Journal of Regulatory Economics*, **3**(June 1991).

“The Dominant-Firm Advantage in Multi-Product Industries: Evidence from the U.S. Airlines,” *Quarterly Journal of Economics*, **106**(November 1991).

“Selling Costs and Switching Costs: Explaining Retail Gasoline Margins,” *RAND Journal of Economics*, **22**(Autumn 1991).

“The Evolution of U.S. Airline Competition,” *Journal of Economic Perspectives*, **7**(Spring 1992).

“Competition and Price Dispersion in the U.S. Airline Industry,” (with Nancy Rose), *Journal of Political Economy*, **103**(August 1994).

“Antitrust Policy in Aftermarkets,” (with Jeffrey MacKie-Mason and Janet Netz), *Antitrust Law Journal*, **63**(Winter 1995).

- “Bankruptcy and Pricing Behavior in U.S. Airline Markets” (with Nancy Rose), *American Economic Review Papers and Proceedings*, **85**(May 1995).
- “Dynamic Pricing in Retail Gasoline Markets” (with Andrea Shepard), *RAND Journal of Economics*, **27**(Autumn 1996).
- “Settling for Coupons: Discount Contracts as Compensation and Punishment in Antitrust Lawsuits,” *Journal of Law and Economics*, **39**(October 1996).
- “Market Power in California Electric Markets” (with James Bushnell, Edward Kahn, and Steven Stoft), *Utilities Policy*, **5**(3/4, 1996).
- “Do Gasoline Prices Respond Asymmetrically to Crude Oil Price Changes?” (with Colin Cameron and Richard Gilbert), *Quarterly Journal of Economics*, **112** (February 1997).
- “Why Do All the Flights Leave at 8 a.m.? Competition and Brand Differentiation in Airline Scheduling” (with Janet Netz), *International Journal of Industrial Organization*, **17**(July 1999).
- “An Empirical Analysis of the Potential for Market Power in California’s Electricity Industry” (with James Bushnell), *Journal of Industrial Economics*, **47**(September 1999).
- “Market Power in Electricity Markets: Beyond Concentration Measures” (with James Bushnell and Christopher Knittel), *Energy Journal*, **20**(4,1999).
- “Is Cost Cutting Evidence of X-Inefficiency?” (with Joseph Farrell), *American Economic Review Papers and Proceedings*, **90**(May 2000).
- “Exercising Market Power in Proprietary Aftermarkets,” (with Jeffrey MacKie-Mason and Janet Netz), *Journal of Economics and Management Strategy*, **9**(Summer 2000).
- “The Competitive Effect of Transmission Lines in a Deregulated Electricity Generation Market” (with James Bushnell and Steven Stoft), *RAND Journal of Economics*, **31**(Summer 2000).
- “Economics and Electronic Commerce” (with Garth Saloner), *Journal of Economic Perspectives*, **15**(Winter 2001).
- “The Trouble With Electricity Markets: Understanding California’s Restructuring Disaster,” *Journal of Economic Perspectives*, **16**(Winter 2002).
- “Sticky Prices, Inventories, and Market Power in Wholesale Gasoline Markets,” (with Andrea Shepard), *RAND Journal of Economics*, **33**(Spring 2002).
- “Measuring Market Inefficiencies in California’s Deregulated Wholesale Electricity Market” (with James Bushnell and Frank Wolak), *American Economic Review*, **92**(December 2002).
- “The Impact of Bankruptcy on Airline Service Levels” (with Nancy Rose), *American Economic Review Papers and Proceedings*, **94**(May 2003).
- “The Long-Run Efficiency of Real-Time Electricity Pricing,” *Energy Journal*,**26**(3) (2005).
- “On the Efficiency of Competitive Electricity Markets With Time-Invariant Retail Prices,” (with Stephen Holland), *RAND Journal of Economics*, **36**(Autumn 2005).
- “Customer Risk from Real-Time Retail Electricity Pricing: Bill Volatility and Hedgability” , *Energy Journal*,**28**(2) (2007).
- “Wealth Transfers Among Large Customers from Implementing Real-Time Retail Electricity Pricing,” *Energy Journal*,**28**(2) (2007).
- “Do Investors Forecast Fat Firms? Diagnosing Profit Dissipation from the Stock Market Values of Gold Mining Firms,” (with Joe Farrell), *RAND Journal of Economics*, **38**(Autumn 2007).
- “Inefficiencies and Market Power in Financial Arbitrage: A Study of California’s Electricity

Markets,” (with James Bushnell, Christopher Knittel, and Catherine Wolfram), *Journal of Industrial Economics*, **56**(2) (June 2008).

“Why Can’t U.S. Airlines Make Money?” *American Economic Review Papers and Proceedings*, **101**(May 2011). (A longer version is available as NBER Working Paper #16744)

“The Public and Private Economics of Renewable Energy,” *Journal of Economic Perspectives*, **26**(Winter 2012).

“The Equity and Efficiency of Two-Part Tariffs in U.S. Natural Gas Markets,” (with Lucas Davis) *Journal of Law and Economics*, **55**(1), February 2012.

“The Redistributive Impact of Nonlinear Electricity Pricing,” *American Economic Journal: Economic Policy*, **4**(3), August 2012.

“Career Concerns, Inaction and Market Inefficiency: Evidence from utility regulation,” (with Meghan Busse and Ryan Kellogg), *Journal of Industrial Economics*, **60**(2), June 2012.

“Effective and Equitable Adoption of Opt-In Residential Dynamic Electricity Pricing,” *Review of Industrial Organization*, **42**(2), March 2013, 127-160.

“The Incidence of an Oil Glut: Who Benefits from Cheap Crude Oil in the Midwest?” (with Ryan Kellogg) *Energy Journal*, **35**(1), January 2014.

“A Microeconomic Framework for Evaluating Energy Efficiency Rebound And Some Implications,” *Energy Journal*, forthcoming January 2015.

Other Publications:

“High Air Fares: Don’t Blame Deregulation,” *Washington Post*, August 25, 1987.

“USAir Merger Promises Higher Fares, Less Competition,” *Hartford Courant*, January 12, 1988.

“Losses in Airline Demand and Value Following Accidents,” (with Martin Zimmerman) in Moses and Savage, eds., *Transportation Safety in an Age of Deregulation*, Oxford: Oxford University Press, 1989.

“Dissipating the Airline Deregulation Dividend: The Decline of Competition at Hub Airports,” *Regulation*, Fall 1990 (and reply letter in Winter 1991 issue).

“Prospects for Competitive European Air Travel,” in W.J. Adams, ed. *Singular Europe: Economy and Polity of the European Community After 1992*, Ann Arbor: University of Michigan Press, 1992.

“USAir in 1986,” (with Andrea Shepard), Stanford Graduate School of Business Strategic Management Case S-SM-4, January 1993.

“The Economics of Customer Lock-In and Market Power in the Service Business,” (with Jeffrey MacKie-Mason and Janet Netz) in Patrick T. Harker, ed. *The Service Productivity and Quality Challenge*, Kluwer Academic Press, 1994.

“Uncle Sam at the Gas Pump: Causes and Consequences of Regulating Gasoline Distribution,” (with Richard Gilbert), *Regulation*, Spring 1993.

“A Guide to the Blue Book,” (principal authors Carl Blumstein and James Bushnell), *Electricity Journal*, September 1994.

“Repeat-Buyer Programs in Network Industries,” in Werner Sichel ed., *Networks, Infrastructure, and The New Task for Regulation*, University of Michigan Press, 1996.

“Airline Deregulation” (with Nancy Rose), entry in *The New Palgrave Dictionary of Law and Economics*, New York: Grove’s Dictionaries, 1998.

“Rapid Communication and Price Fixing: The Airline Tariff Publishing Company Case,” in John E. Kwoka and Lawrence J. White, eds., *The Antitrust Revolution: The Role of Economics*, Oxford University Press, 3rd edition, 1998. (Revised version in 4th edition, 2004.)

“A Cheaper Way to Clean Gasoline” (with Steven Stoft) in *San Francisco Chronicle*, March 16, 1999.

Comments on Kole and Lehn’s “Workforce Integration and the Dissipation of Value in Mergers: The Case of USAir’s Acquisition of Piedmont Aviation,” in *Mergers and Productivity*, Steven Kaplan, ed., University of Chicago Press, 2000.

“California ‘Lessons’ Derive from Mischaracterization of Our Work,” (with James Bushnell) letter in *The Electricity Journal*, March 2000.

“Electricity Restructuring: Deregulation or Reregulation?,” (with James Bushnell), *Regulation*, **23**(2, 2000).

“Understanding Competitive Pricing and Market Power in Wholesale Electricity Markets,” *The Electricity Journal*, July 2000.

“California Consumers Haven’t Seen Benefits of Deregulating the Electrical Industry Yet – What Went Wrong?” (with James Bushnell), *San Jose Mercury News*, August 27, 2000.

“Electricity Pricing Should Clue Consumers to Judicious Use,” *Los Angeles Times*, January 17, 2001.

“Government Aid to Airlines is Just Excess Baggage for Taxpayers,” *Los Angeles Times*, August 27, 2002.

“Power Politics Hurts Consumers,” *Financial Times*, August 19, 2003.

“What’s Wrong with Regulating Gasoline Prices?,” *Sacramento Bee*, September 12, 2003.

“Solar Initiative Has a Dark Side”, *San Jose Mercury News*, August 20, 2004.

“Mere drops in the world’s oil barrel”, *San Jose Mercury News*, June 2, 2005.

“Time-Varying Retail Electricity Prices: Theory and Practice,” in Griffin and Puller, eds., *Electricity Deregulation: Choices and Challenges*, Chicago: University of Chicago Press, 2005.

”Will Solar PV Save You Money?“, *San Francisco Chronicle*, April 21, 2008.

“Cost, Conflict and Climate: Navigating the Global Oil Market,” *Milken Institute Review*, 4th Quarter 2008. (a more detailed version of the paper is available as “Cost, Conflict and Climate: U.S. Challenges in the World Oil Market,” Center for the Study of Energy Markets Working Paper #177, University of California Energy Institute, Revised June 2008.)

“Gas Surcharge Could Help Deficit, Environment,” *Sacramento Bee*, November 17, 2008.

“Markets for Anthropogenic Carbon Within the Larger Carbon Cycle,” in *The Design and Implementation of U.S. Carbon Policy*, Don Fullerton and Catherine Wolfram eds., National Bureau of Economic Research and University of Chicago Press, 2012.

“Making the Wrong Case for Renewable Energy,” *Bloomberg Business Class*, February 13, 2012.

“The U.S. Can’t Control the World Oil Markets,” *U.S. News & World Report, Debate Club*, March 2, 2012.

“Why the U.S. Airlines Need to Adapt to a Slow-Growth Future,” *Bloomberg Business Class*, June 4, 2012.

“Seeking a fix for Californias gasoline market problems,” *Los Angeles Times*, December 2, 2012.

“How Airline Markets Work...Or Do They?” (with Nancy Rose), in N. Rose ed., *Economic Regulation and Its Reform: What Have We Learned?*, University of Chicago Press, 2014.

Educational Software:

“The Competitive Strategy Game,” Version 3.50, August 2011. A computer simulation of competition among firms for use in undergraduate and graduate courses in economics and business. (Since Version 1.0 was released in 1994, the CSG has been used in undergraduate, MBA, and/or Ph.D. courses at 85 colleges and universities in 23 countries including U.C. Davis, U.C. Berkeley, U.C. Irvine, Stanford University, University of Michigan, Purdue University, M.I.T., University of Chicago, Yale University, and London Business School.) See <http://csg.haas.berkeley.edu>

“The OPEC Game,” (with Jim Bushnell). A simulation of the world oil market in which student teams, each taking the position of one country in OPEC, make strategic decisions about oil production. Since its creation in 2001, the OPEC game has been used in three different courses at Berkeley and at Yale, Stanford, Texas A&M, UNC-Greensboro, and a number of other universities.

“The Electricity Strategy Game,” (with Jim Bushnell). A simulation of a wholesale electricity market in which student teams decide how much to bid for portfolios of electricity generators and then how to bid that power into a wholesale market. The game can also be augmented to include a tradable permits market for greenhouse gas emissions.

Recent Working Papers:

“Regional and Income Distribution Effects of Alternative Retail Electricity Tariffs,” Energy Institute at Haas Working Paper #225, U.C. Berkeley, October 2011.

“Would Pricing Aviation GHGs Really Lower Efficiency or Profitability?: A Comment on Winchester et al, ‘The Impact of Climate Policy on U.S. Aviation’,” Energy Institute at Haas Working Paper #216, U.C. Berkeley, June 2011.

“An Index of Inter-City Business Travel for Use in Domestic Airline Competition Analysis”, U.C. Berkeley, June 2010.

“The Implications of a Gasoline Price Floor for the California Budget and Greenhouse Gas Emissions,” Center for the Study of Energy Markets Working Paper #182, University of California Energy Institute, revised December 2008.

“The Value (and Cost) of Time-Varying Electricity Production from Solar Photovoltaic Cells,” Center for the Study of Energy Markets Working Paper #176, University of California Energy Institute, January 2008.

“Electricity Rate Structures and the Economics of Solar PV: Could Mandatory Time-of-Use Rates Undermine Californias Solar Photovoltaic Subsidies?,” Center for the Study of Energy Markets Working Paper #172, University of California Energy Institute, September 2007.

Not-So-Recent Working Papers:

“U.S. Domestic Airline Pricing, 1995-2004,” Competition Policy Center Working Paper CPC05-

48, University of California, Berkeley, January 2005.

“Retail Policies and Competition in the Gasoline Industry,” (with James Bushnell) Center for the Study of Energy Markets Working Paper #144, University of California Energy Institute, May 2005.

“Market Power in California’s Gasoline Market,” (with James Bushnell and Matthew Lewis) Center for the Study of Energy Markets Working Paper #132, University of California Energy Institute, May 2004.

“Price Incentives for Fuel Switching: Did Price Differences Slow the Phase-Out of Leaded Gasoline?”, POWER Working Paper PWP-010, University of California Energy Institute, April 1993.

Recent Academic Presentations:

- 2003-04 National Bureau of Economic Research, UC Santa Barbara, Cal Tech, Wharton, International Industrial Organization Conference
- 2004-05 University of Michigan, UC Irvine, University of Florida, American Economics Association, UC Berkeley, UCEI Ninth Annual POWER Conference
- 2005-06 National Bureau of Economic Research, UC Berkeley, Berkeley-Stanford IOfest '05
- 2006-07 University of Michigan, University of Toronto, Northwestern University, UC Berkeley, UC Davis, Resources for the Future
- 2007-08 National Bureau of Economic Research, UC Berkeley, University of Michigan, UC Davis, UCEI Thirteenth Annual POWER Conference
- 2008-09 University of East Anglia, Stanford, NYU, USDOJ, IOfest '08, Rice, Texas A&M, Reed College, American Economics Association, Industrial Organization Society, Arizona State, University of Chicago, UCEI Fourteenth Annual POWER Conference, UC Santa Cruz, Yale, MIT
- 2009-10 National Bureau of Economic Research (3), Lawrence Berkeley National Lab, Columbia University
- 2010-11 International Monetary Fund (2), UCSD, UC Berkeley, Stanford, American Economics Association, UCEI Sixteenth Annual POWER Conference
- 2011-12 Federal Reserve of San Francisco, National Bureau of Economic Research, Harvard University, Duke University, UC Davis
- 2012-13 Carnegie-Mellon University, Case Western Reserve, U.S. Department of Justice, U.C. Berkeley, University of Alberta, Energy Institute at Haas Eighteenth Annual POWER Conference
- 2013-14 University of Chicago, University of Cape Town, NBER, U.C. Berkeley, Stanford

Recent Policy Presentations:

- 2003-04 Cornerstone conference on Market Manipulation, Haas Alumni Lunch, Oakland Rotary Club, Center for the Study of Electricity Markets, Foundation for American Communications, SF Public Utilities Commission, Northern California Power Agency, Pacific Gas & Electric Law Department, Haas Private Equity Conference, California Energy Commission, World Affairs Council, Power Association of Northern California, Electricity Consumers Research Council, American Society of Appraisers

- 2004-05 Rossmoor Democratic Club, Western Energy Institute, UC Berkeley Wellman Lunch, California Energy Commission, Haas Alumni Association of the South Bay, Discover Cal functions in LA and Irvine, Environmental Defense symposium, Power Systems Engineering Research Center, Public Utilities Research Center (Univ of Florida), National Association of Energy Service Companies, CleanTech Energy Investors
- 2005-06 Silicon Valley Leadership Group, Energy Producers and Users Group, Haas Katrina teach-in, LA County Bar Association, Association of Bay Area Governments, California Manufacturing and Technology Association, Delta Phi Epsilon fraternity, California Republican Assembly Caucus, League of Women Voters, Haas Alumni Association of San Francisco
- 2006-07 Sacramento Economics Roundtable, Lawrence Berkeley National Lab Physics Department, Berkeley Breakfast Club, Berkeley Rotary Club, CSEM electricity policy conference, UCLA Anderson forecasting conference, UC Berkeley Homecoming, Communications Institute National Energy Symposium, UC Office of the President's Agriculture Advisory Committee, UC Berkeley Foundation Trustee's meeting, American Institute of Chemical Engineer's annual meetings, UC Santa Barbara Emerging Energy Technologies conference, ACG/Haas private equity conference, California Institute for Energy and the Environment, UC Berkeley Energy Symposium, Commonwealth Club, MSRI climate change symposium
- 2007-08 Hanson-Briggett energy forum, California Public Utilities Commission, American Society of Heating, Refrigerating and Air-Conditioning Engineers, California Energy Commission, Councils of the California Public Utilities Commission, Haas Orange County Alumni Association, CSEM electricity policy conference, Claremont McKenna College, Haas teach-in on economic downturn, Western Bar Association, BERC Energy Symposium, Golden Gate Society of Petroleum Engineers, BERC Symposium on Public Investment, Richmond Rotary, Power Association of Northern California, Haas Alumni Reunion, Haas EWMBBA end-of-year family day
- 2008-09 Haas Alumni Network–New York, Haas Alumni Network–Washington DC, Haas Alumni Network–Tokyo, Discover Cal–Redwood City, Discover Cal–Los Angeles, Calif. Manufacturers & Technology Association, UC Energy Institute, CalStart conference, Fueling California group, Berkeley Rotary Club, PG&E officers' retreat, Tesoro managers' dinner
- 2009-10 Jewish Community Center of the East Bay, Leadership California, UC Osher Lifelong Learning, Energy Institute at Haas Policy Conference, Haas Alumni Association of the South Bay, Multi-scale Systems Center, California Energy Efficiency Industry Council, California Clean Energy Fund, BERC Cleantech Symposium, Intel Power conference, Haas Alumni Reunion, Haas Alumni Network–Los Angeles
- 2010-11 Goldman Sachs, ACEEE, PG&E, California Energy Commission, California Public Utilities Commission
- 2011-12 Commonwealth Club, Power Association of Northern California, National Association of Regulatory Utilities Commissioners, California Foundation for Environment and the Economy, Berkeley Energy and Resources Collaborative, Contra Costa Council of Industries, Fueling California Policy Conference on Low Carbon Fuel Standard
- 2012-13 Haas Homecoming, EPRI, UC Berkeley Travers Conference, Haas alumni reunion, Haas CRB ARCS conference, Resources for the Future
- 2013-14 Band of Angels investors meeting, California Public Utilities Commission (2), MIT Center for Energy and Environmental Policy Research, U.C. Berkeley Alumni, U.C. Berkeley Emeritus Faculty Association

Selected Professional Activities:

Testified before U.S. House of Representatives, Subcommittee on Aviation on proposals for market allocation of airport landing and takeoff slots at ‘slot-constrained’ airports (9/85).

Member of National Academy of Sciences panel examining the impacts of regulatory reform (10/88).

Co-organizer and participant in Department of Transportation seminar on airline policy, including D.O.T. Secretary Skinner and Assistant Secretary Shane, (2/91).

Participant in Department of Transportation briefing on airline policy for D.O.T. Secretary Card and Assistant Secretary Shane, (8/92).

Co-organizer and Chair of National Bureau of Economic Research conference on “Cooperation, Coordination, and Collusion Among Firms,” (5/93).

Testified before California joint legislative committee on electricity rates and the restructuring of the California electricity industry (10/94).

Organizer of the winter meeting of the National Bureau of Economic Research Program in Industrial Organization (2/95).

Testified before the California Little Hoover Commission on regulation of the California electricity industry (3/96).

Co-organizer (with Ben Hermalin) of IOfest ’96 — the first joint Berkeley-Stanford conference in industrial organization (4/96).

Testified before the Minnesota state legislature on airfares at Minneapolis/St. Paul Airport (6/96).

Testified before the California state legislature on market power in the California gasoline markets and the implementation of state-mandated reformulated gasoline (10/96).

Co-organizer (with Ben Hermalin) of IOfest ’97 — the third annual joint Berkeley-Stanford conference in industrial organization (10/97).

Testified before a committee of the Transportation Research Board on competition in the U.S. Airline Industry (1/99)

Testified before the California state legislature on oversight and market power in the California electricity markets (3/99).

Testified before the California state legislature on California gasoline prices and markets (4/99 and 6/99).

Organizer of IOfest ’99 — the fifth annual joint Berkeley-Stanford conference in industrial organization (10/99).

Testified before the California state legislature on legislative proposals to mitigate gasoline price spikes (3/00 and 4/00).

Testified before the California state legislature on proposals to lower electricity prices and increase supplies (8/00).

Testified before the California state legislature on California electricity crisis (2/01).

Testified before the California state legislature on market manipulation in the California electricity market (5/01).

Testified before the U.S. Senate Committee on Governmental Affairs on the California electricity crisis (6/01).

Organizer of IOfest ’01 — the seventh annual joint Berkeley-Stanford conference in industrial

organization (10/01).

Testified before the California state legislature on implementing real-time electricity pricing (6/02).

Organizer of IOfest '03 — the ninth annual joint Berkeley-Stanford conference in industrial organization (10/03).

Testified before the California state legislature on California gasoline prices (12/03).

Co-organizer (with Alan Sorensen) of the winter meeting of the National Bureau of Economic Research program in Industrial Organization (2/04).

Co-organizer (with Catherine Wolfram) of IOfest '05 — the eleventh annual joint Berkeley-Stanford conference in industrial organization (10/05).

Testified before the U.S. Senate Judiciary Committee on competition in the oil refining sector (3/06).

Organizer of inaugural CSEM oil/gasoline conference (12/06).

Organizer of IOfest '07 — the 13th annual joint Berkeley-Stanford conference in industrial organization (10/07).

Testified before California Assembly on Fuel Prices (10/08).

Testified before California Committee on the Twenty-First Century Economy about raising revenues through taxes on externalities (3/09).

Co-organizer (with Dennis Carlton) of NBER Universities Research Conference on “Competition and Government Intervention in the Airline Industry” (5/09).

Organizer of IOfest '11 — the 17th annual joint Berkeley-Stanford conference in industrial organization (10/11).

Testified before California Assembly and CPUC on research and privacy issues related to energy consumption data (9/13).

Co-organizer (with Ben Handel) of IOfest '13 — the 19th annual joint Berkeley-Stanford conference in industrial organization (11/13).

Co-organizer (with Ben Handel) of NBER winter meeting of Industrial Organization program (1/14).

Organizer or co-organizer of annual Energy Institute POWER research conference on energy markets and regulation (1996-2014).

Executive Education Teaching:

“Fundamentals of Electricity Markets,” 2-day course taught with James Bushnell (1/03, 1/04, 9/04, 1/05, 1/06, 1/07, 1/08, 3/09)

“Advanced Topics in Electricity Markets,” 1-day course taught with James Bushnell (3/07)

“Economic Fundamentals of Energy and the Environment,” 2-day course taught with James Bushnell (4/07, 3/08, 3/09, 6/10, 7/12, 3/13, 9/13)

Dissertations Advised (since 1995):

Chair or Co-Chair

Victor Stango, Department of Economics, 1995, chair
Christopher Knittel, Department of Economics, 1999, co-chair
Eric Emch, Department of Economics, 2000, co-chair
Bennet Zelner, Haas School of Business, 2000, co-chair
Justine Hastings, Department of Economics, 2001, co-chair
Steven L. Puller, Department of Economics, 2001, chair
Erin T. Mansur, Department of Economics, 2002, chair
Matthew Lewis, Department of Economics, 2004, chair
Celeste Saravis, Department of Economics, 2004, chair
Meredith Fowlie, Department of Agricultural & Resource Economics, 2006, co-chair
Amol Phadke, Energy & Resources Group, 2006, chair
Jennifer Shanefelter, Department of Economics, 2007, chair
Andrea Martens, Haas School of Business, 2008, chair
Ryan Kellogg, Department of Agricultural & Resource Economics, 2008, co-chair
Koichiro Ito, Department of Agricultural & Resource Economics, 2011, co-chair
Catherine Hausman, Department of Agricultural & Resource Economics, 2013, co-chair
Naim Darghouth, Energy & Resources Group, 2013, chair

Member

Matthew W. White, Department of Economics, 1995
Daniel Rascher, Department of Economics, 1997
Wedad Elmaghraby, Department of Industrial Engineering & Operations Research, 1998
Haru Connolly, Department of Economics, 1998
Kyle Mayer, Haas School of Business, 1999
Guy Holburn, Haas School of Business, 2001
Nathan Hultman, Energy & Resources Group, 2002
Pinar Karaca-Mandic, Department of Economics, 2004
Karen Herter, Energy & Resources Group, 2006
Greg Nemet, Energy & Resources Group, 2007
Matthias Fripp, Energy & Resources Group, 2008
Rob Letzler, Graduate School of Public Policy, 2008
Howard Chong, Department of Agricultural & Resource Economics, 2011
Kate Foreman, Department of Agricultural & Resource Economics, 2013