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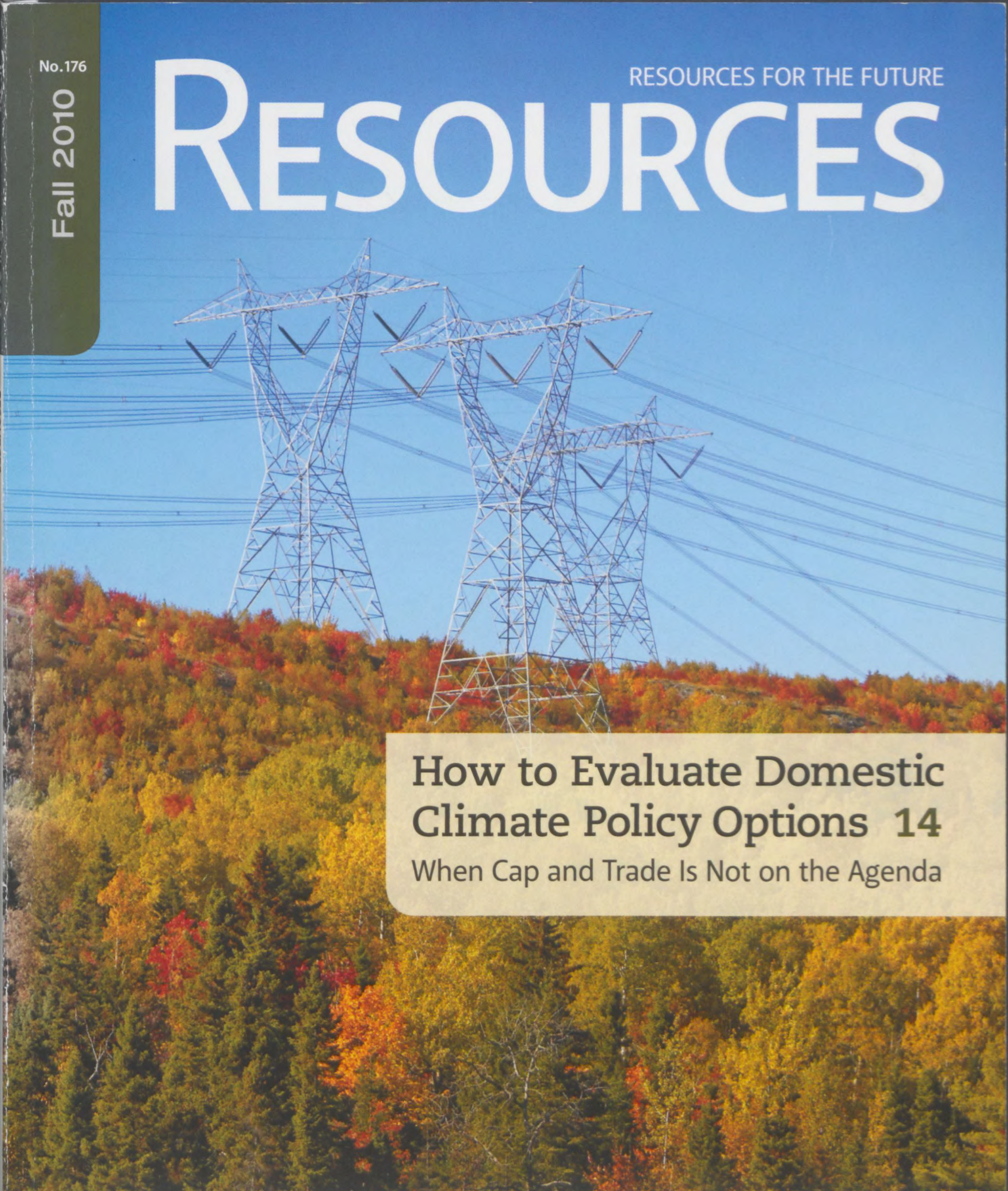

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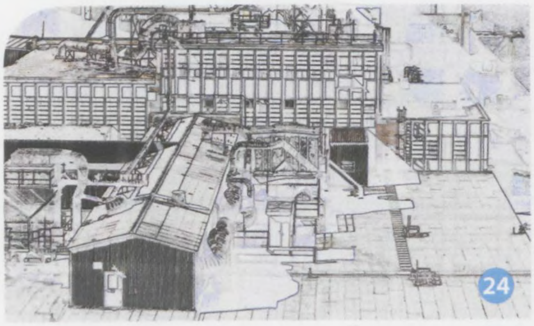

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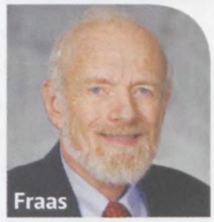
In This Issue

Dallas Burtraw, an RFF senior fellow, is one of the nation's foremost experts on environmental regulation in the electricity sector. He studies electricity restructuring, competition, and economic deregulation. He is particularly interested in incentive-based approaches for environmental regulation and has studied ways to introduce greater cost-effectiveness into regulation under the Clean Air Act. p. 24



Arthur G. Fraas is now a visiting scholar at RFF, following a distinguished career in senior positions within the federal government. His research centers on energy and the environment, including the treatment of uncertainty in regulatory analysis of major rules and the potential regulation of greenhouse gases under the Clean Air Act. p. 30

Grant D. Jacobson is an assistant professor in the Department of Planning, Public Policy, and Management at the University of Oregon. The links between environmental economics and environmental policy, particularly within the context of climate change and energy, are his main area of study. p. 08

Raymond J. Kopp, an RFF scholar for more than three decades, is an expert on climate change and energy issues. His current studies focus on U.S. domestic greenhouse gas mitigation and adaptation policy, U.S. foreign policy as it pertains to international negotiations on climate change, and deforestation and degradation in tropical countries. p. 14

Matthew J. Kotchen is an associate professor of environmental economics and policy at Yale University. His research interests lie at the intersection of environmental and public economics. p. 08

Randall Lutter investigates the economics of regulatory issues related to risk in the areas of food and drug safety and the environment. He is former chief economist and deputy commissioner for policy of the U.S. Food and Drug Administration, where he oversaw policies on public health concerns, ranging from pandemic flu countermeasures to the risks of imported and counterfeit drugs. p. 30

Contributors

Richard D. Morgenstern, an RFF senior fellow, is an expert on the economics of environmental issues, the use of economic incentives to address air pollution, and global climate change. Recently, he has been analyzing competitiveness and trade issues at international, national, and state levels. **p. 42**

Karen L. Palmer has been a researcher at RFF for more than 20 years and was the first recipient of the Darius Gaskins Senior Fellowship. Her work seeks to improve the design of incentive-based environmental regulations that influence the electric utility sector, including controls of multipollutants and carbon emissions. **p. 19**

Ian W.H. Parry, an RFF senior fellow, evaluates the cost-effectiveness and net benefits of policies to reduce externalities related to the environment and transportation systems. His recent work has analyzed gasoline taxes, fuel economy standards, environmental tax shifts, and emissions taxes versus cap and trade. **p. 38**

Nigel Purvis is a visiting scholar at RFF and president of Climate Advisers, a consulting firm. He also holds senior policy research appointments at the German Marshall Fund of the United States and the Brookings Institution. Previously, Purvis was directly involved in U.S. environmental diplomacy. **p. 34**

Nathan Richardson is an attorney and a resident scholar at RFF. His research at RFF encompasses a range of climate change issues, including EPA regulation of greenhouse gases, analysis of proposed or potential climate legislation, and international climate agreements. He also studies environmental liability and regulatory institutions and practices. **p. 24**

Phil Sharp, president of RFF since 2005, serves on the board of directors of the Duke Energy Corporation, is vice chair of the Energy Foundation, and is the congressional chair for the National Commission on Energy Policy. He was appointed to The National Academies' Committee on America's Climate Choices and to the Blue Ribbon Commission on America's Nuclear Future. Sharp served 10 terms as a member of the U.S. House of Representatives from Indiana. **p. 11**

Roberton Williams III is a senior fellow and director of academic programs at RFF, an associate professor in the Department of Agricultural and Resource Economics at the University of Maryland–College Park. He has examined a range of specific policy issues, including gasoline taxes and climate change policy. **p. 38**

Same Magazine, New Look!

We have retooled *Resources* to better match our new editorial direction. Our goal is to provide you the means and perspective to better understand evolving energy, environmental, and natural resource issues, and stay on top of our latest research findings. The fundamentals haven't changed: you'll find short, accessible stories by RFF scholars, written without partisan bias or technical jargon. The purpose of the new design is to make it easier to find what you're looking for as well as easier to read—the type is bigger!

What has changed is the look of *Resources* over the years—this issue, number 176, marks the 9th new design and my 35th issue as editor. Over 50 years ago, departmental secretaries typed each issue of the original newsletter, documenting each new research paper. Today, the magazine can be read page by page online and you can also receive it electronically for less clutter in your mailbox (resources@rff.org). The print edition likely will continue for the next 50 years at least; we know that most of you turn to hard copy when you need to delve into the facts. Now we'll make it easier for you to quickly grasp what you need to know and lead you to the experts and research analysis when you need to delve deeper.

RFF stands by its reputation as an honest broker of the facts. Over time, you'll see new contributors and new features in *Resources* as we try to open up the dialogue between policymakers and the research community.

I welcome any comments, suggestions, or questions you might have—feel free to contact me at day@rff.org.

Thanks!

Felicia Day

Felicia Day, *Senior Editor*

A LOOK BACK:
Resources, from 1959 until today.

CAA Celebrates 40 Years

But Questions Remain about Progress Ahead

In September, as the Clean Air Act turned 40, the nation's top environmental leaders of the past and present met in Washington for an anniversary conference celebrating the political victories of the past and pondering the future of environmental policy.

The Clean Air Act, the nation's first modern pollution control law, paved the way for today's bedrock environmental statutes. Because of it, skies are clearer and Americans are healthier. "We've helped prevent tens of thousands of premature deaths every year," noted EPA administrator Lisa Jackson.

During the debate leading up to passage of the 1970 law, polluting companies warned that tough federal air pollution controls would devastate the economy, recalled former EPA regulator David Hawkins, now director of the Natural Resources Defense Council's climate program and an RFF board member. Instead, the pollution control mandates spurred development of new environmental industries and products that American companies were able to sell to foreign firms. As pollution declined, the nation's GDP grew. "We made the air cleaner and have done it without hurting economic growth," Hawkins said.

But those at the meeting, sponsored by EPA and the Bipartisan Policy Center, were less confident about the future of environmental policy. Discussion quickly turned to Washington's failure to enact climate change legislation. During this Congress, House Democrats narrowly passed a climate bill, gaining only eight House Republican votes. And the Senate was never able to cobble together a consensus bill.

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Speakers at the conference agreed that the climate change legislation fell victim to the national economic recession, a lack of public support for ambitious new environmental laws, and increased political partisanship on Capitol Hill. By comparison, the 1970 act was buoyed by the popular environmental movement of the 1960s. The 1990 amendments were adopted at a time when the nation was worried about summertime ozone pollution and acid rain damage in northeastern forests caused by sulfur dioxide emissions from midwestern coal plants.

In 1988, environmental issues helped Republican candidate George H.W. Bush win the New Hampshire presidential primary and ultimately the presidency, RFF president Phil Sharp said. "Plans to expand the Clean Air Act did not get going until President Bush was elected and put a plan on the table," recalled Sharp, who at the time was a member of the House of Representatives. Bush's staff worked closely with Democratic congressional leaders to craft the final 1990 air pollution amendments, which passed both houses of Congress by wide majorities.

emissions of greenhouse gases. He argued that conservatives and the public are more likely to rally behind energy programs than a climate change bill.

John Holdren, director of the White House Office of Science and Technology Policy, said the White House is looking to use laws other than the Clean Air Act to cut U.S. emissions of global warming pollution. "We're looking very systematically at the array of levers that are available to the executive branch to take on different pieces of this problem," he noted. "There is a lot of executive authority without waiting for the Congress."

"It's going to take some serious natural disaster that is associated in the public's mind with climate change. Until there is something that goes beyond perhaps Katrina that is associated by sound scientists as a manifestation of what you'd expect with climate change, I don't see much change."

William Reilly, former EPA administrator

During current climate change debates, however, Republicans and Democrats have been at odds. "What did we lack this year?" House Energy and Commerce Committee chairman Henry Waxman asked at the anniversary gathering. "We had no bipartisan cooperation." Today's political standoff is not likely to change during the next Congress, according to former congressman Sherwood Boehlert. "The best we can hope for [on environmental action] is inertia," he said. "The worst is disaster."

Former EPA administrator William Reilly said that for the near term, Washington should focus on energy efficiency and clean energy programs that could also cut

Environmental insiders at the anniversary celebration acknowledged that climate change legislation is off the radar screen in Washington for the foreseeable future. Until the public becomes more aware of and concerned about the impacts of global warming, the increasingly conservative Congress will not pass legislation to control greenhouse gases. "It's going to take some serious natural disaster that is associated in the public's mind with climate change," Reilly said. "Until there is something that goes beyond perhaps Katrina that is associated by sound scientists as a manifestation of what you'd expect with climate change, I don't see much change."

– MARJORIE KRIZ HOBSON

Commentary

Building Codes and Energy Policy

Making Strides to Improve Energy Efficiency

Improving energy efficiency in the built environment is now seen as a growing policy priority. Buildings account for 72 percent of electricity consumption, 39 percent of energy use, and 38 percent of carbon dioxide emissions. Energy codes are the most common policy tool used to affect the energy efficiency of both residential and commercial buildings. Most existing codes were first put in place after the 1973 oil embargo. Codes by state but they generally establish a minimum energy efficiency standard for new and remodeled construction.

Congress is at a standstill regarding climate legislation, but energy codes are a central part of two bills that have directly shaped the terms of the current debate. The Waxman-Markey bill (HR 2454) would require that, by 2014, all states enact residential building codes that are 30 percent more stringent than the 2006 International Energy Conservation Code, the prevailing standard. The target increases to 50 percent more efficient in 2017, and a 5 percent increase every three years until 2029 The Boxer-Kerry bill (S 1733) would also mandate increased stringency, requiring the U.S. Department of Energy to establish building code energy efficiency targets by January 1, 2014. It also includes provisions for state adoption of a national building-code standard.

Energy Code Effectiveness

It is important to understand how effective energy codes are at saving energy and reducing emissions. The existing evidence comes from engineering simulation models.

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Although this approach is useful for making predictions, it fails to account for actual enforcement and compliance, changes in building practices, and the behavioral responses of building occupants. One such response is the "rebound effect," whereby consumers in more energy-efficient residences might heat their homes more because it is less costly. Evidence also shows that the realized returns of energy efficiency investments sometimes fall below those indicated by engineers and product manufacturers. To complement the engineering approach, a few recent studies provide new evidence on energy code effectiveness by looking at actual energy consumption.

We conducted a study of the increased stringency of Florida's residential energy code that occurred in 2002, by focusing on the city of Gainesville. By comparing utility bills for homes constructed within three years of the code change—before and after—we were able to estimate how the energy code's increased stringency affects energy consumption. After controlling for

building characteristics, those built after the code change used 4 percent less electricity and 6 percent less natural gas. We also examined how residences built under the stricter code differ in their responsiveness to weather fluctuations.

Together, our results are consistent with reduced consumption of electricity for air-conditioning in the summer and reduced consumption of natural gas for heating in the winter. Our estimates are statistically comparable to engineering simulations of Florida's energy code change, lending validity to both approaches for evaluating the effectiveness of energy codes.

We also estimated the economic costs and benefits and found that the payback period of the energy code change for the average residence is 6.4 years, the length of time for the additional construction costs imposed by the more stringent building code pay for themselves. The social payback period is 3.5 years, a lower number because it accounts for the avoided costs of emissions that do not occur because of the more stringent building code.

However, that the social payback calculation assumes that emissions reductions in one area are not offset by emissions increases in another, which may well be the case if reductions are sufficiently large to affect behavior in existing or potential cap-and-trade programs. This possibility underscores the importance of considering the interaction of multiple policy instruments in order to evaluate the true effectiveness of any one.

The results from our Florida study are likely to be representative of many regions of the United States. Additional studies provide further evidence: one recent study used aggregated data to evaluate the relationship between implementation of a state energy code and state residential electricity consumption. The results showed that states with energy codes experienced decreases in aggregate consumption in the range of 3 to 5 percent and even more in states with stricter codes and better enforcement. Another study used a billing data methodology similar to the one we applied in Florida to examine the effectiveness of energy codes in California and and achieved similar results.

Policy Implications

These findings do not imply that energy codes are the most effective policy to promote energy conservation and a reduction in greenhouse gas emissions.

The alternatives—a comprehensive cap-and-trade policy on emissions or a carbon tax—would increase the price of energy and provide an economic incentive for conservation. Economic theory suggests that price-based mechanisms are likely to be more efficient than direct mandates such as energy codes, because they exploit a broader range of possibilities for emissions reductions.

Political support for these price-based policies is not very strong and recently has been eroding even further. In this context, energy codes offer a politically feasible alternative in the meantime. And even if a price-based policy is eventually implemented, building codes may still be a worthwhile component of national energy policy.

Given that consumers often overlook the long-term benefits of investments in energy efficiency even when the investments make economic sense, the energy-efficiency paradox. Therefore, mandatory requirements like energy codes may be advisable to include among the strategies for addressing energy and climate challenges. ● – GRANT D. JACOBSEN AND MATTHEW J. KOTCHEN

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Expectations, Great and Small

As We Move Toward a Low Carbon Future

Phil Sharp

Two years ago, advocates for major cuts in greenhouse gases expected the United States would soon adopt a system of cap and trade and the international community would reach a comprehensive post-Kyoto agreement. Copenhagen and Congress—more accurately, the Senate—have dashed those expectations.

Yet, much in our energy markets and government policy continues to move us toward a lower-carbon future. Political changes in Washington may signal that a carbon-pricing architecture will not soon be constructed, but other options may receive consideration. Energy and climate issues are unlikely to fall off the public agenda.

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Expectations: The Science

Over the last year, the debate about climate science was recharged with the "revelations" of emails among a few scientists and the mistakes found in the Intergovernmental Panel on Climate Change (IPCC) *Fourth Assessment Report*, published in 2007.

Some skeptics believed the validity of the science had been dealt a serious blow. But those notions have also been dashed. The revelations triggered serious reviews within the scientific community that confirmed the basic proposition that human activities are significantly contributing to the warming of the planet by changing the chemistry of Earth's atmosphere and oceans, posing significant risks for mankind and all natural systems.

Studies completed since the 2007 IPCC assessment have reinforced these scientific claims. See one of the more readable accounts in *Advancing the Science of Climate Change* from the National Academy of Sciences (www.americasclimatechoices.org).

To assure the rigor of the fifth IPCC assessment, an international panel of natural and social scientists was created to review the IPCC plans and processes and issue a report. Maureen Cropper, an RFF senior fellow and member of the National Academy of Sciences, served on that panel. While the RFF staff does not include climate or natural scientists, we seek to follow best practices of social science inquiry.

Expectations: Technology

The past decade witnessed a near explosion of technologies that are changing or are expected to change the ways we produce, transport, and use energy. Developed over earlier decades, these technologies range across nearly all fuels and uses of energy: from solar film production to shale gas extraction and modular nuclear reactors; from high-efficiency lighting to digital management of the grid and plug-in hybrid electric cars.

These advances were primarily driven by rising prices, supplemented by government policy, and by expectations among investors that the United States would join other nations in restricting carbon emissions.

A radical rise in natural gas prices occurred early in the decade, followed by price shocks in global oil—which drove changes in investor, consumer, and government behavior.

Congress and the president—in 2005, 2007, and 2009—adopted a plethora of mandates, tax incentives, loan guarantees, and funding programs to push the development of alternative fuels and the use of more efficient technologies. A number of state governments did as well.

A trifecta of factors—lower energy prices, especially for natural gas; the possible loss of taxes and other subsidies as Congress tries to rein in the massive federal deficit; and ongoing uncertainty regarding carbon policy—will affect whether these technological advancements continue at their previous pace.

Expectations: The Near Term

The conventional wisdom on market prices is that oil will remain fairly stable until more rapid growth returns to the world economy and that natural gas prices are likely to remain reasonably low, assuming water regulations do not significantly limit shale gas production. But past predictions about commodity prices have been notoriously wrong.

In terms of government policy, it is safe to say Congress is highly unlikely to adopt an economywide carbon-pricing policy any time soon. But existing and proposed energy and climate policies are likely to receive consideration on a piecemeal basis.

There may be a serious sorting out of the policies on the books: some undoubtedly are of questionable value or are unnecessarily costly in terms of the budget. Ethanol subsidies, among others, are likely to get reconsideration.

There may be adoption of various new mandates, such as clean energy standards and added incentives such as expanded nuclear loan guarantees, to push so-called clean energy technologies, especially out of concern for competition with developments in China and elsewhere. But all these developments remain speculative at this time.

Carbon skirmishes can be expected in Congress, the administration, the courts, and state regulatory proceedings. Siting energy facilities that have a carbon impact will likely face challenges from citizen groups.

Expectations: EPA

In the new Congress, disputes about whether and to what extent EPA ought to restrict greenhouse gas emissions are almost guaranteed. As a result of the 2007 Supreme Court decision *Massachusetts v. EPA*, the agency has begun the complex process of adopting restraints on emitters using the current authorities of the Clean Air Act. The energy and climate legislation, now moribund, would have forestalled use of these authorities, relying instead on a carbon-pricing strategy by means of a cap-and-trade policy.

For many economists and policy analysts, regulating carbon emissions under the act is not the most cost-effective route. The act generally operates by the periodic setting and resetting of standards—that is, the periodic ratcheting up of requirements—which invariably entails periods of delay, uncertainty, and legal wrangling. Consequently, for many economists and policy analysts, the regulatory path is not as likely to find the cheapest means as a well-crafted pricing strategy to provide continuous incentives. But the political choice to resist a pricing option may leave regulation as the only viable option.

In the Congress about to end, various factions are pushing to either repeal EPA's authority or delay its implementation, and the congressional elections have undoubtedly added strength to these efforts. Given the president's commitment to climate action and his veto authority, it is not clear what the outcome will be.

RFF scholars have been looking at the various regulatory options available under the law to EPA with an eye toward the least-costly path possible. As a general principle, that is most likely achieved when the agency seeks to maximize the flexibility for emitters within the confines of its authority, giving them an incentive to find least costly solutions. In addition, we are planning

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discussions with various stakeholders about legislative changes that might make the act a more cost-effective instrument.

Expectations: The Longer Term

Climate and energy issues are likely to remain compelling in the decade ahead. The fundamentals of world population and rapid economic development in China, India, Brazil, and elsewhere will mean major growth in the demand for energy and in greenhouse gas emissions unless green technology becomes a major part of the energy equation. Demand growth will put major pressures on energy resources and energy markets. Global warming will put pressures on nations to grapple with adaptation, emissions cuts, and possibly geoengineering strategies.

Expectations: RFF Ahead

As noted throughout this issue of *Resources*, RFF is deeply involved in a host of energy and climate issues. In setting our priorities for the next three to five years, we are determined to build our capacity to provide policymakers high-quality analysis on a number of fronts. They need to be able to make informed choices about policy options in term of their costs, effectiveness, and impact on U.S. competitiveness, as well as their implications for technological innovation.

We will be ready to help assess various policy options. We will build, for example, on our major new report, *Toward a New National Environmental Policy: Assessing the Options*, produced in conjunction with the National Energy Policy Institute at the University of Tulsa (www.rff.org/assessingtheoptions). This report provides a first of its kind, apples-to-apples comparison of some 35 policy options in terms of their cost-effectiveness in reducing carbon emissions and oil dependence.

RFF is also working to capitalize on the research revolution enabled by Earth-observing satellites—remote sensing—which should provide new tools for the private and public management of many global resources. Our Forest Carbon Index is an early example of how data mapping might contribute to building a forest carbon market; and our scholars are participating in an emerging proposal at the Sloan Foundation that would substantially improve knowledge about global forests. In the years ahead, space technology may play a prominent role in the implementation and verification of compliance of various provisions of international climate agreements.

In ways great and small, RFF is committed to helping build a wiser, effective process for energy and environmental policymaking in the United States.

How to Evaluate Domestic Climate Policy Options

When Cap and Trade Is Not on the Agenda

Raymond J. Kopp

President Obama pledged to the world community that the United States will reduce its emissions of greenhouse gases (GHGs) 17 percent below 2005 levels by 2020. The basis of that pledge was comprehensive climate legislation—the American Clean Energy and Security Act of 2009—passed by the House of Representatives in June 2009. That legislation contained numerous provisions to reduce U.S. GHG emissions. Perhaps the most important feature was cap and trade, which established a price and yearly declining limit on U.S. emissions, which would yield the reductions pledged by the president. However, similar legislation was not passed by the Senate in the 111th Congress, and given the results of the recent midterm elections, it seems unlikely the Senate will pass similar cap-and-trade oriented, comprehensive legislation in the next Congress.

While cap and trade may not be on the immediate congressional agenda, concern over U.S. GHG emissions remains. In the near term (12 to 24 months), one can expect proposals and action to reduce those emissions emanating from Congress, the executive branch agencies, and the states. These proposals and actions will likely manifest in many forms and vary considerably with respect to their environmental efficacy (tons of GHGs reduced), economic efficiency (cost per ton reduced), and political viability (who bears the costs and reaps the benefits of the policy).

The articles in this special issue of *Resources* discuss and analyze a great many of the climate policy options that will be considered in the near term. The purpose

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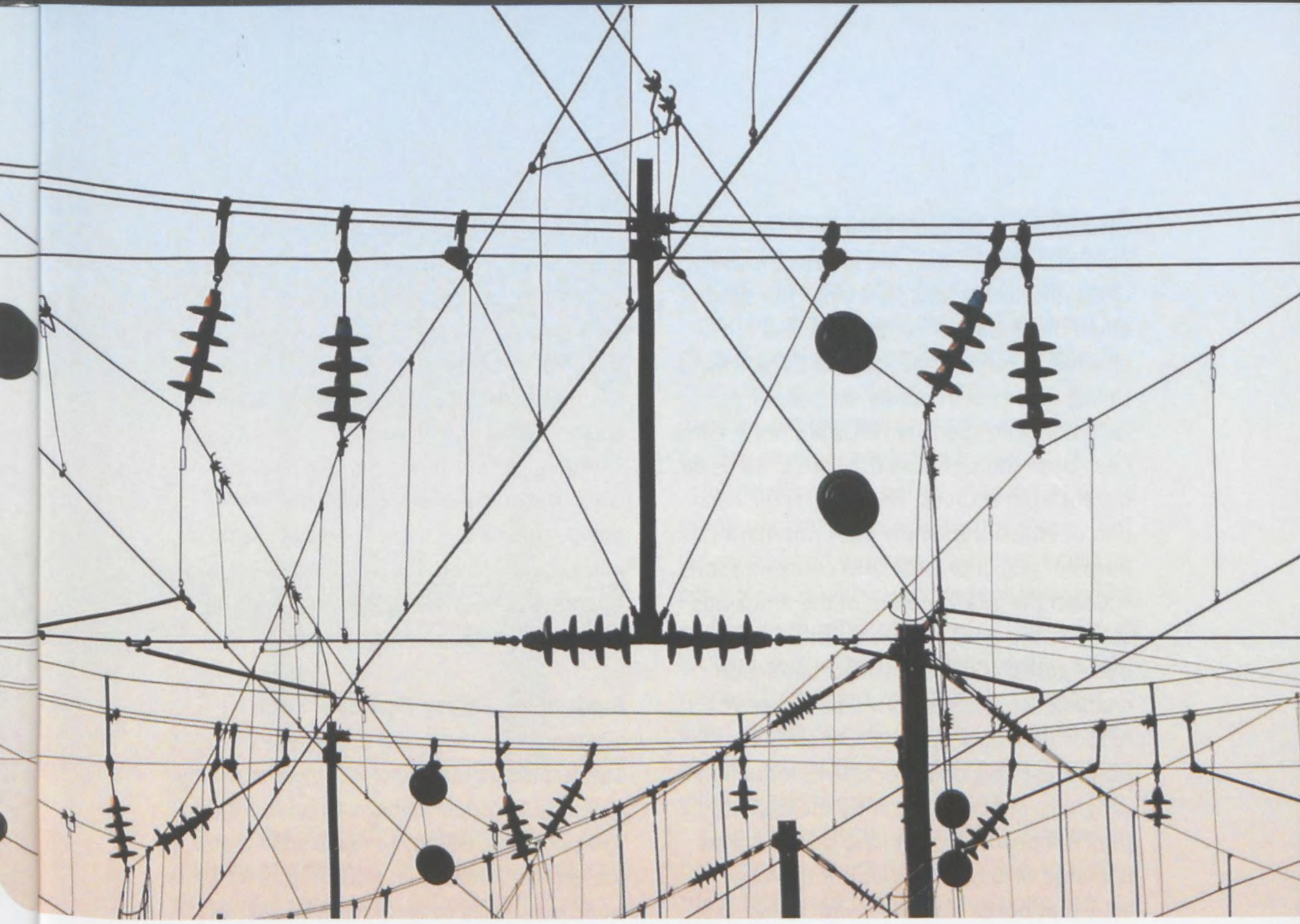

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of this introductory essay is to provide some guidance to aid readers as they evaluate these very same options.

A Uniquely Difficult Problem

In a very simple sense, GHG emissions can be viewed as air pollution. Since we have decades of experience controlling air pollution, it seems it should be a straightforward task to develop policies to control GHGs and prevent serious alteration to the global climate system. However, to properly design and evaluate policy options one must appreciate the distinctive features of the climate problem and the varied ways in which GHG emissions substantively depart from simple air pollutants. It is these unique features that make the formulation of climate policy challenging.

Perhaps the greatest air pollution success story in the United States is the ongoing control of acid-rain causing sulfur dioxide emissions. These emissions are largely confined to a relatively small number of coal-fired electricity generation facilities. In contrast, GHGs, especially carbon dioxide (CO_2), are ubiquitous gases, emitted by a vast number of sources in every country on the planet. They are emitted naturally and anthropogenically through many human activities in quantities ranging from trivially small to truly massive. Even the initial process of identifying relevant emissions sources is daunting.

GHGs remain resident in the atmosphere for a century or more, and therefore concentrations of these gases (quantities of GHGs per given volume of atmosphere) accumulate over time. This "stock" aspect of GHGs means that current concentrations are the result of global actions, natural and human, over the past century and the emissions today and over the next decade will in part determine concentrations a century from now.

GHGs are uniformly mixing gases that

contribute equally to global concentrations no matter where they are emitted. A ton of GHGs emitted in New Jersey has the same effect on global concentrations as a ton emitted in Paris, or Moscow, or Cape Town. Unlike many conventional air pollutants, local concentrations of GHGs are not greater near large sources than they are in areas far distant from sources. The geographic location of emissions simply does not matter in terms of global or local GHG concentrations.

Given the global nature of the emissions sources, the uniform mixing attribute of these gases, and the stock accumulation characteristics of the gases, programs to reduce GHG atmospheric concentrations must be global. Local GHG reduction programs are helpful, but by themselves they will be insufficient. The United States is a large GHG emitter, but not the largest—that honor now rests with China. U.S. GHG reductions are necessary to maintain concentrations at desired levels, but not sufficient to further reduce concentrations.

The investments in new technology and other changes to the global socioeconomic system necessary to seriously reduce global GHG emissions will not be free. The greater the cost, the greater the political reluctance to undertake the programs aimed at severe cuts in global emissions.

At the present time, the safe level of GHG concentrations is not known with any degree of certainty. Therefore, as time passes and knowledge is gained, programs to control GHG emissions will have to be adjusted to reflect new knowledge.

Evaluating Policy Options

Governments, including that of the United States, have agreed to work toward limiting global GHG concentrations to no more than 450 parts per million. To reach such a goal, the United States must reduce its GHG emissions essentially to zero over the next 75 to 100 years (accounting for GHGs that are emitted, but then embodied in forests and other plants through photosynthesis).

The policies put in place today must be effective and robust with respect to the many unknown and unknowable social, economic, technological, and political changes that will occur throughout the world over the next century.

GHGs are emitted from fundamental human activities having to do largely with energy production and use, and land-use changes. Reducing emissions requires massive alterations to global energy systems and the manner in which we manage our landscapes. Reducing emissions in the energy sector will require massive global investments in new climate-friendly energy sources and end-use technologies, many of which have yet to be invented and developed for widespread commercial deployment.

However, given the global nature of GHGs, actions by the United States working alone or in concert with European allies will not be sufficient to reach the goal. It will be up to major emitters like China, India, Brazil, and Indonesia to take similar action. Effective U.S. GHG policy must not only control domestic emissions, but also include an effective foreign policy component that encourages long-term cooperative action among all the major global emitters.

Reducing U.S. emissions to zero requires

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a policy that can effectively target tens of millions of domestic GHG sources. Policies that target sources on an individual basis will be effective for very large sources but wholly intractable for millions of smaller sources. Effective policy must target all sources or provide incentives for the many small sources to reduce emissions in the absence of direct regulation.

Slowing the growth in global emissions, eventually stopping the growth, and then working to reduce emissions until global concentrations stabilize at acceptable levels will take decades. The policies put in place today must be effective and robust with respect to the many unknown and unknowable social, economic, technological, and political changes that will occur throughout the world over the next century. Overly complex, costly, and politically divisive policies are unlikely to survive and be effective over the long term.

One of the keys to the global transformation necessary to reduce GHG emissions is the cost of making that transformation, and the key to cost is technology. If there were GHG-free electricity generation technologies today that were as productive, globally available and as cheap as current fossil-fuel technologies, the task of reducing GHG emissions would be considerably easier. Effective U.S. climate policy must embody economywide incentives to develop, commercialize, and deploy such technologies on a global scale, decade after decade going forward.

In the near term, before the new generation of climate-friendly technology is developed and deployed, we must begin to control GHGs with available technology. The enormous number of domestic GHG sources is characterized by great heterogeneity with respect to the cost of reducing emissions. Even among specific source categories like electric power generation, there is a stark difference in the cost of control.

One aspect of climate policy is simple. Basic math and economics tells us the lower the total cost of reducing emissions, the greater the amount of emissions we can reduce. The key to lowering the total cost is to develop and deploy a policy where the greatest reductions are sought from the sources that can reduce emissions most cheaply. And then things start to get complicated: given the global nature of the problem, effective regulation must look beyond U.S. borders and motivate reductions from foreign sources as well.

Even the most cost-effective U.S. policy will raise domestic energy prices and the prices of other goods dependent on energy—at least in the near term. Given the diverse pattern of energy production and use in the United States, this will cause the burden of these price increases to be unevenly distributed across regions, household demography, and industry. Environmentally effective GHG policy must also be politically viable, and that means that it must recognize and, in some manner, address the differential distribution of these costs across society.

Considering Our Options

While many policy approaches to reduce GHGs are under discussion, a 2007 Supreme Court ruling provided the U.S. Environmental Protection Agency (EPA) with the authority to regulate GHGs, at least in part, under the nation's Clean Air Act (CAA). In this issue, Richardson, Fraas, and Burtraw examine the options and latitude EPA has to regulate under the act, "options and latitude" being the operative words, since the regulatory path forward is quite uncertain.

If the new Congress turns its attention to energy and climate change, which seems likely, a package of new policies designed to enhance energy efficiency and the deployment of renewable and climate-friendly energy technologies could be politically viable. Palmer describes and simplifies the complex existing landscape of state and federal energy efficiency and renewable policies and discusses some modifications that would enhance these policies to attain greater economic efficiency and environmental benefit.

Fraas and Lutter assess the impact of EPA's parallel efforts to develop and issue several major rules to reduce conventional pollutants, which will impose heavy costs on the electric utility sector, especially coal-fired plants, for the installation of new emissions control equipment. EPA is responding to a set of independent and unrelated court decisions, settlement agreements, and statutory requirements that mostly tie back to the CAA. Facing the uncertainty of congressional or EPA actions to control carbon, utilities are facing the choice between making these investments given the potential that they become "stranded" by future carbon regulations or to retire these coal-fired EGUs and replacing them with other power sources.

For better or worse, labels matter in political discourse. The economic efficiency of a GHG regulatory framework designed around a tax on carbon has always been overshadowed by the negative political connotations attached to a tax. Now the same negativity has been attached to cap-and-trade policies. However, the current undesirability of these labels does not diminish the value of regulatory policies that place a price on carbon, and suitable relabeling of these policies (such as "deficit reduction policies") may give them new life. Parry and Williams revisit the carbon tax idea with an eye toward the importance of recycling the revenue to improve the performance of the U.S. tax system and address deficits.

Regardless of the policy path taken to reduce domestic GHG emissions, the economist's mantra that there is "no free lunch" means someone will the bear the cost of these reductions. Morgenstern considers how regulation of the nation's electricity generation sector under CAA will inevitably lead to higher electricity prices, negatively impacting energy-intensive, trade-exposed industries. Importantly, he examines the flexibility within the act to mitigate the impact of the regulations on these particular industries.

At the same time President Obama pledged to reduce GHG emissions, he promised that the United States would provide financial aid to poor countries to help them "green" their energy sectors and adapt to a changing climate. This commitment too was based on the comprehensive climate legislation passed by the House containing provisions by which the purchase of carbon offset credits would result in billions of private-sector dollars flowing to developing countries. Purvis considers the diplomatic fallout of the likely failure to meet that financing pledge due to the demise of the House-passed legislation, and the need to develop alternative sources of finance in order to keep important international climate negotiations moving forward.

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Cleaner Electricity and Less of It:

The Prospects for Reducing CO_2 Emissions by Requiring Renewables and Energy Efficiency

Karen L. Palmer

The Senate's failure to pass comprehensive cap-and-trade legislation for greenhouse gases during the last session of Congress and the ongoing skirmishing about climate policy this election season are clear signs that a federal policy that imposes a price on emissions of carbon dioxide (CO_2) will not be enacted anytime soon. This change in course on the policy front introduces a fair amount of uncertainty about how many emissions reductions can be achieved using a collection of more targeted strategies instead of imposing a comprehensive emissions cap and at what cost.

For example, the climate legislation that passed the House in 2009, the Waxman-Markey bill, promised a 17 percent reduction in CO_2 emissions below 2005 levels by 2020. Will it be possible to achieve cuts like these using alternative measures, such as policies to promote renewables and energy efficiency? The answer to this question depends on what types of policies are adopted, specific aspects of their design, and the context in which they are implemented, including what other policies are included in the mix.

Much like the devil, the tons of carbon and the amount of dollars necessary to obtain them are in the details of these policies.

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Renewables Policies

In the United States, two of the main policy approaches to encouraging greater use of renewable sources of electricity are tax incentives at the federal level and renewable portfolio standards (RPS), also known as renewable electricity standards (RES), which have been enacted in 29 states and the District of Columbia. For new renewable generators brought online between 2009 and the end of 2013 (2012 for wind), the federal production tax credit policy provides a 2.1 cent tax credit for every kilowatt-hour (kWh) generated using wind, geothermal, and closed loop biomass, and a 1.1 cent per kWh tax credit for other nonhydro renewables (not including solar, which is eligible for an investment tax credit). The production tax credit applies to all generation during the first 10 years of operation.

The RPS works by requiring that a minimum percentage of electricity generation (or sales within the state be supplied by qualified renewables) increases and that percentage increases over time. (The set of qualified renewables and the minimum percentage vary across states.) It is typically implemented through the use of renewable energy credits, or RECs, that are created whenever a kWh of electricity is generated by a qualified renewable electricity generator. In several states, RECs are tradable within the state and RECs from other states may also be allowed. Some states also include an alternative compliance payment, which acts as a ceiling on the price of RECs and helps contain the cost of the policy, but could also limit its effectiveness in encouraging renewable electricity investment.

In general, an RPS is less effective than cap and trade or any policy that prices CO_2 directly because it does not differentiate among nonrenewable technologies based on CO_2 intensity. The RPS basically imposes a tax on all the kWh generated using nonrenewables that are included in the basis, but this tax is the same for a kWh produced with natural gas, nuclear, and coal despite their very different CO_2 emissions impacts. The RPS also tends not to have a big effect on electricity price in those regions where electricity is priced competitively. Unlike a cap-and-trade policy, it does little to encourage

technologies beyond renewables—such as incremental nuclear and fossil technologies with carbon capture and storage—will lower the cost per ton, but will also lower the likely emissions reductions unless the minimum targets are increased substantially.

Energy Efficiency

There is little doubt that investments in more energy-efficient technologies for lighting, air-conditioning, refrigeration, and other energy services could reduce CO_2 emissions and reduce consumers' energy bills, all else being equal. The explanations for why these investments are not being made today include the possibility that their true costs may be higher than suggested by engineering studies, households and businesses have other investment options that promise a higher return, or consumers don't have good information about these opportunities and misperceive or miscalculate the net benefits. The difference between the energy efficiency level that exists and what could be achieved with these cost-effective investments is known as the "efficiency gap."

electricity conservation. This lack of price effect should not be interpreted as a lack of cost because RPS policies do impose costs, which typically will be passed on to consumers in regulated regions. But in competitive regions, much of the cost is born by generators that will see their profits fall as a result.

Much like the devil, the tons of carbon and the amount of dollars necessary to obtain them are in the details of these policies.

RFF research suggests that a federal RPS will yield substantially lower CO_2 emissions reductions than recent cap-and-trade proposals, and the cost per ton of CO_2 reduced will be between 15 and 60 percent higher than the cost per ton for a cap-and-trade policy, depending on how the RPS policy is designed. If the alternative compliance payment is binding, raising it will yield additional emissions reductions. Expanding the scope of the portfolio standard to include a broader range of clean energy

A number of policies designed to close this efficiency gap have been implemented at various levels of government, including federal and state minimum efficiency standards for appliances, state and local building codes, mandatory energy efficiency labels, programs that identify and label energy efficient choices for consumers (Energy Star), low-cost financing for energy efficiency investments, and incentives for purchase of efficient appliances.

Energy efficiency provisions in the climate bills and other pieces of federal energy legislation would expand the use of appliance standards and building codes, and provide greater financial incentives for end-user investments in energy efficiency. A policy approach that a number of states are taking, which has been suggested at the federal level as well, is an energy efficiency resource standard (EERS). Similar to an RPS, an EERS requires that electricity retailers and, in some cases, natural gas distributors, provide evidence of energy savings from efficiency programs and investments equal to a minimum percentage of total electricity (or natural gas) sales in a particular year. This policy could also be implemented through the creation of energy efficiency credits (EECs) that could be traded.

The challenges raised by this type of policy are numerous and include evaluating how effective it will be in yielding energy savings and emissions reductions are numerous. Chief among them is identifying the appropriate baseline level of energy consumption against which savings are to be measured. Additional challenges include the following:

- How should the savings produced by other policies and programs such as appliance standards and building codes be treated in the calculation of savings attributable to the EERS?
- What are the appropriate ways to translate measures of gross energy savings suggested by efficient appliance purchases or participation in rebate programs into net energy savings that are truly attributable to the policy measure?
- How will regional differences in energy savings due to largely weather-related differences in energy service demand and efficiency of the current capital stock be handled in a federal program?

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Other factors that make quantitative analysis difficult include possible rebound effects due to lower costs of energy services and potential spillover effects that reduce electricity consumption for those consumers not participating in the program. Estimating the emissions reductions will also depend on what types of generation are being displaced by the efficiency investments. As the targets for state-level renewables programs get more ambitious, a growing portion of the energy that is displaced could be from renewables, which would diminish their emissions-reducing potential. Moreover, to the extent that standards for greenhouse gas emissions under the Clean Air Act reduce emissions from existing and new fossil generators, they will also lower the emissions that would be displaced by energy efficiency policies.

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Combined Renewable and Efficiency Standards

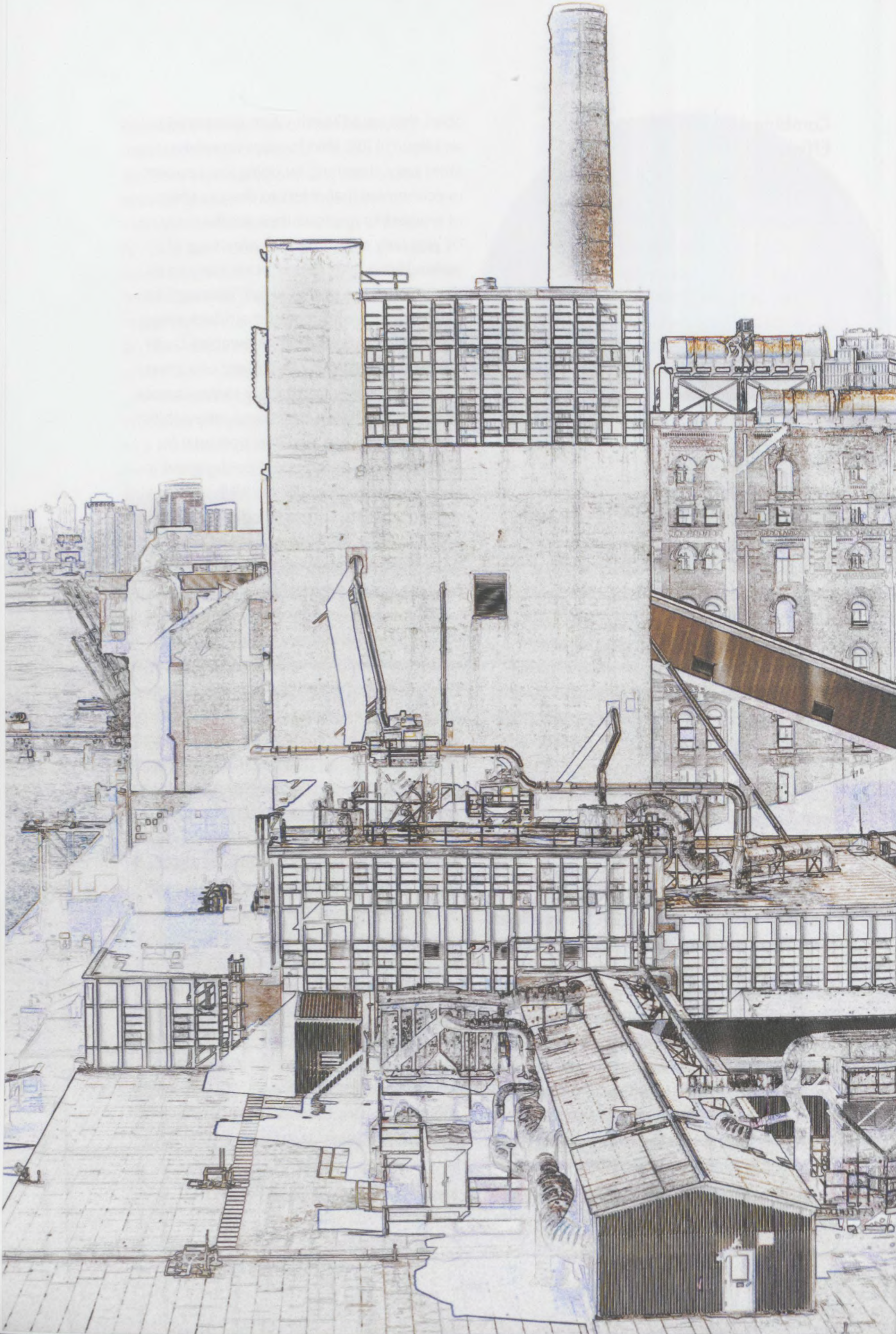
Most of the recent federal legislative proposals to promote cleaner sources of electricity link RPS and EERS policies. For example, the Renewable Energy Promotion Act of 2010, proposed in September 2010 by Senators Bingaman (D-WY) and Brownback (R-KS), incorporates energy efficiency into the RPS by allowing for just over 25 percent of the renewables standard to be met by savings from certain energy efficiency programs, including incentive and information programs operated by utilities or state efficiency agencies.

Linking policies in this way increases flexibility in how utilities can comply, and therefore presumably lowers costs and increases political acceptability. But that flexibility is also the source of uncertainty about the future value of RECs, which are an important source of income for renewables developers. Up until now, the energy savings associated with efficiency programs, which are understandably hard to quantify, have not had a direct effect on the market price of RECs. Under a linked policy, renewables developers will be wary of competing with energy efficiency programs that could generate large amounts of credits and insist on strict verification.

Bringing more parties to the table raises the likelihood that the energy savings attributed to a particular efficiency program are real. However, it also might complicate and delay the process of assigning net electricity savings to particular investments, which could offset some of the anticipated cost savings of a combined policy. Much will also depend on which efficiency measures are part of the EERS policy and which are incorporated into the baseline.

Bundling renewables and efficiency into a single standard also limits the extent of technological "learning by doing" for renewables that could result when compared to an identical RPS that focuses on renewables only. (Learning by doing is a concept in economics that refers to the capability of workers to improve their productivity by regularly repeating the same type of action.) How large this effect is likely to be depends on the potential for "learning" to yield reductions in cost of manufacturing, installing, and operating renewables facilities. This potential is the subject of a great deal of uncertainty and likely to vary across different technologies. If some renewables technologies have a greater potential for "learning," the policy could be designed to give more than one REC per kWh to those technologies for some period of time in order to encourage their use relative to the more mature and lower-cost renewables typically favored by an RPS.

The mix of electricity savings from energy efficiency and electricity generation from renewables induced by a combined policy will depend in part on the incentives that state regulators provide for utilities to invest in energy efficiency. Typically, revenues and profits of regulated utilities selling electricity distribution services increase with electricity sales. When this is the case, utilities have a disincentive to invest in efficiency. To mitigate this disincentive, measures to decouple revenues from sales have been enacted in a number of states. Some states have gone even further to provide incentive payments for utilities that can demonstrate certain levels of energy savings attributable to efficiency programs. Measurement difficulties aside, having these types of policies in place should increase not only the willingness of utilities to invest in energy savings but also the relative contribution of energy efficiency to these combined standards.



The Return of an Old and Battle-Tested Friend,

The Clean Air Act

Nathan Richardson, Arthur Fraas, and Dallas Burtraw

Until recently, it has been widely assumed that U.S. action on climate change would come, if at all, through new legislation—most likely by pricing carbon within a broad cap-and-trade system. While almost all economists and policy experts still agree that legislation remains the best long-term option, it has become increasingly likely that in the near future the regulatory vehicle for carbon emissions will be an old friend: the Clean Air Act.

The act is a battle-tested law: its predecessors were passed in 1963 and 1967 before substantial revision and expansion led to its modern form under Richard Nixon in 1970. Important further amendments followed in 1977 and again in 1990. So why is it being applied to greenhouse gas emissions only now? And why has its use moved to the forefront of the policy debate on climate change?

The wheels of justice (and government) grind slowly, as it turns out. It was only in 2007 that the Supreme Court held in *Massachusetts v. Environmental Protection Agency* (EPA) that greenhouse gases were included in the act's definition of "pollutants." Before this decision, it was unclear whether carbon could be regulated under the act at all—the Bush-era EPA had argued that it could not be, and that new legislation would be necessary. The effects of this decision have taken some time to percolate through EPA's regulatory apparatus and the policy community in general.

While the Bush-era EPA did important preparatory work, it did not move to regulate carbon under any part of the act. Now, under the Obama administration, EPA has moved relatively quickly to bring the act to bear on greenhouse gas emissions. The agency issued an "endangerment finding"

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for greenhouse gases, which legally established that greenhouse gas emissions threaten public health and welfare, a crucial first step. This finding formed the basis for the agency's first carbon regulation under the act—new emissions standards for cars and trucks issued in March 2010. Although these moves focused on transportation-sector emissions, they commit EPA to regulate stationary sources (power plants and industrial facilities) as well.

At the same time, continuing congressional inertia means that there is no new comprehensive climate legislation. While new legislation would almost surely supersede and preempt at least some aspects of existing EPA authority, the current lack of action leaves regulation under the Clean Air Act (CAA) as the inevitable alternative.

The result is that, at least over the short term, continued EPA moves to regulate carbon emissions under the act are likely. What that means in practice is only partly clear. The 2010 rules for cars and trucks show the agency's plans for the transportation sector. Indeed, the transportation standards that will take effect over the 2012 to 2016 period would be, if implemented today, among the most stringent such standards in the world. EPA has also clarified the timing for consideration of greenhouse gas emissions in the CAA permit process for all new stationary sources (and those undergoing major upgrades), but how this ultimately will be implemented is still uncertain. Under the act, major sources are nominally defined as sources emitting greater than 100 tons per year, if the sources are associated with listed manufacturing source categories, or 250 tons per year otherwise. If this permitting process emerges as superficially required by the CAA, permits could be required for even very small emitters of greenhouse gases, likely including tens of thousands to millions of facilities that cumulatively account for a very small portion of emissions and have not been subject to Clean Air Act permitting processes in the past.

To avoid this conundrum and improve the cost-effectiveness of permitting, EPA issued a rule to "tailor" the process—meaning that only large emitters would be affected, at least initially—but this approach is legally questionable. This tailoring rule has been challenged in court by some of the states that would be required to implement it and by firms that could be subject to the permitting process, though it is likely to enter into effect while that litigation is resolved. In addition, as a part of this process, the CAA requires that permits include controls based on a determination of the "best available control technology." It is unclear what such technology would be for greenhouse gas emissions. EPA has only just recently released guidelines for this determination.

Even greater uncertainty exists about how EPA would regulate other existing stationary emissions sources—that is, the large fraction of existing sources that are not being modified. How the agency chooses to do so is the

The best and most likely CAA mechanism seems to be sectoral performance standards under the New Source Performance Standards (NSPS) program—which, confusingly, also applies to existing emissions sources.

largest unanswered question in this area, not least because these existing sources account for the majority of U.S. carbon emissions. EPA has a variety of tools available under the Clean Air Act, including setting a national air quality standard (the approach used for major traditional pollutants such as particulate matter and nitrogen oxides) or treating carbon as a hazardous pollutant (as is done for mercury, for example). Most of these approaches have significant legal and/or practical problems, however.

The best and most likely CAA mechanism seems to be sectoral performance standards under the New Source Performance Standards (NSPS) program—which, confusingly, also applies to existing emissions sources. States would assume the primary implementation and enforcement role for existing sources under this program. Traditionally, these performance standards are technology-based, but the act appears to be sufficiently flexible for EPA to incorporate market-oriented mechanisms.

At RFF, we have analyzed how EPA might use performance standards to regulate carbon emissions from one sector, coal power plants. Preliminary studies by EPA and the U.S. Department of Energy indicate relatively accessible emissions reduction opportunities from coal in the form of power-plant efficiency improvements and cofiring of biomass with coal. Traditional technology-based performance standards would allow EPA to require efficiency improvements. But market tools would allow the agency to reach these opportunities and those from biomass cofiring in a more cost-effective way.

For example, EPA could implement an emissions efficiency-based performance standard, but allow plants to trade their progress toward that standard. Plants that could readily become more efficient or that could cofire biomass could sell credits to plants for which such actions would be more expensive. EPA might also generate a cap-and-trade system for coal plants

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(and other categories of emissions sources) that would generate similar incentives.

Our analysis indicates that CAA regulation of the coal sector could result in emissions reductions of between 5 and 10 percent, equivalent to up to about 3 percent of total U.S. emissions, without changing the level of electricity generation. This is not a large number, but it is not trivial either. It represents a significant portion of the reductions expected from coal-fired power plants under the "17 percent by 2020" goal articulated by President Obama in his pre-Copenhagen announcement and the House of Representatives in the Waxman-Markey bill.

And these gains are only from one technology in one sector—CAA regulation of other technologies and sectors could achieve additional reductions. Others at RFF and elsewhere are studying the emissions reductions that might be possible from Clean Air Act regulation of other sectors, such as cement manufacture and petroleum refining. Achieving these reductions will require EPA to move beyond the permitting process it is currently implementing through the states to a more far-reaching and cost-effective focus on sectoral performance standards.

A good case can be made that the Clean Air Act—if used wisely by EPA—can be an important vehicle for short-term greenhouse gas regulation.

Although our evaluation does not yet estimate costs, there is reason to believe that such modest regulation would have modest costs. Because efficiency improvements and biomass cofiring would very likely be among the first moves made by coal plants under a carbon price (implemented, presumably, under new legislation), it is unlikely that requiring these moves through regulation would result in comparatively higher costs.

Bold Action Needed

Any enthusiasm about the Clean Air Act as a vehicle for carbon regulation should be tempered, however. First, achieving meaningful emissions benefits at reasonable cost, as our research suggests is possible, requires EPA to be bold. The agency must interpret sections of the act to enable use of trading mechanisms, must be ambitious in setting emissions targets, and must shift its focus to a new regulatory program. In short, to do all of this well, the agency will need to innovate. For an agency scarred by defeats in recent court battles, there may

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be little appetite for such ambition, though we can hope EPA will find new courage, not only to regulate but to do so intelligently.

Second, EPA action under the act is a clear second-best option to new legislation from Congress, especially over the long term. While it is possible to identify some readily available opportunities for emissions reductions and push them via regulation (with market tools to keep costs down), it quickly becomes difficult to identify what steps should be taken next. A carbon price (either cap and trade or a carbon tax) created by legislation would allow the market to make these decisions. Comprehensive climate legislation could also establish a uniform carbon price across sectors, provide for international offsets, create greater opportunities for innovation, and include other cost-saving mechanisms that the Clean Air Act cannot provide.

Congress can also make political trade-offs between different parties that stand to lose or gain from carbon regulation, can take measures to protect trade-exposed industries, and can be bold without inviting litigation. It will be difficult for EPA to do any of these things with the tools it already has.

With those reservations, however, a good case can be made that the Clean Air Act—if used wisely by EPA—can be an important vehicle for short-term greenhouse gas regulation. Given the inertia in Congress, that is good news. Not everyone agrees, of course—members of Congress from both parties have introduced measures to permanently or temporarily block EPA action on carbon under the act. But none of these proposals has succeeded, and even if one were to pass in Congress, the president would likely veto it. Until and unless this changes, or Congress passes climate legislation, the Clean Air Act can be effective in the short term. Moreover, it is the tool we have at hand and, because it is the law, a tool we are compelled to use.

Can a Stew of **Power Generation Regulations** *Clear the Air?*

Arthur Fraas and Randall Lutter

The U.S. Environmental Protection Agency's activities to reduce carbon emissions under the Clean Air Act have attracted significant interest, but the agency's work developing and issuing a stew of major rules to reduce conventional pollutants, including sulfur dioxide (SO_2) and nitrogen oxides (NO_x), merits much more attention. The reason is they may cost the electric utility sector in general, and coal-fired plants in particular, tens of billions of dollars per year.

With this collection of rules, utilities will likely be required to install costly new emissions control equipment over the next five years, significantly raising the cost of generating electricity from the coal-fired units currently operating without flue gas desulfurization controls for SO_2 emissions or synthetic catalytic reduction (SCR) units for control of NO_x, roughly one-third of plants in EPA's base case. These two control systems can achieve state-of-the-art control of SO_2 and NO_x, reducing emissions by greater than 90 percent. This increase in control costs may render a significant fraction of this generation capacity uneconomic and force its retirement from the coal-fired fleet.

EPA is moving forward with these rules in response to a set of independent and unrelated court decisions, settlement agreements, and statutory requirements. As a result, the proposed rules appear not to be ordered or coordinated in a manner that reflects a deliberate consideration of how to achieve the greatest environmental improvement for a given regulatory burden. A more coordinated grand bargain—including a program to limit greenhouse gas emissions—may achieve comparable emissions reductions with lower net costs and smaller increases in electricity prices.

What follows is the stew recipe—a complicated chronology of ongoing and forthcoming rulemaking.

Ongoing Regulations

This August, EPA published its proposed Federal Transport Rule as a replacement to the Clean Air Interstate Rule (CAIR). The 2005 CAIR established a regional cap-and-trade program to reduce electric utility SO_2 and NO_x emissions in the eastern United States. In 2008, the DC Circuit remanded CAIR to EPA, requiring the agency to replace the rule with a new one that would repair the significant CAIR flaws identified by the court. The proposed transport rule would significantly limit trading and banking (as compared to CAIR) and advance by one year the second phase SO_2 and NO_x emissions caps.

The effect of these changes will be to force a faster reduction of SO_2 and NO_x emissions as compared to CAIR, reducing the generation of coal-fired electricity in 2012 and beyond. The regulatory impact analysis accompanying the proposal estimates that the proposed transport rule will have only a modest effect on coal-fired electricity generation. The regulatory impact analysis projects that the transport rule will render 1.2 gigawatts (GW) of coal-fired capacity as uneconomic and reduce carbon dioxide (CO_2) emissions by 15.2 million tons in 2014 (versus EPA's projected emissions for its 2014 base case).

EPA, however, may have to further tighten the transport rule to meet a new National Ambient Air Quality Standard (NAAQS) for ozone, which is expected to issue in final form before the end of this year. On January 19, 2010, based on its reconsideration of the NAAQS for ozone set equal to .075 parts per million (ppm) in March 2008, EPA proposed an ozone NAAQS to protect public health "within the range of .060 ppm to .070 ppm."

A more stringent standard for the ozone NAAQS would likely require EPA to revise the NO_x emissions caps in its transport rulemaking. In fact, the proposed rule discusses the possibility of further revisions, as follows: "For future ozone and $PM_{2.5}$ NAAQS, EPA intends to quantify the emissions reductions needed to satisfy the requirements of 110(a)(2)(D)(i)(I) with respect to those NAAQS." (75 FR 45300).

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EPA also plans to issue a National Emissions Standard for Hazardous Air Pollutants (NESHAP) for coal- and oil-fired electric utility steam-generating units. EPA published a final rule requiring reductions in emissions of mercury from electric generating units (EGUs) in May 2005. The DC Circuit Court vacated that rule in 2008, requiring EPA instead to issue regulations of coal- or oil-fired EGUs under the Section 112 air toxics provisions of the Clean Air Act (CAA).

EPA plans to issue a proposal in March 2011 and a final rule by the end of that year. A stringent air toxics rule could result in the retirement of a number of older coal-fired power plants. Earlier this year, EPA proposed a NESHAP for industrial boilers that would establish stringent emissions standards for acid gases, a requirement that would require the installation of specific scrubbers for boilers lacking such controls. ("Acid gases" refers to the hydrogen chloride, hydrogen fluoride, and other gases that are formed in the combustion of fossil fuels.)

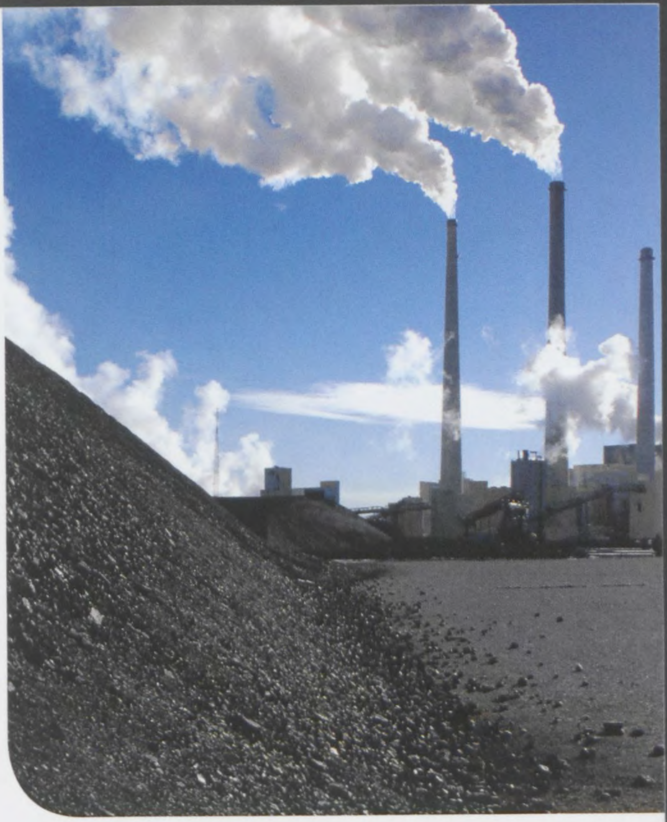
If EPA were to adopt similar requirements for coal-fired EGUs, electric utilities would likely retire a significant number of older coal-fired plants—roughly one-third of coal-fired plants do not have acid gas scrubber controls in place—rather than install the very expensive flue gas desulfurization scrubbers. In addition, this rulemaking may establish very stringent particulate matter (PM) limits (as a surrogate for the control of metals emissions) requiring an additional commitment of capital at coal-fired units that must replace or augment existing electrostatic precipitator equipment with bag houses.

Finally, EPA is reviewing the NAAQS for particulate matter. Under the CAA, EPA is required to review and, if appropriate, revise the NAAQS standards every five years. On October 17, 2006, EPA published its final rule revising the particulate matter NAAQS for the 24-hour fine PM standard, leaving in place the annual fine PM standard of 15 micrograms per cubic meter ($\mu g/m^3$), issued in 1997. EPA initiated its current round of NAAQS reviews in 2007 and plans to issue a proposal on whether to retain or revise the NAAQS for particulate matter by the end of this year, with a final determination and rule by September 2011. A final rule revising the NAAQS for particulate matter (by adopting a standard more stringent than the current

A Complicated Chronology

RULE	PROPOSED	FINAL
Transport Rule	July 2, 2010	April 2011
Ozone NAAQS Reconsideration	January 19, 2010	December 2010
Particulate Matter NAAQS	January 2011	October 2011
Air Toxics Maximum Achievable Control Technology (MACT)	March 2011	January 2012
Cooling Water Intake	January 2011	July 2012
Coal Combustion Waste	June 21, 2010	July 2011

Source: US EPA, Semi-annual Regulatory Agenda, Spring 2010.



annual standard of 15 μg/m^3 or the current 24-hour standard of 35 μg/m^3) would likely require the SO_2 and NO_x annual emissions caps to be tightened further in the upcoming transport rule.

In addition to these CAA rules, EPA is developing other major rules affecting coal-fired power plants. One would list coal ash as a hazardous waste under the Resource Conservation and Recovery Act and likely impose significant additional costs on the disposal of fly and bottom ash and scrubber sludge from coal-fired units. Another would establish new requirements for cooling water intake structures—potentially requiring cooling towers at all electric utility plants—under Section 316(b) of the Clean Water Act.

Missing from this stew, but not from the kitchen pantry, is a regulation setting new efficiency standards to control greenhouse gas emissions under the CAA. As discussed elsewhere in this volume, EPA has authority to issue such a regulation but has not yet proposed it.

A Legislative Bargain

While this is not a complete list of pending rules affecting coal-fired power generators, it is easy to see how pending regulatory actions complicate investment planning by utilities. Given the uncertain future of congressional and EPA efforts to regulate carbon emissions from EGUs, electric utilities are at a financial crossroads, having to choose whether to make the investments required by this array of prospective rules, may given the potential that they become "stranded" by future carbon regulations or, alternatively, to retire these coal-fired EGUs and replace them with other power sources.

In a recent report, the North American Electric Reliability Corporation (NERC) projected that four of these upcoming EPA rules—the transport rule, the (NESHAP) air toxics rule, the Section 316(b) cooling water rule, and the coal combustion waste rule—could force the retirement of roughly 50 (or more) GW of electric generating capacity. (NERC is an international regulatory authority established to evaluate reliability of the bulk power system in North America.) Given the potential magnitude of these retirements on the reliability of the electricity supply system, NERC emphasized the importance of a coordinated effort by the industry and EPA, FERC, DOE, and the state regulators to moderate the impacts on the bulk power system.

A grand bargain, including a program limiting greenhouse gas emissions from the electric utility sector, would set out a reasonable and certain regulatory path over the next decade. This legislative bargain—a simpler recipe—could resolve the complicated decisions arising from the array of requirements facing the electric utility industry under the current environmental statutes, as interpreted by the agency and the courts. And the nation could benefit by achieving substantial, beneficial emissions reductions at significantly less cost. •

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Smog envelops the horizon as vehicles crawl in traffic along a major road in Beijing.

International Climate Finance

The New Reason for Global Climate Gridlock

Global climate negotiations have been deadlocked for 20 years, but now there's a new barrier to overcome that unfortunately may prove just as troublesome as the old impediments to progress. The United States has been in the international doghouse for a long time because of our failure to reduce our own greenhouse gas emissions. Our outlier status is not likely to change in the years ahead for an additional reason—our reluctance to help emerging economies finance their climate measures.

Nigel Purvis

Climate Diplomacy until Today

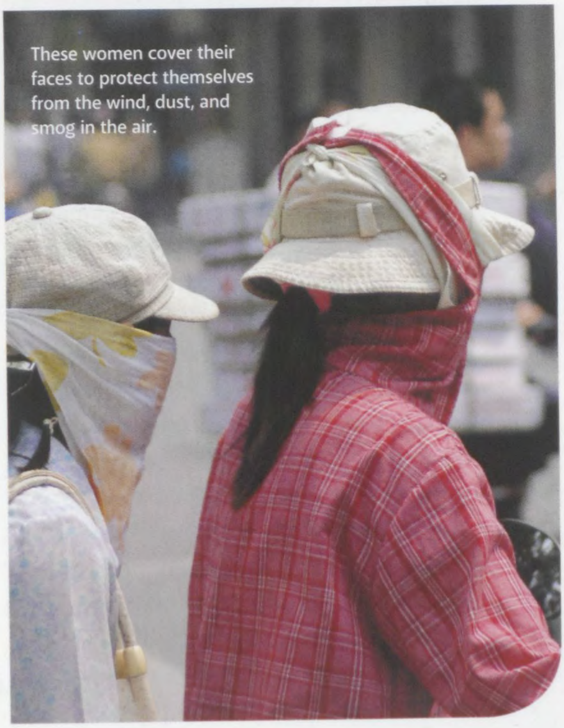
For the past two decades, developed and developing countries have argued about which nations should mitigate climate emissions. On one hand, China, India, and other emerging economies declined to commit to slow the growth of their emissions prior to dramatic emissions reductions by the United States and other developed nations. On the other hand, the United States refused to take action absent simultaneous emissions abatement commitments from major emerging economies. A decade ago most of the world (but not the United States) accepted the developing country position and enshrined it in the controversial 1997 Kyoto treaty, which asked developed nations alone to modestly reduce emissions (an average of 5 percent below 1990 levels).

In the run-up to the news-making Copenhagen climate summit last December, there were many reasons for optimism about the prospects for a new global compact that would involve action by all major economies and thus move beyond the original Kyoto-era divide. A comprehensive climate and energy bill passed the U.S. House of Representatives that, if enacted into law, would have created the foundation for U.S. global leadership. In addition, Brazil, China, India, Indonesia, and most other major emerging economies announced new clean energy or emissions abatement targets prior to Copenhagen.

While far from perfect, global diplomacy produced the Copenhagen Accord and a new roadmap for global action. The world's major economies, including all major emerging economies, agreed to take action. They also agreed to report transparently on their progress and to participate in a new international consultation process to promote trust and accountability. President Obama committed the United States to reduce its emissions in the range of 17 percent from 2005 levels by 2020. Other major economies also made nationally appropriate mitigation pledges.

Under the Copenhagen Accord, developed countries agreed to help finance climate actions in developing nations. They pledged to provide $30 billion in foreign aid by the end of 2012 and to mobilize $100 billion a year from public and private sources by 2020. International climate finance is an essential part of a climate solution because historic responsibility and financial capacity point primarily to developed nations, whereas low-cost emissions reductions and climate vulnerability are primarily in developing nations. Financial flows between rich and poor nations are critically needed to make sure solutions are both fair and cost-effective.

The International Energy Agency expects that well over 90 percent of the growth in greenhouse gas emissions over the next several decades will take place in developing countries, with trillions of dollars set



These women cover their faces to protect themselves from the wind, dust, and smog in the air.

Left: Corbis, Right: iStockphoto

to be invested in new energy sources and infrastructure. Without billions of dollars per year in financial support to "green" these investments, the world will likely fail to reach agreement on mitigation targets. Financial incentives are also needed to help developing nations reduce deforestation, which accounts for about 15 percent of global greenhouse gas emissions, and to help protect vulnerable countries from potentially devastating and destabilizing climate impacts.

And without adequate international assistance, developing nations will simply do less than the world needs of them. This is basic economics: the world's climate is a global public good, and incentives and collective action are required for real solutions.

Storm Clouds Ahead for Climate Diplomacy?

Following the collapse of climate and energy legislation in the U.S. Senate, some climate and foreign policy experts are wondering aloud whether the Copenhagen Accord framework is stillborn. Robust U.S. emissions mitigation in the months ahead is unlikely given the outcome of the midterm elections, growing opposition to government regulation, high unemployment rates, and skyrocketing budget deficits. Even climate policy optimists envision only incremental progress on clean energy policy.

Many experts predict that the U.S. political environment will have a chilling effect on climate actions by other nations. With this backdrop, expectations for the December climate summit in Cancun, Mexico, are exceptionally modest. The best-case scenario seems to be agreement on UN text that merely restates the Copenhagen Accord and makes incremental progress toward the creation of implementing mechanisms, such as a new "Green Fund." If the negotiations break down (always a possibility), expect governments, advocates, and the media to point the finger of blame toward Congress and its refusal to regulate U.S. emissions.

But taking a slightly longer view, however, the outlook for global climate diplomacy may look somewhat different, although perhaps equally troubling. The collapse of comprehensive climate legislation in the United States may well have a negative impact on climate diplomacy but not for the reason being given. This is because on emissions mitigation the situation is not as dire as it may appear. The United States still has a number of potentially significant tools for reducing its emissions, including regulating greenhouse gases under the Clean Air Act, state- and regional-level cap-and-trade programs, and federal and state clean energy policies, such as renewable portfolio standards and efficiency standards for appliances and automobiles.

The consensus of researchers at RFF and the World Resources Institute (WRI) has been that the United States would achieve reductions in the range of 10 to 14 percent below 2005 levels by 2020 if these mechanisms were deployed in a robust manner. In 2020, the difference between these potential "plan B" outcomes and the 17 percent reduction President Obama pledged in Copenhagen may not be so large (in either political or environmental terms) as to derail global climate cooperation. Also, Congress might yet enact a comprehensive climate bill this decade. Given the unpredictability of U.S. and global events, accurately predicting what will happen in 2013 or 2015 on domestic climate policy is almost impossible.

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In contrast, the United States now has no real strategy for mobilizing public and private finance to support climate actions in developing nations at the level envisioned by the Copenhagen Accord. Had the Senate approved the climate bill that passed the House, the legislation would mobilize $10 billion to $15 billion a year in 2020 for climate actions in developing nations—a sum that begins to approach the U.S. share of the $100 billion a year promised in the Copenhagen Accord. (The Senate bill would have set aside a portion of new revenues from the auctioning of emissions permits to industry and created financial incentives for polluters to invest in emissions mitigation activities overseas.)

Mobilizing similar sums under the Clean Air Act, automobile efficiency standards, and other incremental energy policies, however, would be challenging and unprecedented. Stated simply, the United States has no "plan B" on climate finance.

Stated simply, the United States has no "plan B" on climate finance.

In view of this, developing nations and climate advocates are pressing donor nations to find what they are calling "innovative sources" for climate finance. Earlier this year, UN Secretary General Ban Ki Moon appointed a high-level advisory group on this subject, chaired by Prime Ministers Meles Zenawi of Ethiopia and Jens Stoltenberg of Norway. That group and others are evaluating several options including redirecting fossil-fuel subsidies, levying fees on international aviation and shipping, charging fees on certain financial transactions, and "greening" multilateral energy-sector lending by the major development banks.

Expect little agreement among countries on such ideas anytime soon. Indeed, neither the UN report on climate finance nor the upcoming Cancun negotiations are likely to provide a clear political narrative about how to pay for climate action in developing nations, what the money should be used for, what these investments would achieve in any concrete way, when any new funding sources would start, or how decisions on these and other critical climate finance issues will be made.

Answers to these questions are urgently needed to keep the Copenhagen framework from unraveling. This will take time in today's fractious political environment. But make no mistake: international climate finance is moving to center stage. In the years ahead the world will measure U.S. leadership on climate change not just by what our nation does domestically, but also by what role we play in mobilizing the financial resources needed to create a fair and cost-effective global solution.

Is a Carbon Tax *the Only Good* Climate Policy?

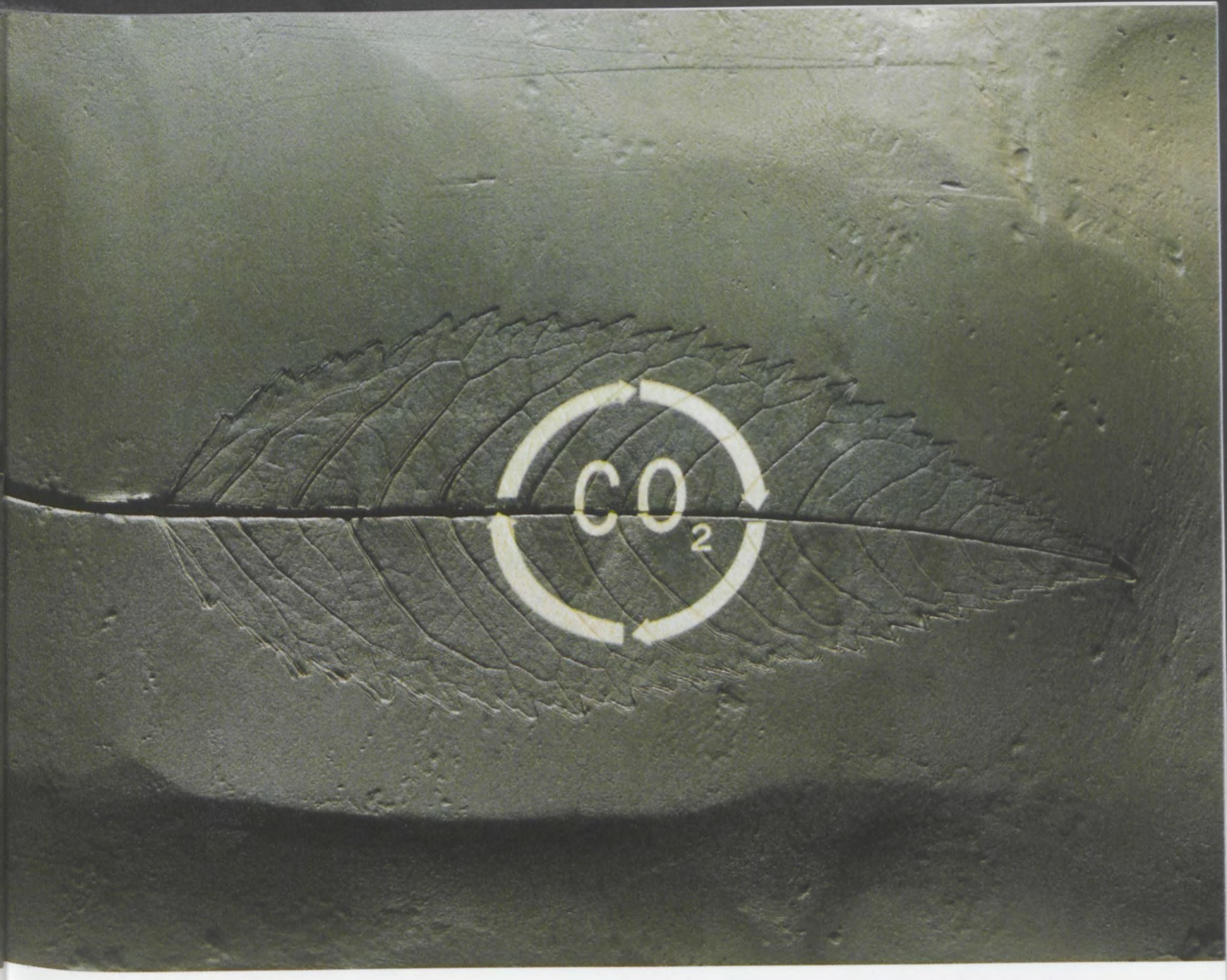
Options to Cut CO_2 Emissions

Ian W.H. Parry and Roberton C. Williams III

Congress's failure to pass comprehensive climate legislation provides an opportune time to reconsider the main options for initiating a major program to cut domestic carbon dioxide (CO_2) emissions. Cap and trade is still on the table. So too is a carbon tax, especially as policymakers grapple with how to address large federal budget deficits. A third possibility is a regulatory approach, such as a CO_2 per kilowatt-hour standard for the power sector. This last option has a weaker effect on energy prices and in this regard might be politically attractive because, unlike a carbon tax or cap and trade, it does not involve the pass-through of tax revenue or allowance value into fuel and electricity prices.

Economywide, market-based approaches have a cost advantage because placing a price on CO_2 exploits all emissions reduction opportunities across the economy. In contrast, an emissions standard would promote fuel switching in the power sector (replacing coal plants with natural gas, renewables, and nuclear) but have little or no effect on electricity conservation or reductions in other sectors.

However, economic analysis (much of it done at RFF) demonstrates that the costs of new climate policies also depend on their interactions with preexisting sources of distortion in the economy that are created by the broader fiscal system. Once these interactions are accounted for, the only sound policy on economic grounds seems to be a carbon tax with revenues substituting for tax increases that would otherwise be needed to finance the government's budget. In fact, cap-and-trade systems, of the sort envisioned in recent climate bills, appear to perform especially poorly on cost-effectiveness grounds. Why is this?



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Tax Distortions: Three Key Lessons for Instrument Choice

The U.S. tax system distorts economic behavior in a variety of ways. To explain why, we turn to some basic economic theory. Taxes on labor income (such as income and payroll taxes) reduce the rewards to working and thereby reduce labor force participation, effort on the job, investment in human capital, and so on below levels that would maximize economic efficiency. Taxes on business income and household savings reduce incentives for capital accumulation. And a variety of tax exemptions and deductions distort the composition of goods produced by encouraging too much spending on, for example, medical insurance and owner-occupied housing.

These sources of distortions have three important implications for the choice of climate policy instruments.

A carbon tax, with revenues used to substitute for other distortionary taxes in the fiscal system, has a substantial cost advantage over cap-and-trade systems.

This is because cutting other taxes can produce gains in economic efficiency that are relatively large in magnitude, by (slightly) increasing employment, investment, and the bias toward tax-favored spending.

According to our estimates, a carbon tax of about \$30 per ton of CO_2 in 2020 (in current dollars) would cut domestic, energy-related CO_2 emissions in that year by about 8.5 percent and raise revenue of about \$150 billion, or 30 percent of the projected federal budget deficit for that year. If this revenue is used to substitute for income taxes, we estimate the annual cost saving would be about \$50 billion, compared with an equivalently scaled cap-and-trade program. In fact, with revenue "recycling," the overall costs of carbon taxes are modest, and perhaps even slightly negative.

Of course, cap-and-trade systems could also generate the same benefit if all the allowances were auctioned and the proceeds transferred to the U.S. Treasury, but this seems unlikely in practice. (In existing proposals, allowance proceeds are largely used for compensation programs.) Moreover, there seems little point in designing an elaborate cap-and-trade program if its only purpose is to mimic the effect of a simpler carbon tax.

be $15 billion a year in 2020, about a third of the cost of an economy-wide cap-and-trade system, although still substantially higher than the cost of a carbon tax with revenue recycling.

Proposed cap-and-trade systems may not pass a standard cost-benefit analysis.

A large interagency task force has recently come up with recommended values to be used in cost-benefit analysis for the social cost of carbon—that is, the global benefits from reduced future climate change associated with one less ton of CO_2 emissions.

For CO_2 emissions in 2020, an interagency task force recommends using a range of about $7 to $42 per ton, or perhaps about $80 if Earth warms faster than expected.

The costs of market-based policies without the revenue-recycling benefit may actually exceed those of traditional regulatory approaches like emissions standards, at least in the short run.

The increase in energy prices caused by market-based climate policies causes higher production costs throughout the economy, which in turn leads to a slight contraction in the overall level of economic activity, employment, and investment. As a result, distortions in labor and capital markets due to preexisting taxes are increased, producing an economic cost. This cost is larger for market-based instruments because they tend to have a much greater impact on energy prices than emissions standards, for envisioned CO_2 reductions over the medium term.

Again, according to our rough estimates, the cost of achieving the above CO_2 reduction under an emissions standard would

For CO_2 emissions in 2020, this task force recommends using a range of about $7 to $42 per ton, or perhaps about $80 if Earth warms faster than expected.

For the scale of CO_2 reductions discussed here for 2020, our estimates suggest the average cost per ton reduced is $91 under cap and trade, which exceeds even the highest recommended value for the social cost of carbon.

Reasons to Be Cautious

Naturally, there are many reasons to suspect these provocative findings, which suggest that federal policymakers may have been focused on the wrong climate policy instrument from an economic perspective.

For one thing, we should always be cautious in taking the policy implications from economic models too literally—our judgment about reasonable model assumptions can change with new evidence, and there is always the possibility that models miss something important. Moreover, meaningful action by the United States on CO_2 emissions would likely promote similar efforts in other countries. This would produce further global benefits in terms of slowing climate change, though at the cost of mitigation burdens borne by other countries.

Market-based approaches are also more effective than traditional regulatory approaches at promoting the development of cleaner production technologies over time. However, the net economic benefits from additional innovation under market-based approaches are probably not large enough to affect our ranking of policy instruments. On the other hand, the relative differences in policy costs due to interactions with the tax system are less pronounced at considerably higher levels of abatement, and the relative efficiency gain from emissions pricing is larger. For a sufficiently stringent policy, cap and trade will be more cost-effective than traditional regulation. However, that level of emissions reductions is not envisioned in recent climate bills for at least the next 20 years.

One of the main objections to carbon taxes is that they are regressive, meaning that they impose a larger burden on lower-income families, as a portion of their income, compared with higher-income households. These adverse distributional impacts could be neutralized through adjustments to the tax-benefit system, such as tax cuts and/or benefit increases targeted at lower-income households, though such changes produce smaller efficiency benefits from the revenue-recycling effect than do broad-based tax cuts.

Alternatively, it might be argued that the design of policies to reduce pollution should be kept separate from policies to promote a more equitable society, as the latter encompasses so many diverse issues related to poverty; education; and low-income assistance for health, housing, and food.

Use Tax Revenues or Allowance Value Wisely

One of the practical arguments made in favor of cap and trade is that opposition from adversely affected parties can be ameliorated through allocation of the allowance value. But from an economic perspective, the revenue or allowance value created by market-based climate policies is potentially problematic. Ideally, it should be used to substitute for distortionary taxes (or otherwise increase economic efficiency) for us to be confident that these instruments perform well on economic grounds. The best way to do this is to design a carbon tax that is well integrated into the broader fiscal system so that revenues, combined with those from other taxes, meet a sequence of total government revenue targets over time.

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The Potential Impact on

Energy-Intensive Trade-Exposed

Industries of Clean Air Act Regulation of GHGs

Richard D. Morgenstern

Pricing carbon emissions, through either a cap-and-trade system or an emissions tax, will not only adversely affect electricity and primary energy producers, but also hurt the competitive performance of heavy fossil-fuel users in downstream industries, especially in trade-exposed sectors like steel and chemicals. Furthermore, some of the environmental benefits might be eroded ("emissions leakage") if increases in U.S. manufacturing costs from uneven international carbon pricing caused economic activity to shift to nations with weaker greenhouse gas mitigation policies or none at all.

The Waxman-Markey bill (HR 2454) would have addressed these concerns by identifying energy-intensive trade-exposed (EITE) industries based on measurable criteria and adopting an allowance allocation method, known as output-based rebating, for these sectors. A related provision in these bills provides rebates to local distribution companies to cushion impacts on both industrial and residential electricity consumers. Both measures attempt to level the near-term playing field between domestic and foreign producers, thereby reducing both the competitiveness and the leakage impacts.

With the demise of legislative options, attention is now shifting to the use of the Clean Air Act (CAA) authorities to reduce emissions of greenhouse gas (GHG) emissions. What effect would CAA-based regulations have on EITE industries? How would the likely impacts on EITE industries differ from those of emissions pricing with output-based rebate schemes embodied in the legislative approach?

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There are clearly many unknowns about how, if at all, the U.S. Environmental Protection Agency (EPA) might proceed with regulating stationary sources of GHGs. However, one commonly discussed approach is for the agency to adopt New Source Performance Standards (NSPSs)—technology-based regulations—for electric generating units and, quite possibly, for high-emitting industrial sources. Presumably, these industrial sources would be many of the same sectors Congress has categorized as EITE industries. At this point, no additional findings are required prior to issuing GHG-based NSPSs for more than 60 source categories and subcategories covering major stationary sources, including coal, oil, and gas power plants; refineries; cement plants; and various other industrial categories for which the agency made an endangerment finding many years ago based on non-GHG pollutants.

An NSPS, based on best demonstrated technology, would apply to both new units and existing sources that make major modifications. EPA also has the authority to establish guidelines for states to use in setting technology standards for existing sources. As my colleagues Nathan Richardson, Art Fraas and Dallas Burtraw (2010) have written, the NSPS approach is "the most predictable, likely and practical, that is, knowable pathway."

Below I describe two cases, one in which EPA issues an NSPS for electric generating units (EGUs) only, and the other in which the agency also issues a series of NSPSs for EITE industries. Initially, imagine that EPA issued an NSPS for coal power plants requiring certain low-cost actions that would yield modest but meaningful emissions reductions. As Richardson et al. hypothesize, efficiency improvements and biomass cofiring might be good candidates.

Arguably, a cleverly designed NSPS might actually result in *smaller* consumer impacts

than under full-blown cap and trade, largely because only the actual resource costs would be passed on to consumers, at least in the cases where electricity rates are set by the states. This contrasts with a national cap-and-trade scheme where the cost pass-through would be determined in most cases by the systemwide marginal costs, which would, on average, likely be higher than the cost of the resources needed to achieve the near-term reductions. Although it is not possible to estimate the actual price differences at this time, calculations by Burtraw et al. (2009) indicate they could be substantial.

How would these potentially modest but nonzero costs of an NSPS for electric generating units affect these industries? And how would the impacts differ from those driven by a comparable Waxman-Markey style emissions reduction strategy? If EPA could, indeed, identify the optimal investments that would be chosen by EGUs under a cap-and-trade system, then the electricity price impacts would likely also be modest, even in the absence of Waxman-Markey style rebates. While states could still offer rebates, it is almost certain that they would

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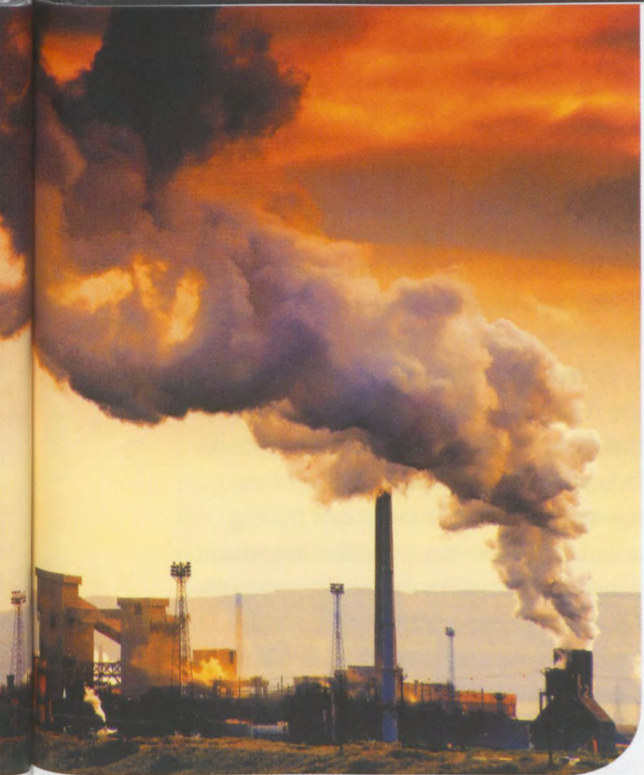

not be uniform across the country. In fact, one could imagine a beggar-thy-neighbor competition whereby states might use overly generous rebates to attract energy-intensive industry.

Whatever the ultimate size of the NSPS-induced electricity price hikes, however, the pattern of impacts on EITE industries would be quite different under an EGU-only NSPS compared to an economy-wide cap-and-trade scheme. The table on page 46 compares the impacts on a highly disaggregated set of manufacturing industries of an economywide policy versus an EGU-only approach, based on a modeling analysis using census data from the 1990s. The per-ton charge on carbon inputs is equal for the two policies. However, the former policy affects all carbon inputs, both direct and indirect, used in the manufacturing sector while the latter affects only carbon used in the production of electricity. Manufacturing industries relying heavily on electricity or nonfuel inputs that, in turn, are heavy electricity users—for example, the makers of aluminum car parts purchased by the auto industry—would be most adversely affected by an electricity-only policy.

The left side of the table displays the 10 industries hardest hit by the economywide policy and their corresponding ranking for the EGU-only policy among 361 manufacturing industries analyzed. Eight of the 10 industries hardest hit by the economywide policy rank lower (or the same) for the EGU-only policy, in most cases considerably lower.

The right side of the table displays the 10 industries hardest hit by the EGU-only policy along with their corresponding ranking for the economywide approach. The hardest hit, aluminum, ranks 13 for the economywide policy. All of the top 10 under the EGU-only policy rank lower (or the same) for the economywide policy, often substantially lower. The conclusion of this policy comparison is clear: manufacturing industries are affected very differently by the economywide pricing of carbon emissions compared to regulation of the electric power sector only.

Industry NSPSs

Now we turn to the second case, wherein EPA issues an NSPS for EITE industries, in addition to the one for electric generation. Similar to the EGU NSPS, the industry ones would take the form of technology-based standards for new sources and existing sources making major modifications. The agency could, in principle, also set rules for states in their review of existing sources, although short of imposing a draconian federal implementation plan, it is difficult to imagine strong, uniform implementation across the different states.

The first thing to note about such standards is that they could be much more fine grained than the congressionally mandated procedures under Waxman-Markey, which focused on the six-digit North American Industrial Classification Scheme (NAICS). In setting regulations under the CAA, EPA could adopt a much more refined approach, focusing on the subindustrial categories that had the greatest emissions and/or the most cost-effective potential to reduce their emissions—equivalent, perhaps, to a 7- or 8-digit NAICS. In addition, EPA could potentially exclude certain subsectors of congressionally defined EITE industries and include others not covered by the Waxman-Markey definitions.

This is important because studies have shown that there is great heterogeneity in energy use and carbon dioxide emissions among industries, both within and outside the EITE sectors. Consequently, the agency's ability to reach down in a granular fashion to the large emitters opens up the potential for highly efficient regulation. While there is certainly no assurance the agency would achieve a higher degree of efficiency in this process, the potential to do so under CAA versus a six-digit NAICS Waxman-Markey approach clearly exists.

Beyond the potential for fine-tuning of the regulations under the CAA, the rest of the story for EITE industries is not particularly promising when compared to the legislative approach. Emissions trading across industries has not been tested and would certainly face an uphill court battle. Absent that authority, the potential for within-sector trading is limited by both legal and practical factors, not the least of which is the potential market power of individual firms in particular industrial sectors. This contrasts with the electric

Comparison of Economywide and Electricity-Only Policies

INDUSTRY	RANKED BY ECONOMYWIDE POLICY RANK AMONG 361 MANUFACTURING INDUSTRIES	
	ECONOMYWIDE CARBON CHARGE	ELECTRICITY-ONLY CARBON CHARGE
Petroleum refining	1	145
Products of petroleum and coal, not elsewhere classified	2	191
Lubricating oils and greases	3	154
Carbon black	4	36
Asphalt paving mixtures and blocks	5	76
Lime	6	6
Nitrogenous and phosphatic fertilizers	7	25
Asphalt felts and coatings	8	196
Cement, hydraulic	9	3
Blast furnaces and steel mills	10	8

sector where, despite early concerns by some groups in the sulfur dioxide debates, experience has shown that the large size of that market enables firms to trade allowances without fear of competitiveness concerns among themselves.

Even if an interindustry emissions trading program was established, presumably by the states, it is unlikely that an effective output-based rebating scheme could be put in place. As noted, there is a potential for beggar-thy-neighbor actions. In the absence of a uniform system, it would be virtually impossible to develop a credible rebate mechanism to address competitiveness and leakage concerns without violating the rules of the World Trade Organization.

The bottom line is that carbon dioxide regulation under the Clean Air Act, presumably via an electricity-only NSPS or by the addition of a series of NSPSs covering EITE industries, could potentially result in smaller initial energy price impacts than an economywide cap-and-trade scheme. In the case of an electricity-only policy, the pattern of affected industries would clearly be different than under a broader-based mechanism. Going forward, and given the agency's inability to offset higher energy costs as in Waxman-Markey, the challenge for the agency will be to craft rules that impose only modest costs, thereby obviating the need for offsetting mechanisms that are likely infeasible under a CAA approach. ●

Comparison of Economywide and Electricity-Only Policies (cont.)

INDUSTRY	RANKED BY ECONOMYWIDE POLICY RANK AMONG 361 MANUFACTURING INDUSTRIES	
	ECONOMYWIDE CARBON CHARGE	ELECTRICITY-ONLY CARBON CHARGE
Primary aluminum	13	1
Electrometallurgic products, except steel	18	2
Cement, hydraulic	9	3
Aluminum rolling and drawing	49	4
Primary smelting and refining of copper	52	5
Lime	6	6
Primary nonferrous metals, not elsewhere classified	64	7
Blast furnaces and steel mills	10	8
Metal cans	48	9
Aluminum castings	95	10

Source: Impact of Carbon Price Policies on U.S. Industry. 2008. Ho, Mun. Richard D. Morgenstern, Jhih-Shyang Shih. RFF discussion paper 08-37. December. www.rff.org/RFF/Documents/RFF-DP-08-37.pdf.

Kraiem Begins Three-Year Term on RFF Board

The newest member of the RFF Board of Trustees is Rubén Kraiem. A partner in the New York office of Covington and Burling, LLP, he is a cochair of the law firm's Clean Energy and Climate industry group, as well as the partner principally responsible for Covington's corporate practice in Latin America. In the past several years, he has been deeply involved in U.S. as well as international climate change policy issues, and he attended COP-13 (in Bali) and COP-15 (in Copenhagen) as an adviser to the Coalition for Rainforest Nations.

Kraiem argues that a new conceptual framework is needed to reach an agreement in the international climate change talks. "We won't be agreeing on caps—they can't be negotiated among the key players, at least not in the near or medium term," he believes. Kraiem is nevertheless optimistic about eventual consensus among nations: "We will figure out ways to cooperate on actions, like a concerted international effort to reduce emissions from deforestation, that will make a substantial difference and may even detonate other changes." He looks for alliances among countries in identifying and deploying breakthrough technologies, with a view to finding the most effective and cost-efficient opportunities for reducing global emissions.

"Every country in the developing world appreciates the extent of the climate change problem and wants to do something about it," Kraiem says, "even those countries that for good and sufficient reasons have resisted the imposition of absolute caps on their emissions." The challenge is creating the right incentives so that developing countries can reconcile their global climate change obligations with the imperative to create prosperity and alleviate poverty at home.

For all the energy and work devoted to addressing the climate change issue, Kraiem says, it's surprising that we are still searching for ways to communicate about the problem. The many writers who seek to explain the conundrum and its solutions are still striving to find compelling language that resonates with the public.

At some point, however, he believes people will make decisions that are rational and efficient. If we cannot find common ground on an emissions cap, he says, it may be time to turn to a carbon tax, which would introduce a new dynamic into the market while raising the money needed to make critical improvements along the path toward low-carbon growth. "At the same time," he says, "we have to summon the political will and the flexibility to find solutions that are not driven by ideology but reflect instead a common desire to achieve the best possible results on a global scale."

Environmental issues are both profoundly important and intellectually interesting to this graduate of Yale College and the Harvard Law School. Early in his career, Kraiem says, he determined that nothing was more important than addressing how we, as a species, managed our connection with the natural world. "It's a moral issue," Nothing is more international than the environment. Climate change—both the problems and the solutions —cannot be understood without an appreciation of its global nature.

he says. "If we can define this relationship in a way that is genuinely sustainable and puts the right values on the right things, it follows that we will have improved our practices in other areas, including our observance and respect for human rights."

"Very often," he explains, "human rights issues have the same basis as our relationship with the natural world. How will we structure the relationship—as a source for exploitation, or as a resource that has inherent value and integrity?"

Kraiem's background and knowledge of different cultures—he was born in Mexico and came to the United States as a college student—were what attracted him to international work. "I've always felt that where I can contribute the most is in an international context," he says. "And nothing is more international than the environment. Climate change—both the problems and the solutions—cannot be understood without an appreciation of its global nature."

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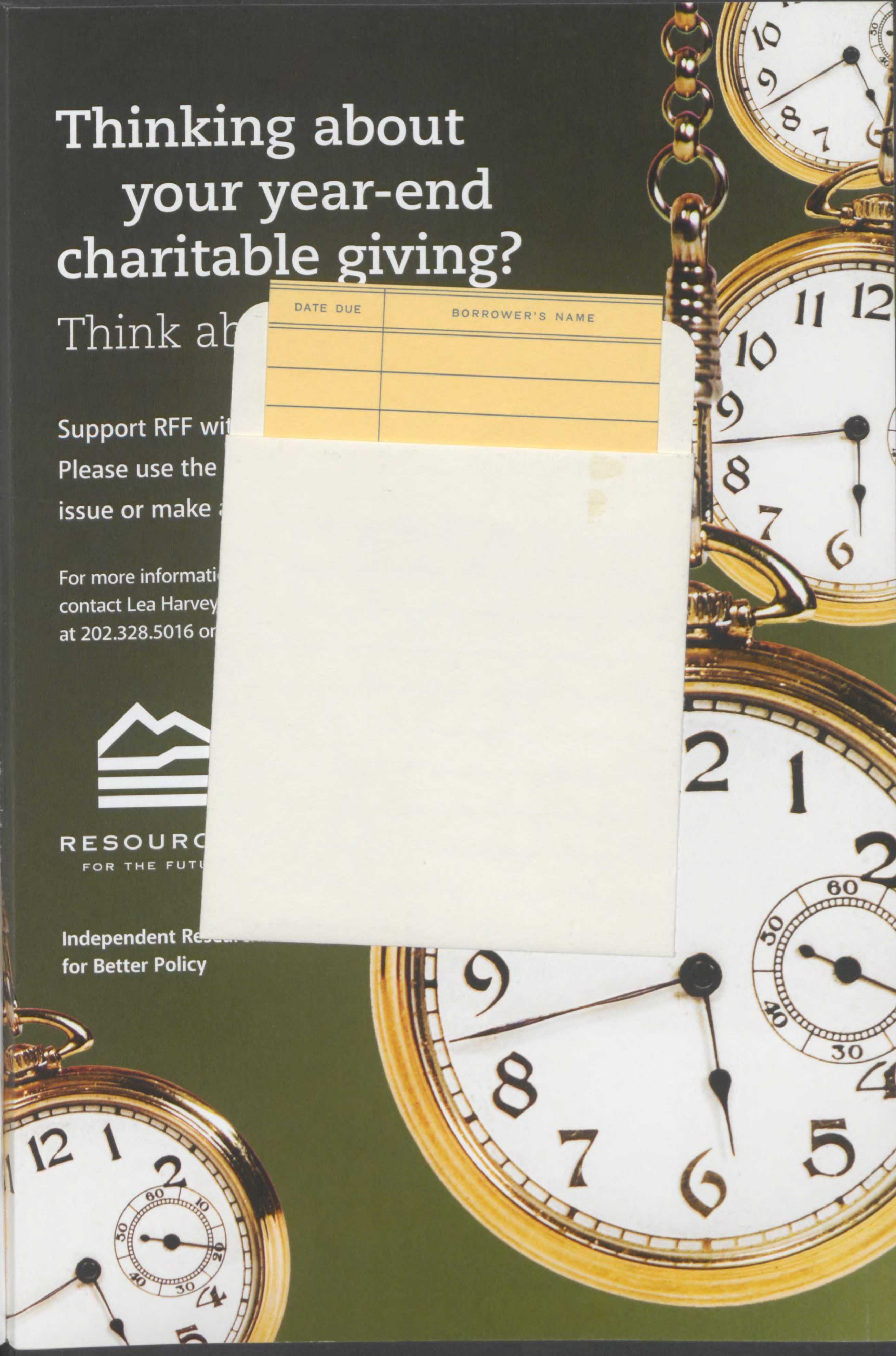
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