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Acting in Time on Energy Policy

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This book clarifies the urgent priorities for U.S. energy policy at the dawn of the Obama administration and recommends specific steps that the U.S. government should take to address the numerous energy-related challenges facing the United States. Government must play a prominent role to ensure that adequate supplies of various forms of energy are available to enable and sustain U.S. economic growth, boost the competitiveness of U.S. firms in the global energy marketplace, counter the extreme volatility in oil prices of the past few years, limit the political and economic vulnerabilities associated with dependence on oil and natural gas, adequately and cost-effectively address the global climate change threat, and develop, acquire, and deploy advanced, clean, and efficient energy technologies to meet all of the above challenges.

The book's title—*Acting in Time*—refers to the persistent problem in U.S. energy policy that typically just enough is done to satisfy the short-term political imperatives, but not enough is done to actually solve the underlying problems themselves. As a result, many of the fundamental economic, environmental, and security-related challenges arising from patterns of U.S. energy production and consumption have become more intractable. Some now approach a point of crisis.

The United States is hugely influential in global energy markets, and in turn, international energy resources, supplies, and prices are central to the economic and environmental health of the United States. As the world's biggest economy, the United States is the largest national energy consumer,

largest electricity producer, largest oil consumer, largest oil importer (twice as large as the second-largest oil importer, Japan), largest refiner of crude oil (in terms of crude distillation capacity), largest natural gas importer, largest producer and consumer of nuclear power (it has almost twice as much installed capacity as France), and the largest emitter of carbon dioxide (the dominant greenhouse gas [GHG]) on a per capita basis within the Organization for Economic Cooperation and Development, together with Australia.[1] The United States is the second-largest coal consumer, second-largest GHG emitter in aggregate terms, and fourth-largest producer of hydroelectric energy.[2] As for renewable energy, the United States is the largest ethanol producer and ranks third in terms of new renewable energy capacity investment and overall capacity.[3] Notably, U.S. wind installations in 2007 were not only the largest on record in the United States but were more than twice the previous U.S. record, set in 2006. Despite the widespread perception that the United States has fallen behind Europe in renewable energy development and deployment, no country in any single year has added the volume of wind capacity that was added to the U.S. electrical grid in 2007.[4]

Internationally, 61 percent of the world's proven oil reserves are located in the Middle East.[5] The global proven oil reserves controlled by nationally owned oil companies are estimated to range from 80 to 90 percent.[6] Most currently economically recoverable natural gas reserves are located outside the United States, with 67 percent located in the Middle East and Russia.[7] Rapidly growing industrializing countries are demanding increasingly more energy services. Between 2006 and 2008, for example, Asian oil demand grew on average 1.5 million barrels a day each year.[8] Primary energy demand in India and China is projected by the International Energy Agency (IEA) to

1. International Energy Agency (IEA, 2008).

2. Qatar, Kuwait, Bahrain, Australia (just slightly), Trinidad and Tobago, and the United Arab Emirates all have higher CO_2 emissions per capita (measured in tons CO_2 per capita) than the United States. U.S. per capita CO_2 emissions were 19 tons CO_2 per person in 2006 compared with a world average of 4.28 tons CO_2 per person. In terms of total national emissions, China is believed to have surpassed the United States in 2007, though its per capita emissions are 4.5 times smaller than U.S. per capita emissions (IEA 2008; British Petroleum [BP] 2008).

3. Renewable Energy Policy Network for the Twenty-First Century (2007).

4. Wiser and Bolinger (2008).

5. BP (2008).

6. Pirog (2007).

7. BP (2008).

8. U.S. Energy Information Administration (EIA), "International and United States Total Primary Energy Consumption, Energy Intensity, and Related-Data Tables" (www.eia.doe.gov/emeu/international/energyconsumption.html [December 2008]).

more than double by 2030 but only grow by 25 percent in the United States during the same time period.[9] Already about two-thirds of India's oil imports and 45 percent of China's oil imports come from the Middle East, and their dependence on that region is certain to grow.

With oil prices set in a global market, the degree of U.S. economic vulnerability is proportional to its *total* oil dependence, not just *import* dependence. And the United States is by far the largest oil consumer in the world. Consumers must pay the market price increase on every gallon or barrel consumed, not just on the imported barrels, although the degree of import dependence certainly affects who gets the revenue.[10] Lately oil imports have accounted for about one-third of the U.S. trade deficit.[11] The U.S. transportation sector accounts for the majority of U.S. oil consumption and the largest and fastest-growing fraction of U.S. greenhouse gas emissions, so it is a ripe target for policy attention.[12]

With the election of President Barack Obama, a window of opportunity to change U.S. energy policy has opened again. Each new presidential administration offers the possibility of change, a theme upon which President Obama himself vigorously campaigned. A cautionary tale can be told based on the history of promises made during presidential campaigns and subsequent energy policies enacted. Every presidential candidate since the oil shocks of the 1970s has campaigned on a theme of energy "independence," but every subsequent president left office with the United States more, not less, dependent on foreign oil. U.S. oil imports as a percentage of total oil consumption were 37 percent during the Nixon administration, and they rose to 66 percent during the Bush administration.[13] On the subject of climate change, the record is no better. The Clinton-Gore administration entered office on the heels of the United Nations Conference on Environment and Development in Rio where the UN Framework Convention on Climate Change had been negotiated. Vice President Al Gore had just published his famous book *Earth in the Balance* (1992), which stressed the importance of action to tackle climate change. But despite the Clinton administration's initial proposal for an energy usage tax ("BTU tax"), subsequent negotiating of the Kyoto Protocol, and development of a voluntary domestic climate change action plan, no enforceable policies were enacted during its eight-year term. The Bush

9. IEA (2008).
10. See chapter 4 in this volume.
11. Jackson (2007).
12. Gallagher and Collantes (2008).
13. National Commission on Energy Policy (NCEP, 2007).

administration declined to support mandatory policies to reduce GHG emissions, and U.S. carbon dioxide emissions grew another 4 percent between 2001 and 2007.[14] U.S. government investments in energy research, development, and demonstration are approximately half the level they were thirty years ago in constant dollars. Japan now exceeds the United States in total government investments in energy technology innovation as well as in government investments as a percentage of GDP.

During his campaign, President Obama made many noteworthy and important commitments, namely, that he would

—invest approximately $15 billion a year for ten years in cleaner energy, thereby creating approximately 5 million associated jobs;

—reduce oil imports by volumes equal to the imports from the Middle East and Venezuela within ten years;

—modernize the national electricity grid;

—commit to reduce carbon emissions to 1990 levels by 2020 and to effect an additional 80 percent reduction by 2050 via a market-based cap-and-trade system with a full auction, as well as to reengage in international climate negotiations;

—give every family a $1,000 energy rebate and pay for it from oil company profits;

—provide $4 billion in loans and tax credits to American auto plants and manufacturers so that they can retool factories and build fuel-efficient cars;

—put 1 million 150-mpg, plug-in hybrids on U.S. roads within six years and give consumers a $7,000 tax credit to buy fuel-efficient cars; and

—ensure that 10 percent of U.S. electricity comes from renewable sources by 2012 and 25 percent by 2025, as well as extend the production tax credit for renewable energy for five years.

Given the severe financial and economic challenges facing the new president, it is natural to wonder if energy policy should be a top priority at the beginning of the new administration. If this book does nothing else, it makes the case that the United States cannot afford to wait any longer to enact long-term policies for climate change, carbon capture and storage (CCS), electricity structure reform and infrastructure investment, oil security, and energy-technology innovation. Tempting as it may be to defer policymaking in the energy and climate domains, not taking prompt action early in the Obama administration will constitute a failure to act in time. In fact, acting early is clearly in the longer-term financial interest of the United States.

14. EIA (2008).

Some, including President Obama, have argued that the financial crisis presents an opportunity for investing in a "green" recovery. One can thus readily imagine that President Obama's commitment to invest $15 billion a year in the development and deployment of cleaner energy technologies will be acted upon because such investments are likely to create new jobs and enhance the industrial competitiveness of U.S. firms, which are increasingly at risk of arriving too late to the global marketplace for advanced energy technologies. Eight of the ten top wind manufacturers are European, none of the top five global producers of photovoltaic cells is based in the United States, and two Japanese producers supply 85 percent of the world's market for hybrid electric vehicle batteries.[15] Numerous suggestions for how to best deploy and utilize these proposed funds are outlined in chapter 5, on energy-technology innovation. One likely source of these funds could come from the passage and implementation of domestic climate change legislation, which would generate revenues if carbon dioxide emissions are taxed or if permits are auctioned rather than given away.

There will be tensions as the Obama administration endeavors to tackle all the energy challenges. One consistent theme in this book, for example, is that higher energy prices would help achieve all the policy objectives in the longer term—improved oil security, lower GHG emissions, more efficient operation of the electricity system, more incentives for private sector innovation in energy technologies, and more incentives for consumers to purchase cleaner and more energy-efficient products. But, of course, higher energy prices have not been deemed politically palatable in the past, and there is the legitimate concern that they can unfairly burden low-income Americans. To address the disproportionate impacts on low-income families, rebates could be provided or social welfare programs enhanced. Policymakers need to break out of the trap of reinforcing energy problems by suppressing energy prices, and there is evidence to suggest this is doable. For example, there is substantially more support for carbon taxes, which increase energy prices, when they are presented in the context of other public finance choices, such as reductions in income taxes. Polling from 2006 shows that support for the same carbon tax level tripled and opposition fell by two-thirds when a large carbon tax was paired with a similarly large income tax cut.[16]

Although there were many possible focuses within the realm of energy policy for this book, we chose to concentrate on six topics in particular: climate

15. See Anadon and Holdren, chapter 5 in this volume.
16. Ansolabehere (2006).

change policy, CCS policy, oil security policy, energy technology innovation policy, electricity market structure and infrastructure policy, and barriers to acting in time on energy policy and strategies for overcoming them. Each of these topics is the focus of one full chapter, and policy recommendations are provided at the conclusion of each chapter. These topics were chosen because they are arguably the six most important and urgent focuses for the Obama administration. Each is considered in turn below.

More than ten years have passed since the Kyoto Protocol was adopted, and since the turn of the century, 26 billion tons of CO_2 a year have been emitted from the burning of fossil fuels (with another 4–8 billion tons emitted from land use change and deforestation) on average. Given the large amounts of GHGs that are already in the atmosphere, some climate change is now virtually inevitable. Scientists estimate that about one-third of mid-twenty-first-century warming is already committed given the amount of GHGs already in the atmosphere, but the other two-thirds of projected warming is strongly dependent on how much more is discharged into the atmosphere during the next two decades. No matter which ultimate GHG concentration target is chosen, global GHG emissions reductions are necessary and inevitable, but the hard questions are when each country should begin, and how fast it should reduce its emissions. In chapter 2 on climate change, I argue that the world, and the United States specifically, must first establish a long-term GHG concentration goal. Once there is agreement on this goal, the required avoided emissions can be determined, and a long-term GHG "emissions budget" can be created. An emissions budget is no different from a financial budget in that it simply provides a quantitative limit on emissions (that is, spending) for a given time period.

Procrastination—or failing to act in time—results in much faster required rates of emissions reductions if a certain concentration target is to be met. The faster the pace of required emissions reductions, the more difficult and expensive it becomes to live within the budget. Too much delay and the budget is blown, meaning that our children and grandchildren must cope with much larger magnitudes of climate disruption. Therefore, the three most important steps the U.S. government must take with respect to climate change are to, first, set the long-term goal—recognizing that this goal may need to be revised in light of new scientific information—and thereby create a national emissions budget; second, place an initial price on U.S. greenhouse gas emissions, either through a cap-and-trade mechanism or a tax; and third, reengage internationally, especially with China—the world's largest and fastest-growing emitter—to devise an international solution to the climate change challenge.

With regard to both climate change and energy technology innovation policy, chapter 3 is purely devoted to CCS. Why focus on this technology rather than on technologies for renewable energy, nuclear energy, or energy efficiency? The answer is that there will be a desire to rely increasingly on the vast U.S. coal reserves, both because of their abundance and relative cheapness—if one excludes all the health and environmental costs associated with coal.[17] The United States has a huge number of concentrated point sources of CO_2. If a way can be found to economically capture and store the carbon from those factories and plants, they will not have to be retired prematurely at great economic cost, which is unlikely to happen anyway. There are more than 500 power plants that emit more than 1 million tons of CO_2 in the United States alone. In chapter 3 Daniel Schrag outlines the scientific and technical challenges for large-scale carbon capture (both precombustion and postcombustion) and carbon storage. Even though the technical challenges are significant, CO_2 is already economically captured, transported, and used for enhanced oil and gas recovery all over the world. Costs for the first set of capture and storage facilities appear to be high (too expensive to be motivated by relatively low carbon prices), but Schrag notes that these costs will come down through further research, development, and demonstration. He recommends that the U.S. government provide federal subsidies for ten to twenty commercial-scale CCS projects and argues that these demonstration projects should use different capture technologies, employ different strategies for geological storage, and be spread across different regions of the United States to have the biggest impact, both on knowledge gained and public perception. Schrag also recommends that new federal laws and regulatory policies should be created so that developers and operators of power plants and CO_2 storage facilities understand their liability, and know which environmental regulations will apply to CCS projects. Third, he contends that the federal government should encourage state and local governments to accelerate permitting processes for CCS projects. Finally, he argues that the long-term goal should be the adoption of CCS for all large stationary sources. Acting in time on CCS thus requires that a major research, development, and demonstration program for CCS be implemented immediately so that knowledge can be acquired about the viability of this technology during the next five to ten years, and so that costs can be brought down to a reasonable level by the time deep cuts in CO_2 will be required in the United States to meet our long-term climate goals.

17. As Schrag notes in chapter 3, although coal is the major motivation for the development of CCS, CCS need not only apply to coal: any point source of CO_2 can be sequestered, including CO_2 from combusted biomass, which would result in negative emissions.

In terms of oil security, although President Obama campaigned on a theme of energy independence, Henry Lee points out in chapter 4 that the United States is not its own market but rather part of an international market. Oil independence, therefore, is neither affordable nor desirable. Lee defines the oil security problem as encompassing four concerns: short-term economic dislocations from sudden increases in oil prices, long-term supply inadequacies, a foreign policy overly constrained by oil considerations, and environmental threats, specifically global climate change. He highlights the problems associated with the volatility in oil prices and notes that low prices could easily be followed by an era of high oil prices again. To address these concerns, the growth in world oil consumption and GHG emissions needs to be reduced. To accomplish these goals, Lee suggests that the United States needs to place a price on both imported oil and carbon, either through taxes or a cap-and-trade program. By increasing prices, the government sends a strong signal to consumers to use less oil and emit fewer grams of carbon, and it also sends a powerful signal to entrepreneurs and investors who are striving to develop substitutes for imported oil. Lee suggests that Congress consider a variable tax that would be triggered when oil prices reach a certain threshold—for example, $90 per barrel—so if oil prices slipped below $90 to $80 per barrel, a $10 tax would be imposed. If the price later rose above $90, the tax would disappear. Politically, this proposal seems unlikely during an era of low oil prices, but the government should be prepared to take advantage of this opportunity when oil prices rise again. There are other policy options as well, but a key point is that international cooperation is crucial because a coordinated effort that reduces oil consumption in all the major oil-importing countries will be the most effective way to improve oil security. There are few short-term fixes to the oil security problem, so acting in time on oil security requires devising strategic and consistent domestic and foreign policies that will improve U.S. oil security over the longer term, hopefully before the next crisis hits.

Policy for energy technology innovation is important because innovation can both reduce the costs of energy technologies today as well as improve the menu of options for the future. In chapter 5 Laura Diaz Anadon and John Holdren contend that current U.S. public and private energy research, development, and demonstration expenditures are small in relation to the economic, environmental, and security stakes. To move cleaner and more efficient energy technologies from the laboratory into the marketplace, "market-pull" policies are necessary complements to "technology-push" policies, and there should be much greater coordination between the push and pull policies than has existed until now. Acting in time in the energy innova-

tion domain is necessary if the United States is to maintain its role as a flourishing and competitive economy, give the world a chance to prevent a climate disruption crisis, and minimize the chances of fossil fuel or nuclear energy related international conflicts. To illustrate how important investments in innovation could be for the U.S. economy, consider that growing demand for energy and low-carbon technologies is creating a large market for advanced energy technology suppliers estimated at approximately $600 billion a year. As Anadon and Holdren point out, whether or not U.S. firms will capture a large fraction of this market depends on the right policy conditions and incentives.

A key challenge for electricity market design and regulation is to support efficient investment in infrastructure. In the coming years, if the United States is to have adequate electricity supply or be able to increase the fraction of renewable energy in the electricity mix, for example, a workable regulatory and market framework is essential. William Hogan explains in chapter 6 that initiatives to improve energy security, meet growing demand, or address climate change and transform the structure of energy systems all anticipate major electricity infrastructure investment. Without the necessary infrastructure investment, energy policy cannot take effect, and without sound policy, the right infrastructure will not appear—a classic chicken-and-egg problem. Acting in time thus requires that policies are put into place now to support efficient investment in infrastructure so that all the other desirable energy policies can be implemented. As discussed at length in Hogan's chapter, improved scarcity pricing and a hybrid framework for transmission investment are two workable solutions that seem necessary to meet the needs for a long-term approach to infrastructure investment.

The likely barriers to the policies prescribed in this book and the strategies for overcoming them are identified in the final chapter by Max Bazerman. People often fail to act in time to prevent foreseeable catastrophes—"predictable surprises"—and we see several such surprises looming with respect to U.S. economic competitiveness, oil security, and global climate change. Bazerman argues that enacting wise legislation to act in time to solve energy problems requires surmounting cognitive, organizational, and political barriers to change. To take the example of the organizational barriers, it is clear that the U.S. government is not presently structured in a way that would allow it to forcefully confront our current energy challenges. Moreover, government employees are often not trained in the methods needed to implement smart energy policies. While there is a Department of Energy, civilian energy is a very small part of the department's budget and activities. No single agency or entity is in charge of collecting information on climate change or energy security

from all the departments, analyzing that information, and transforming it into effective policy. Institutions are composed of the laws, rules, protocols, standard operating procedures, and accepted norms that guide organizational action, and members of these institutions come to behave by force of habit. This makes many bureaucratic government departments resistant to voluntary information sharing and regulatory flexibility.

The Obama administration and new Congress, Bazerman argues, must anticipate and address aspects of government organizations that will prevent successful implementation of new ideas aimed at acting in time to solve energy problems. Bazerman suggests five ways to improve the odds that the policies recommended in this book will succeed. First, policymakers should identify policies that make wise trade-offs across issues and then, second, communicate to the public that decisions are being made to maximize the overall benefits to U.S. society rather than to special interest groups. Third, the new administration should devise energy policies that make sense even if climate change were less of a problem than best current estimates suggest. Fourth, the administration should identify a series of small changes or "nudges" that significantly influence the behaviors of individuals and organizations in a positive direction. Finally, when discounting of the future creates an insurmountable barrier to the implementation of wise policies, Bazerman suggests considering a mild delay in implementation.

It should be noted that the energy policy challenges and priorities for the United States are not the same as for many other countries. The U.S. context is unique, and this book focuses primarily on the problems and opportunities that exist in the United States. Other major oil importers, like Japan, Europe, and China, share many of the same oil security problems. Other major coal consumers, including China and India, should be similarly motivated to consider CCS. The United States and China, as the top two GHG emitters on an aggregate basis, will need to think about their carbon mitigation strategy during the coming decades, just as Europe and Japan have already done. Nearly all countries have an incentive to develop strategies for energy technology innovation to address the distinctive needs of their own countries. The challenges with respect to the U.S. electricity grid and electricity markets are perhaps the most specially American given the elaborate regulatory structure at both the federal and state levels.

Finally, although assigned to no special chapter in this book, energy efficiency permeates the basic themes and should be considered a top priority for the U.S. government. The United States lags far behind most other industrialized countries in addressing the overall energy intensity of its economy,

ranking thirteenth among the industrialized countries and fifty-fifth overall.[18] Greater energy efficiency offers leverage against all of the major economic, security, and environmental problems faced by the United States. Greater energy efficiency improves oil security and reduces GHG emissions, the need for greater power supply capacity, and pressure on the electrical grid. It reduces the amount of money being spent on oil and gas imports, and it can improve the productivity of U.S. firms. In fact, a worthy goal would be for the United States to become the most energy-efficient economy in the world.

References

Ansolabehere, Stephen. 2006. "U.S. Public Attitudes on Swapping Carbon Taxes for Income Taxes." Harvard University, Department of Government.

British Petroleum (BP). 2008. *BP Statistical Review of World Energy.* London.

Gallagher, Kelly Sims, and Gustavo Collantes. 2008. "Analysis of Policies to Reduce Oil Consumption and Greenhouse Gas Emissions from the Transportation Sector." Discussion Paper 2008-06. Cambridge, Mass.: Belfer Center for Science and International Affairs (June).

Gore, Al. 1992. *Earth in the Balance: Ecology and the Human Spirit*. New York: Houghton Mifflin.

International Energy Agency (IEA). 2008. *Key World Energy Statistics.* Paris.

Jackson, James K. 2007. "U.S. Trade Deficit and the Impact of Rising Oil Prices." Report RS22204. Congressional Research Service, Library of Congress.

National Commission on Energy Policy. 2007. *Collaborative Development of Petroleum Sector Performance Indicators (PSI)*. Washington.

Pirog, Robert. 2007. "The Role of National Oil Companies in the International Oil Market." Report RL34137. Congressional Research Service, Library of Congress.

Renewable Energy Policy Network for the Twenty-First Century. 2007. *Renewables 2007 Global Status Report.* Paris: REN21 Secretariat, and Washington: Worldwatch Institute.

U.S. Energy Information Administration (EIA). 2008. "U.S. CO_2 Emissions from Energy Sources." (May).

Wiser, Ryan, and Mark Bolinger. 2008. *Annual Report on U.S. Wind Installation, Cost, and Performance Trends 2007.* DOE/GO-102008-2590DOE/GO-102008-2590. U.S. Department of Energy, Energy Efficiency and Renewable Energy (May).

18. See EIA, "International and United States Total Primary Energy Consumption." Energy intensity is defined as total primary energy consumption per dollar of gross domestic product, using market exchange rates. If energy intensity is calculated using purchasing power parity estimates rather than market exchange rates, the United States ranks 144th overall.