

The Alternative Energy Future: Challenges for Technological Change

Robert W. Fri & Stephen Ansolabehere

Modern life needs energy, and lots of it. During the economic boom following World War II, securing adequate supplies of energy was not a big problem for the United States because we were able to meet our needs with domestic energy sources. But in the early 1970s, two events upset this comfortable situation. Introduced in 1970, the Clean Air Act clamped down on the uncontrolled burning of fossil fuels that had characterized domestic economic development for at least a century. And in 1971, the first oil embargo demonstrated the supply risk inherent in an oil market no longer under U.S. control. Suddenly, the United States had an energy problem.

In the ensuing forty years, eight American presidents proposed policies to solve this problem. Although philosophically different – for instance, President Reagan liked markets to work on their own, but President Carter preferred intervening in them – all had the same immutable goal: to guarantee a reliable, affordable, and clean supply of energy. But despite this common aspiration, the energy policies of all eight presidents shared another crucial attribute: they all failed to make much progress toward meeting their goal.

Today, national energy policy remains in disarray. The proximate cause of the current situation is our failure to adopt a sensible policy to mitigate climate change. Only a few years ago, it seemed that the Copenhagen Climate Change Conference would produce a global agreement on mitigation policy,

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*(*See endnotes for complete contributor biographies.)*

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and that in response, the U.S. Congress would pass a strong climate policy. Both Copenhagen and Congress had unraveled by 2010, and we have seen little in the way of national energy policy since.

Against this background, it seems appropriate to ask why creating energy policy is so hard. To provide some insight into this question, the present volume offers views of authors who have recently studied key aspects of energy policy, past and present. Our intention is to examine the lessons learned from decades of disappointment to suggest some directions for the development of a national energy policy that might, in fact, produce a reliable, affordable, and clean energy supply.

The volume's two opening essays frame the central problem of failed energy policy. Michael Greenstone and Adam Looney draw on recent research showing that our energy is woefully mispriced. This research itself is not a new insight, but it is an important up-to-date confirmation of the surprisingly large distortions in energy prices. For example, Greenstone and Looney conclude that coal prices are about half of what they should be to reflect the environmental and human health impacts of mining and burning a fossil fuel that supplies 48 percent of the nation's electricity. Further, if the possible cost of climate change were reflected in coal prices, the price distortion would grow by another third. The distortions are not limited to coal; they pervade the energy system.

Michael Graetz provides a counterpoint to Greenstone and Looney's essay by summarizing the history of energy policy since before the first oil embargo. He documents a record of misdirected policy initiatives that often are more successful in producing subsidies for politically favored industries than in solving energy problems. He notes that the law of

unintended consequences is alive and well in energy policy; in this regard, his review of the financial windfall to the paper industry from a regulation designed to increase the use of biofuels is painfully instructive. However, he maintains that the fundamental reason for repeated failures of energy policy is that no president or Congress has ever had the stomach to insist that consumers pay the full price of the energy they use. In fact, the few attempts to correct just the kind of distortions that Greenstone and Looney identify have been beaten back by powerful political forces. For Graetz, the main problem of energy policy is that we refuse to pay a price that reflects the actual and well-known cost of using energy.

So why is it hard to craft a serious energy policy? It's not that we don't understand how to correct for the price distortions in energy. Joseph Aldy and Robert Stavins argue that the only cost-effective and technically feasible solution to this problem is to bring prices into line with the full cost of energy and, importantly, to know how to do so. They examine three policy tools for this purpose – a carbon tax, a cap-and-trade system, and a clean energy standard. All would have a positive effect if correctly designed, although a clean energy standard is less efficient than the other two policies because it does not explicitly price the environmental externality whose cost is not otherwise reflected in the market price. Perhaps this lack of transparency can provide cover for a president and Congress that is willing to go at least some distance toward solving the price problem in a reasonably efficient way.

But price is not the only consideration. Stephen Ansolabehere and David Konisky present new research on how the public views the need for change in the energy system. Three conclusions stand out. First, the connection in the public mind

between climate change and the need to transform the energy system is very weak. Second, while people respond to energy prices in a predictable way, they have an overly optimistic opinion of the cost of renewable energy. Third, the major driver of change in the energy system is local pollution. Perhaps these findings suggest that as prices clarify, people will choose the changes needed to deal with climate change; but that for now at least, a focus on the local benefits of cleaner energy is the most effective way to frame the issue. Interestingly, Aldy and Stavins make a similar observation.

Yet there are dangers in being too shortsighted. Daniel Schrag analyzes the role of natural gas in reducing greenhouse gas emissions while we wait for the kind of decisive action needed to tackle coal and oil. Natural gas is attractive because it is cleaner than coal or oil and so produces fewer local pollution problems. And thanks to new technology for accessing unconventional natural gas reserves – think shale gas – there may be enough natural gas available to meet many of our energy demands, improve local air quality, and slow the rate of greenhouse gas production.

Although natural gas seems to have much in its favor, Schrag argues that relying on it is not a good solution to the longer-term problem of climate change. He notes that according to climate science, it is cumulative greenhouse gas emissions over one hundred years or so that change the climate, not the rate at which that cumulative load is emitted. Thus, there is a real possibility that the use of natural gas would delay action to reduce coal and oil use, making it harder to do the job in the long run. Worse, cheap gas could depress prices in a way that discourages the development of the new technology needed to deal with climate change. However, Schrag suggests one optimistic point: if

natural gas becomes the fuel of choice, the diminishing power of the incumbent fuels could change the politics of energy.

Regardless of how the price and politics of energy play out, it will be essential to create technology that can grasp the holy grail of affordable, reliable, and clean energy. Developing such technology has long been a mainstay of federal energy policy, and although government has had some success in this area, its record is hardly exemplary. Thus, the companion issue to pricing is innovation. How can government help the private sector develop innovative technology that actually makes it to market, assuming that energy prices are something like right?

Ernest Moniz takes on the innovation issue, building on a recent report of the President's Council of Advisors on Science and Technology (PCAST). He makes the crucial point that innovation involves more than inventing new technology; it also requires that the technology diffuse throughout the economy at sufficient scale to make a difference. Too often, government attempts at innovation have ignored this final but necessary step. Indeed, all ineffective energy policies of the last forty years have fallen into just this trap. Their history is replete with expensive government research programs that produced technology that neither consumers nor industry wanted to buy. Fortunately, we now have a more sophisticated understanding of the innovation process. Moniz, who co-led the PCAST report, summarizes the key lessons, surveys the current (and much improved) state of play, and makes a number of useful recommendations for further progress.

Kassia Yanosek examines the problem of financing the introduction of new energy technologies – one of the key stumbling blocks to innovation and an issue recently in the news. The scale of innovation required to change the energy

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system is very large, and capital formation is often a challenge. Yanosek identifies a crucial gap in the existing system of capital formation, which she labels the *commercialization gap*. Traditional venture capitalists are willing to invest in high-risk, high-reward innovations, but they are not equipped to finance the large investments needed to deploy the innovation at scale. That, of course, is what large companies in the private sector do, but they are often unwilling to bet large sums on innovations that are not yet proven commercial successes. This is the gap that recent government ventures such as Solyndra have tried to close. Yanosek offers recommendations for doing it right.

Finally, Mohamed El-Ashry lends weight to the need to tackle the innovation system at home by documenting the surprisingly robust initiatives in other countries that are building a world market for new energy technology. He reports that ninety-six countries have renewable power generation policies, and thirty-one have mandates for blending biofuels. El-Ashry focuses on renewable energy, but international activity is accelerating around other energy sources as well. For example, almost half of the sixty-odd nuclear power plants now under construction are in China and India. Of course, all this represents a substantial market in which the United States would like to compete. Perhaps most disturbing, however, is not that we aren't competing successfully now, but that we aren't on a learning curve that would help us compete in the future.

What do we make of energy policy today, given the hard-earned insights of experience? In our view, two main themes emerge from this collection of essays. One is that getting prices right is essential to good energy policy, but that a straightforward solution to this problem – raising energy prices – remains politically infeasible,

as it has for forty years. Nevertheless, there may be room for second-best solutions that would at least make a positive contribution to building an affordable, reliable, and clean energy system. For example, well-designed performance standards may be reasonably efficient substitutes for price increases. Focusing public attention on existing environmental insults rather than more global concerns like climate change could also be a useful strategy for taking early action to clean up the energy system. Of course, danger often lurks in second-best solutions, and care must be taken to avoid doing more harm than good. Even so, there is room to do something.

The second theme deals with the need to create the technology to build a new energy system. The nature of the task is well understood, thanks to recent reports by the National Research Council, among others; but it is clear that creating new technology is only the penultimate step in successful innovation. The final step is deployment at a scale that makes a difference. And that means learning to overcome conditions that deflect individual and institutional decisions from presumably rational economic behavior. Physical science and engineering, essential to developing technology, are not the principal tools for addressing these problems. As underscored by a recent report from the American Academy,¹ they are more the province of the social sciences, and greater attention should be given to incorporating social science research into energy-policy development. We will return to that topic in the Winter 2013 issue of this journal.

ENDNOTES

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¹ *Beyond Technology: Strengthening Energy Policy through Social Science* (Cambridge, Mass.: American Academy of Arts and Sciences, 2011).

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