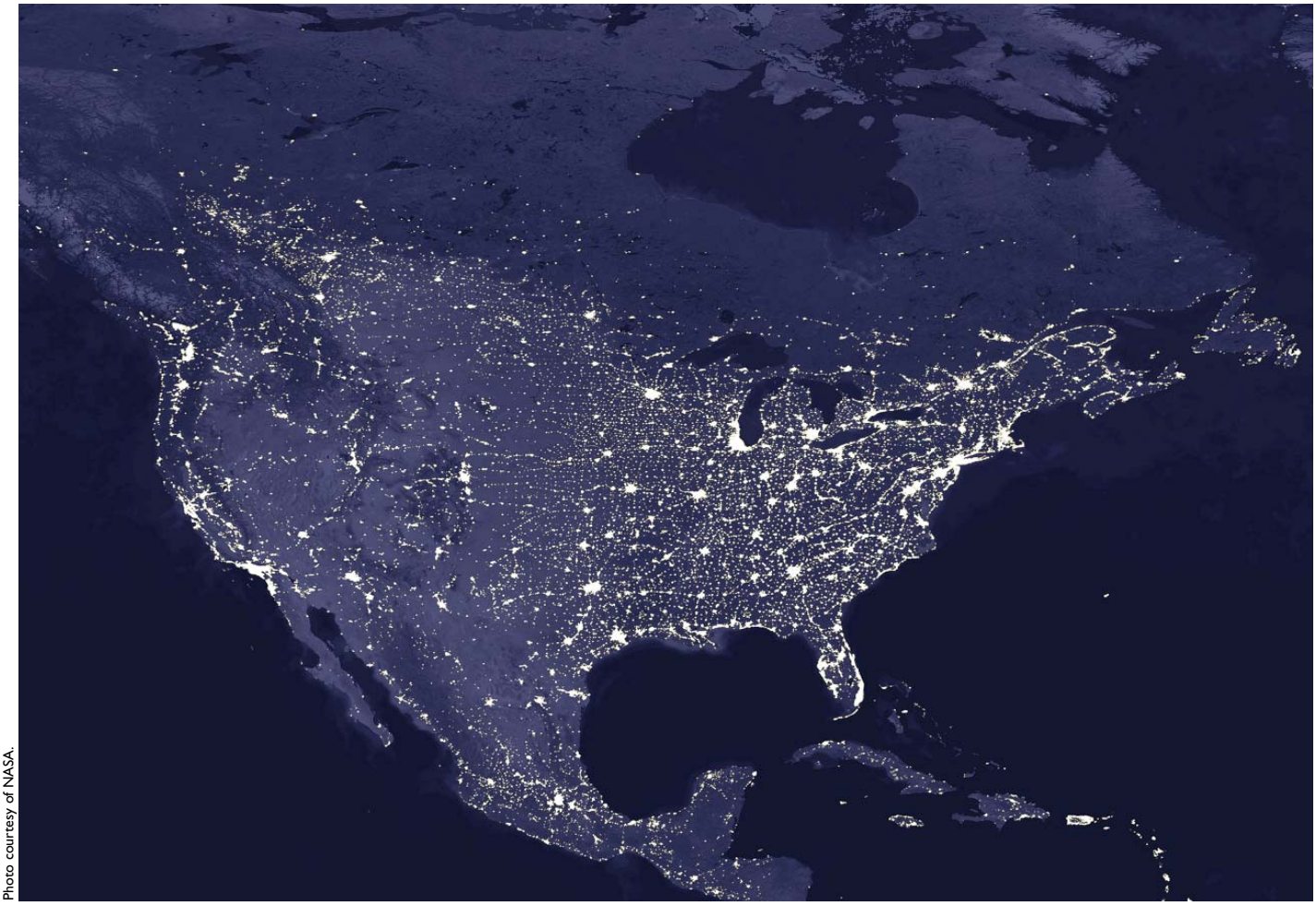


Photo courtesy of NASA.

North America by night.

U.S.–MEX: ENERGY

Energy Shock

by Daniel Kammen

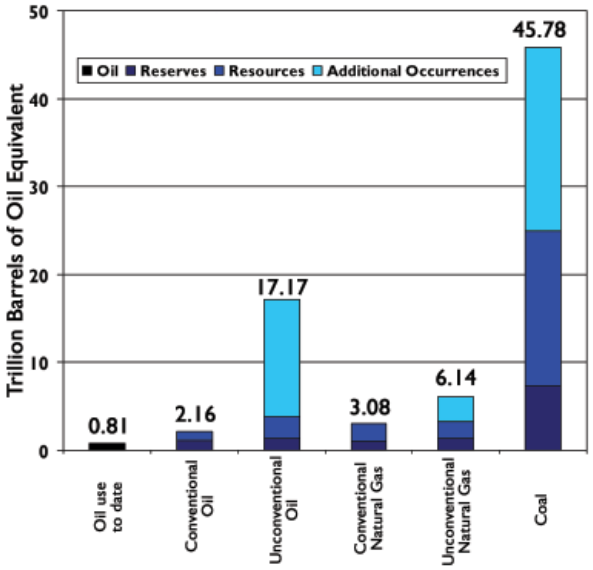
The current increase in energy costs is the second large-scale upheaval we have seen in the energy sector. The first "shock" was the OPEC oil crisis of the 1970s and early 1980s. In retrospect, it is clear that the OPEC crisis was driven by economic and political factors rather than an absolute scarcity of resources. In many ways, this distinction is akin to Nobel Laureate Amartya Sen's classification of famines which differentiates between those caused by a shortage of absolute food resources and those prompted by a lack of "food availability," with the latter a matter of politics and logistics, not total global resources.

In contrast to the crisis of three decades ago, the run-up we're seeing now — while it certainly has political elements — is driven by a much broader set of factors. To begin with, competition for energy resources has intensified. Supplies, at least of conventional oil, are also dwindling, but the supply of unconventional fuels, such as heavy oil, tar sands, shale oil and fuels made from coal is truly vast.

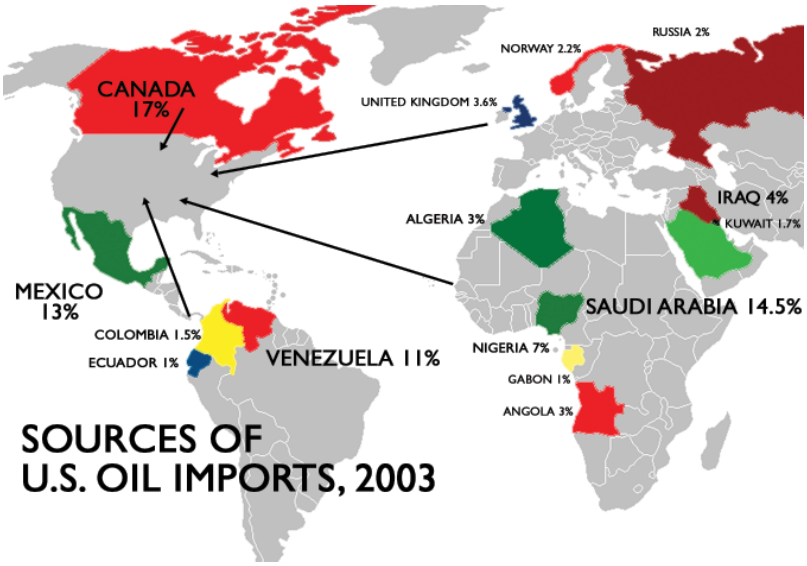
In fact, with these resources taken into account, the world has not used roughly half of the available oil as the "Peak Oil" story suggests, but less than one-fortieth of the total. The problem is we are running out of atmosphere far faster than we are running out of dirty fossil fuels to burn. And so, in Tom Friedman's words, "this is not your grandfather's energy crisis. No, this is something so much bigger…" The overriding consensus is that oil prices will not drop back to the $20, $30 or even the $40 or $50 per barrel range. We're much more likely to see $150 per barrel than we are ever to see $50 per barrel again. This fundamentally changes the debate about our energy future.

In fact, the debate is broader than just where the oil prices are going to go and who is going to make a lot of money on the deal. The standard night-picture of the Northern Hemisphere (above) clearly represents Mexico and the United States but also includes Canada, the single largest source of U.S. oil and the producer of over one

>>



Total conventional and unconventional fossil fuel resources.
Table courtesy of Daniel Kammen.



Map from Wikimedia Commons; Data: EIA.

million barrels of tar-sands derived oil per day. There is more oil in Canada than in all of Saudi Arabia and, per gallon, it is even more damaging to the environment than gasoline. The reason, therefore, to include all three nations in a close, petro-political debate is that energy security in the Americas involves Canada as critically as it involves Mexico and the United States.

Given the fact that the United States now consumes a quarter of the world's oil — and those numbers are expected to rise — it's clear that we have a complicated situation. Unfortunately, we have a situation now where the limiting factor is not the price of oil but the environmental impacts of the carbon economy, which are going in an exceedingly problematic direction.

Despite the lack of aggressive policies from many countries to make their economies more energy efficient and less-carbon-emitting, those of us who are concerned about global warming had been able to take some consolation from the fact that we've had about a hundred-year run where the amount of carbon admitted to the atmosphere by the global economy had been decreasing. On the graph below, this trend is indicated by the slowly decreasing line called the decarbonization curve. We were getting more efficient; it was getting less-carbon-intensive to make a dollar or a peso of GNP.

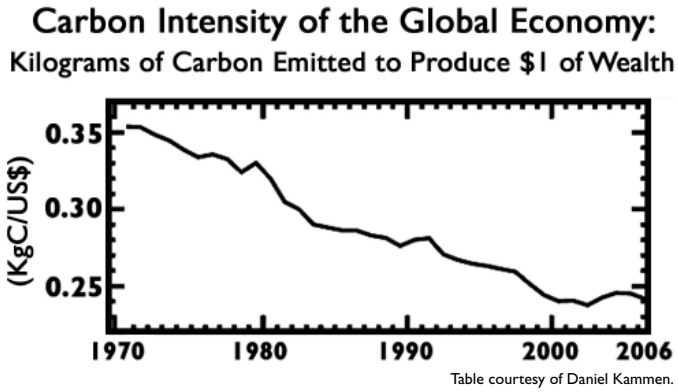


Table courtesy of Daniel Kammen.

Unfortunately, over the last decade, that trend has stopped. And there's nothing more frightening for people who think about energy and climate change than to see that — in spite of all of the good press that California, much of Europe, Japan and now Australia are getting for enacting very impressive climate and energy policies — the trend is going in the other direction. This is a global graph. This is not picking out one's favorite region. The graph clearly shows that the global trend is no longer toward decarbonization. That trend has stopped. And it's not just because of policies in the United States. It's also due to the dramatic run-up in India and China. But together these factors are working in exactly the opposite way of how the science shows we need to go.

And, outside of a few buildings in Washington, D.C., the climate science debate is over. We have politicians, including our governor, Arnold Schwarzenegger, saying, "The science is in; it's time to move on." What we don't know is how rapidly climate change is going to happen. We don't know how dramatic its effects will be. We may never know whether Hurricane Katrina was 10 percent, 0 percent or 100 percent due to global warming, but we know events like that are going to become more frequent. Western forest fires, the forest fires in Greece — all of these events, whether they began by arson of not, are going to be more common in the future. So the economic cost of this fossil-fuel-intensive economy will rise.

And unfortunately, the features that we're seeing on the overall energy budget side are also frightening. Since the 1970s, when scientists began really charting these numbers, we have seen an increase of greenhouse gasses in the atmosphere of about 1 part per million per year. That number had increased somewhat during the intervening decades, but

in the last six or seven years it has nearly doubled. A large fraction of this increase is due to overall economic growth, but the natural system that sucks up those greenhouse gasses is also deteriorating. Changing wind patterns in Antarctica, changing forest patterns: there is globally significant evidence that our natural world's ability to absorb our fossil fuel signature is being degraded.

The baseline story is very problematic. And even though it is easy to get caught up in the short-term and critically important events around security and 9/11, I don't have any qualms in predicting that by 2050, 9/11 will be a minor footnote in history compared to what we did or didn't do about creating a low-carbon economy. As an aside, but a vitally important one, this is one of the reasons why the 2008 U.S. presidential election, which will almost certainly reshape U.S. energy policy, is of such global importance.

The problem is not just the dramatic run-up in the amount of natural gas we're using or the run-up in the amount of oil we're using. The problem is that, without strong policy, what high energy prices may do is enrich a few individuals and companies who have made a good play in the wind or the solar or the carbon sequestration industries without fundamentally changing the economy. These efforts won't change the basic problems we're talking about here, whether oil is $99 a barrel or $105 or $80. That's minor compared to the economic costs, the immigration costs, the social costs of the environmental problems that we're setting up for ourselves.

The North American example I've chosen is not in Mexico or the U.S. but in Alberta, Canada. There is more oil in the ground in Alberta than there is in Saudi Arabia, but it's in solid form. Basically 10 percent of the soil is oil by weight. And it is so full of pollutants that huge pyramids of sulfur are piling up at the site where they separate out the usable oil in order to send it to the United States. Alberta is now sending one million barrels of oil to the United States per day. And that wouldn't have happened when oil was $40 or even $50 a barrel because it takes $30 a barrel to separate out this dirt. If we ever get through burning up the oil in Alberta, there's a harder to get at but equally large supply in Venezuela. So

>>

Mining tar sands in Canada.

Photo by Roy Luck.

essentially we've just discovered two additional Saudi Arabias out there. And the reason this is a worry is that high oil prices make these sorts of technologies and these sorts of supplies much more accessible, and oil from tar sands is much easier to incorporate into the economy than large amounts of wind or solar power, no matter how attractive those resources are.

Policy is going to be the place where we win or lose the global warming battle. It's not going to be won by waiting for a wonderful scientist or engineer to come up with cold fusion or the magic battery or the miracle wind turbine. It's going to be a policy battle, first and foremost. And that's a sobering thought because, in this area, policy in the United States moves slowly and has historically moved slowly.

Global climate agreements pose a difficult challenge for the incoming U.S. president. The United States did not participate in the Kyoto Protocol, and the next stage of that agreement has already begun. The December 2007 meeting in Bali generated what is called the "Bali Roadmap," which is supposed to produce a treaty to be signed in Copenhagen in November and December of 2009. That gives the next administration literally eight months to: 1) come up with a workable way to reengage the United States; 2) sort it out with a host of less-than-useful actors who are in important U.S. government positions; and 3) convince the European, Mexican, Canadian and Asian governments that we're serious about this process. This is a very complicated thing to do: those who have served in administrations know how long it can take just to move out the previous set of people and get the new ones in, even in easy times.

The Copenhagen Protocol puts a much more complicated spin on things. While all of the U.S. presidential candidates are pretty good on this issue — you might want to talk about relative goodness, but in terms of energy policy per se, Obama, Clinton and McCain are all pretty reasonable — but this problem of getting the U.S. into a position where we're serious is going to be an incredible challenge.

One significant tool that policymakers have at their disposal to reach the goals set forth in the Bali Roadmap is energy efficiency, which has been proven to work in Mexico, the United States and around the world. There are some parts of the United States and Europe where per capita energy use has remained constant since the 1970s. Despite the global run-up in energy use, we've seen an actual flat line in terms of new energy needed per person. And that's come through better light bulbs, better meters, better pricing policies — a whole variety of things. In Australia, for example, there is a new campaign to outlaw the incandescent light bulb. There have been a whole variety of similarly dramatic changes.

Furthermore, better energy performance and better service are actually working together. The Moscone Center in San Francisco is a case in point. One side uses new, efficient

light bulbs and timers; the other uses the old light bulbs and timers. The quality of purpose on the left side is better and saves the city $400,000 a year. There are lots of examples like this. So the old debate that "it's going to cost you more" is false.

In 2006, Governor Schwarzenegger, "the Jolly Green Giant," passed Assembly Bill 32, the most significant greenhouse gas law in the United States, that calls for California to essentially admit that we should've gotten serious about the Kyoto Protocol and to make up for it. Assembly Bill 32, the Pavley-Nuñez Bill, calls for California to reduce its emissions back to 1990 levels by 2020. So we have 12 years to cut our greenhouse gas emissions by roughly 25 percent. That's going to be a huge effort. And the big part of the story is that this 25 percent cut is not the endpoint.

The governor also trumped all the environmentalists and all the Democrats by announcing in 2005 that the state was committed to an 80 percent reduction by 2050. That would be in Schwarzenegger's 13th or 14th term. Although unfunded, it is dramatic and very clever politically, and it is the right environmental statement. That 80 percent cut in emissions by 2050 is exactly what the Intergovernmental Panel on Climate Change (IPCC) calls for — 80 percent or more. So Californians have said they're going to do it. The

Photo by Aaron Cole.

The Moscone Center, San Francisco.

problem is that California, for all the great proclamations, is still increasing its greenhouse gas emissions. So we have not turned the corner; the action is not there yet.

We're also seeing versions of what's happening in California in the upper-Midwest, the Pacific Northwest, New England and the Mid-Atlantic states. They involve different approaches to how we will cap and trade, tax carbon and price electricity in more dynamic ways. What are the various things we will do to reduce carbon emissions? That's the hard part.

But the picture in the United States has changed dramatically. We now have 30 U.S. states, including Texas, that have passed obligations to buy renewable energy. Some of them are not so dramatic. Policymakers in Maine, for example, haven't figured out that natural gas is not a renewable source, so they count it. But other states such as Nevada, Arizona, California and New Jersey are emphasizing very aggressive solar programs. Wind power is also being pursued aggressively: Texas now boasts about its wind production capability and is twice as wind-installed as California. It's a remarkable thing. This policy tool, this obligation to use renewable energy, started under Governor Bush and his chair of the energy commission, Pat Wood, and it has been a huge success in terms of setting up a series of aggressive targets.

California's targets help set an agenda for low-carbon electricity generation in a number of western states by redefining the market for clean power. Some of the coal-fired power plants that were being installed as far away as Montana to sell to California are already being turned off because after 2011 the California market will no longer buy coal-fired power.

There's a nice framework out there, although the details are unclear. And part of the story, which is interesting for immigration and labor, is that one of the few things that politicians all across the spectrum agree on is that the dividend for going green is real. You get more jobs when you invest in energy efficiency and renewables, when you use natural gas but also sequester the carbon. These policy changes are truly generating a green energy economy. And this recognition that you can help rebuild economies, that you can build a green-collar labor force, is an important part of the equation.

I've left all the technical details out of this presentation, but they are vital, and I do spend a great deal of time on them. For specifics on my laboratory's efforts in solar and wind power and in energy futures forecasting, see our website: http://rael.berkeley.edu. My favorite technologies using solar, wind and tidal energy are evolving rapidly, and each clearly highlights this changing landscape of innovation and market potential. But what I want to end with is this problem that policy is going to be required if the worst effects of climate change are to be averted. Hoping for new technologies will not solve the problem because the advantages that come to new fossil fuel technologies at higher energy prices will overwhelm moves to green the economy unless the policy agenda changes dramatically.

Professor Daniel Kammen is the Class of 1935 Distinguished Professor of Energy and has appointments in the Energy and Resources Group, the Goldman School of Public Policy and the Department of Nuclear Engineering at UC Berkeley. He is also the founding Director of the Renewable and Appropriate Energy Laboratory and a member of the Intergovernmental Panel on Climate Change that shared the 2007 Nobel Peace Prize.

This article was adapted from a transcript of Professor Kammen's presentation at the 2008 U.S.–Mexico Futures Forum.