RESOURCES

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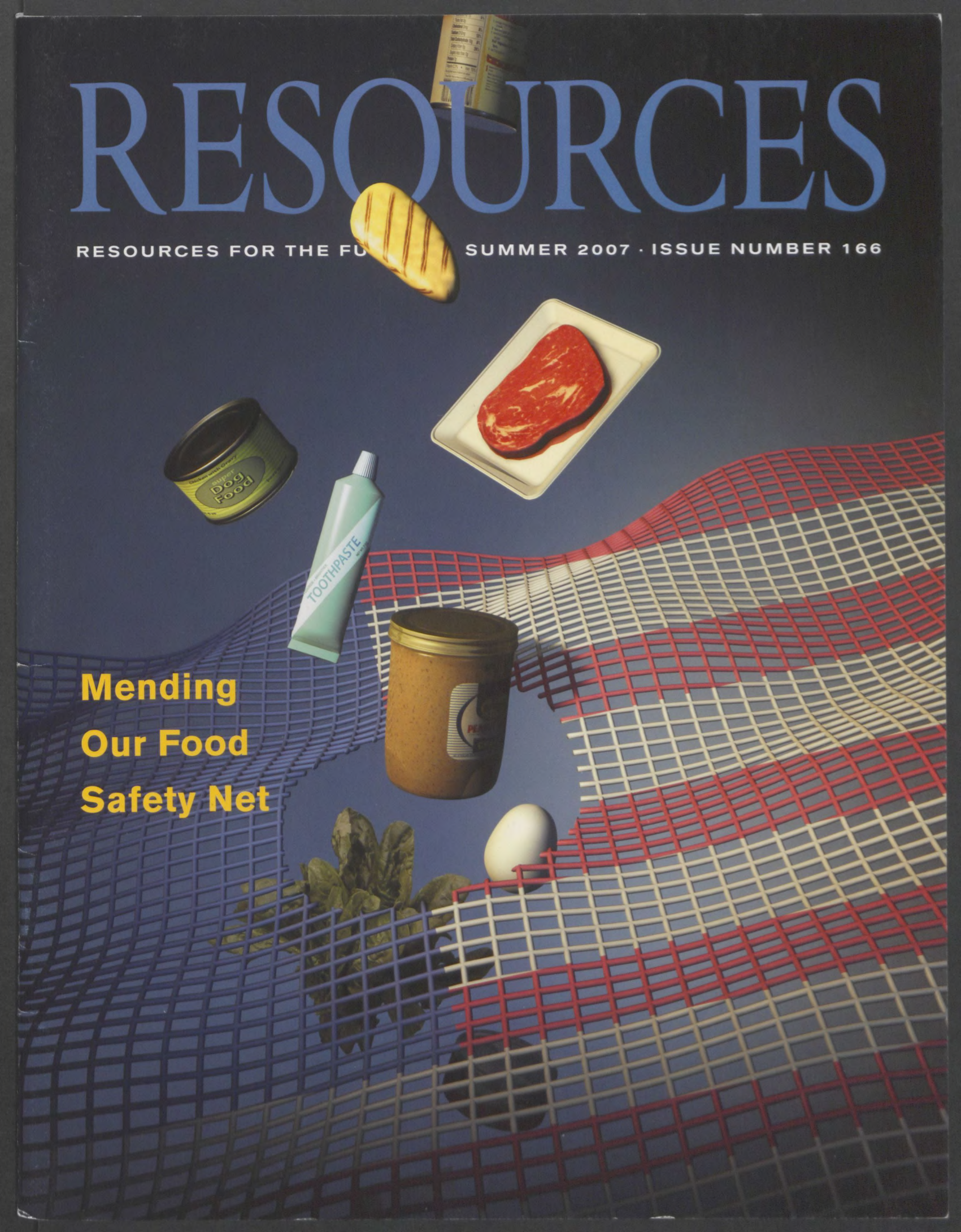


Mending Our Food Safety Net

From the President

PHILIP R. SHARP

Black and White–and Green All Over

America is going green these days, including communications giants like Yahoo!, retailers like Starbucks, and cities from Seattle to Sarasota. These efforts do count: if every household in America replaced just one regular lightbulb with an energy-efficient fluorescent one, we would curb the equivalent amount of greenhouse gas emissions from more than 800,000 cars.

RFF is no exception to the trend. Our office complex in Washington, built 20 years ago, anticipated future needs by installing an energy-saving cooling system that relies on blocks of ice to pump chilly air, "heat-mirror" windows, and energy-efficient lighting. Over the past year, we have planted a green roof that provides additional insulation and prevents water runoff. And we are actively looking for new strategies that will further lessen our environmental impact.

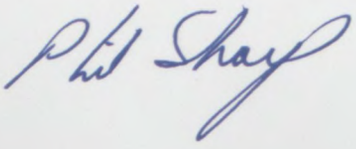
Implementing these brick-and-mortar measures helps us save money and curb carbon emissions. We could do so because the expected results are easy to measure. But the picture becomes much less clear when we talk about climate change policy at the national level; as with corporate greening, in the policy arena we must sort out reality from hype. As policy professionals, RFF scholars like to look behind the green curtain and closely analyze the black-and-white numbers.

In this issue, Senior Fellow Ian Parry questions whether Congress is overlooking the advantages a carbon tax would have compared to a cap-and-trade auction system for controlling emissions. Senior Fellow Roger Sedjo also takes a step back from the headlines to analyze the environmental consequences of various biofuels, looking at their carbon emissions, cost trade-offs, and land-use implications. On our website, you can find additional projects related to climate policy.

Energy and climate issues are scarcely the only things we are working on, however. In her lead article, Fellow Sandra Hoffmann looks at how the system of food safety regulations in this country does—and does not—guarantee the purity of what we feed to our pets, to say nothing of the spinach in our salad.

Effective change will require all of us—leaders and citizens alike—to focus, as economists say, on both the macro and the micro levels. We need to make smart choices in the produce aisle and learn more about how global trade regulations affect the safety of what we do buy. And we need to take a closer look at our individual carbon footprints, and, as a country, to better recognize how our domestic carbon policies fit with global efforts.

As individuals, we can do our part. As a nation, effective policy will be found in the devilish black-and-white details of analysis.



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RESOURCES
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Published quarterly since 1959, *Resources* (ISSN 0048-7376) contains news of research and policy analysis regarding natural resources and the environment. The views offered are those of the contributors and should not be attributed to Resources for the Future, its directors, or its officers.

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CONTENTS

DEPARTMENTS

CORRECTION: The Chairman's Letter in the spring issue of *Resources* contained an editing error. The sentence should have read, "The fact that about 20 percent of atmospheric carbon dioxide results from deforestation has led to proposals that might dramatically change the economics of forest management."

FEATURES

Contributors

Sandra A. Hoffmann

Ian W.H. Parry

Roger A. Sedjo

RFF Fellow **Sandra A. Hoffmann's** research seeks to reduce risk to public health by promoting more effective regulation and common law. She works on a number of policy issues, including food safety, valuation of children's benefits from environmental policy, assessing the social costs of pesticide use, and environmental health issues in China. She is co-editor of *Toward Safer Food: Perspectives on Risk and Priority Setting* (RFF Press).

Ian W.H. Parry, an RFF Senior Fellow, has been with RFF since 1995. His research focuses primarily on environmental, transportation, tax, and public-health policies. Parry has analyzed environmental tax shifts and how other emissions-control policies interact with the broader fiscal system, the incidence of environmental policies, and the implications of technological progress for the design of environmental policies.

RFF Senior Fellow **Roger A. Sedjo** has been the director of RFF's Forest Economics and Policy Program for more than 25 years. He is an expert on forest economics and policy, including public and private forestland management and international forestry. He has helped write a number of major International Panel on Climate Change reports addressing climate and forests, and has examined sequestration incentives and trading mechanisms.

Resource Links

Learn more about the feature stories in this issue:

Should We Abandon Cap and Trade in Favor of a CO_2 Tax? www.rff.org/CO2Tax

Mending Our Food Safety Net: www.rff.org/FoodSafetyNet

From Oilfields to Energy Farms: www.rff.org/OilFieldstoEnergyFarms

Goings On

Weathervane: Global Climate Policy Updates

New Climate Legislation Analysis

As awareness about climate change increases and the call for federal legislation grows louder, one thing becomes abundantly clear: the details surrounding climate change policy are nuanced, complicated, and intricately connected. Scholars from RFF's Climate and Technology Policy Program offer an in-depth analysis of some of the most controversial aspects of proposed mandatory federal legislation.

Among the topics considered in these new issue briefs, available on RFF's Weathervane website (www.weathervane.rff.org), are the following:

- Emissions trading versus CO_2 taxes: Senior Fellows Ian Parry and Billy Pizer examine the economic implications of these two policy choices and how design features shape those implications.
- Allowance allocation: Senior Fellow Ray Kopp looks at the strengths and weaknesses of a variety of permit allocation choices should the United States pursue emissions trading.
- U.S. climate mitigation in the context of global stabilization: University Fellow Richard Newell and Research Assistant Daniel Hall consider if and how climate policy action undertaken in the United States now affects long-term, environmentally significant climate outcomes.
- Assessing the costs of domestic regulatory proposals: Fellow Joe Aldy provides an overview of the costs of various climate proposals for the United States over the next several decades.

RFF Scholar Testifies on the IPCC Report

Senior Fellow Billy Pizer testified on May 16 before the House Committee on Science and Technology on the findings of the Fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC). Pizer was one of more than 100 lead authors on the IPCC report.

In his testimony, he led committee members through a series of considerations about the report: "There are a variety of different stabilization targets we could think about over the next century," he stated, outlining the range of options and associated cost estimates. "An important thing to realize is that this range of estimates... does not have a probability associated with it: the costs could actually be higher or lower."

Pizer also highlighted the importance of technology to successful climate policy. "We can't just set a cap-and-trade program in motion and go home. We're really going to need public support for research and development."

He clarified that IPCC estimates assume both economywide coverage and global participation but acknowledged that the latter is unlikely in the near future. To help mitigate that challenge, he emphasized the importance of action and diplomatic efforts on the part of the United States. "[It is important] to think about broad, flexible domestic policies and engagement with the rest of the world to try and get similar policies elsewhere," he said.

Throughout his remarks, Pizer urged careful thought and further research, but not inaction. "In thinking about policy to deal with climate change, it's very important to consider what is going to happen if our best pick does not end up being right," he advised. However, "the first step is to have a reasonable domestic policy—it's a lot easier to convince people to come along with something once you've already demonstrated leadership."

The full text of Pizer's testimony can be found on Weathervane.

Advisory Committee Suggests Design of Cap-and-Trade Program for California

In June, the California Market Advisory Committee released a report of recommendations on the design of a cap-and-trade system to reduce greenhouse gas (GHG) emissions in the state. Senior Fellow Dallas Burtraw is among the 14 expert advisers chosen by the state's secretary for environmental protection to serve on the committee.

Because of California's limited experience with cap-and-trade systems and national and international emphasis on such programs as an essential part of the effort to combat global warming, the members of the committee were charged with making cap-and-trade program design recommendations to the Air Resources Board.

Critical recommendations from the report include incorporating all major GHG-emitting sectors of the economy into the cap-and-trade program, taking a first-seller approach to capping emissions associated with electricity, using a

mixed approach of free allocation and auctioning of allowances, allowing offsets, and providing linkage opportunities for a California cap-and-trade program with similar policy initiatives in other jurisdictions.

The full report is available at www.climatechange.ca.gov/policies/market_advisory.html.

RFF, *New Scientist,* Stanford Explore Americans' Willingness to Pay for Climate Improvements

RFF Senior Fellow Ray Kopp teamed with colleagues from *New Scientist* and Stanford University to provide policymakers with a better understanding of how willing Americans are to pay for improvements to the climate.

The study, released June 20 at the National Press Club in Washington, is the result of a survey asking Americans how willing they would be to vote for various policies that would result in a range of gas and electricity price increases, in order to reduce U.S. carbon emissions to 5 percent below business as usual by 2020.

The poll set out to test the attractiveness of three main ways to reduce GHG emissions: standards or mandates, in which the government tells companies exactly how they must act to achieve a cut in their emissions; economic incentive-based approaches, including an emissions tax; and a cap-and-trade system. The survey looked only at how options would work for vehicle fuel and the electricity sector, since those categories are responsible for a substantial proportion of U.S. GHG emissions. Also, costs in those categories would likely be passed on to consumers.

According to the survey results, specific policies to combat global warming can command majority support in the United States, as long as they don't hit people's pockets too hard. One of the most interesting findings is that Americans tend to favor standards and mandates over incentive-based approaches. However, the strength of that preference depends on the cost of the regulatory approach. If incentive-based approaches are less costly than mandates, then the preference for mandates fades. ■

Dr. Chauncey Starr, EPRI Founder and President Emeritus, Dies at 95

Dr. Chauncey Starr

Dr. Chauncey Starr, 95, founder and president emeritus of the Electric Power Research Institute (EPRI) and a longtime supporter of RFF, died April 17, 2007, in his home in Atherton, California.

A leader in the electric power industry since World War II, Starr spent 20 years at Rockwell International early in his career, building the Atomics International division. Starr came to know RFF around the time of its founding through his relationships with its early leaders—Sam Schurr, Hans Landsberg, and Joel Darmstadter.

In 1966, Starr accepted a position as dean of the UCLA School of Engineering and Applied Science. While there, he directed a research effort on societal safety in technical systems, which led to a paper titled "Social Benefits versus Social Risks," published in *Science* in 1969. That paper is widely considered the starting point of the formal technical field of risk analysis.

Starr went on to form EPRI in 1972 as a research and development organization to address the challenges faced by the electric utility industry.

During his lifetime, he received numerous honors, including the 2006 George C. Laurence Pioneering Award, given by the American Nuclear Society for pioneering contributions to nuclear reactor safety; the 1990 National Medal of Technology, awarded by then President George H.W. Bush for contributions to engineering and the electric industry; and the 1988 Rockwell Medal, awarded by the International Technology Institute for excellence in technology and contributions to the betterment of mankind.

In 2004, Starr donated $2 million to RFF to fund a chair in risk analysis that bears his name. The chair is currently occupied by Roger Cooke, one of the world's leading authorities on mathematical modeling of risk and uncertainty.

Starr is survived by his wife of 69 years, Doris; a daughter, Ariel Wooley of Los Altos, California; a son, Ross Starr of San Diego, California.; and five grandchildren. ■

Nanotechnology and Nature: Reducing Risks and Reaping Rewards

Nanotechnology is no longer a futuristic idea but a present reality: about 500 consumer products on the market use it, and that inventory increases by four to five products each week. As Jennifer Sass of the Natural Resources Defense Council noted at RFF's June First Wednesday Seminar, "The nano-Titanic has left the port."

She and panelists from the Project on Emerging Nanotechnologies at the Woodrow Wilson International Center for Scholars, the Federal National Nanotechnology Initiative, and EPA gathered to offer their perspectives on burgeoning nanotechnologies, their applications, and their potential health and environmental risks.

To give an idea of nanotechnology's scale, Andrew Maynard of the Project on Emerging Nanotechnologies explained, "Your hair grows approximately 10 nanometers in the time it takes to say 'nanotechnology.'" Scientists now have the tools to work at such a tiny, near-atomic scale, and the potential benefits for society, he and other panelists agreed, are great.

On the energy front, such technology can be applied to improve photovoltaics, fuel cells, energy storage in batteries, energy efficiency in manufacturing, and the conversion of waste heat to energy.

Nanotechnology also holds promise for the cleanup of waste sites, said Marti Ott, an environmental engineer with EPA's Office of Superfund Remediation and Technology Innovation. Nano-sized iron, for example, can be used to remove chlorinated hydrocarbons from groundwater, and other particles at the nano scale can remove heavy metals like mercury from smokestacks and waste streams.

Countries including the United States are investing heavily in these new technologies, according to Celia Merzbacher of the White House Office of Science and Technology Policy. In fiscal year 2001 the federal government launched the National Nanotechnology Initiative that encompasses 26 agencies, half of which have funding totaling about $1.5 billion this year. The initiative focuses on both R&D and oversight: about $37 million was spent on risk research in 2006, an amount that will increase to $60 million in 2008, Merzbacher said.

Sass noted, however, that nanotechnology's novel properties are allowing it to slip through the regulatory cracks. "Partly it's because most of the regulations we have need volumes or mass thresholds to trigger oversight," she said.

She argues for precautionary regulation, citing several areas of concern. The Center for Responsible Nanotechnology has issued a report warning that nanotechnology could create a large-scale disruption on the scale of the industrial revolution—in a much shorter time span—and not all of the risks of nanotechnology can be addressed by the same approach. NATO, too, has called the effects of nanotechnology disquieting: since nano-particles can easily slip into human pores, they hold grave potential for biological and chemical warfare.

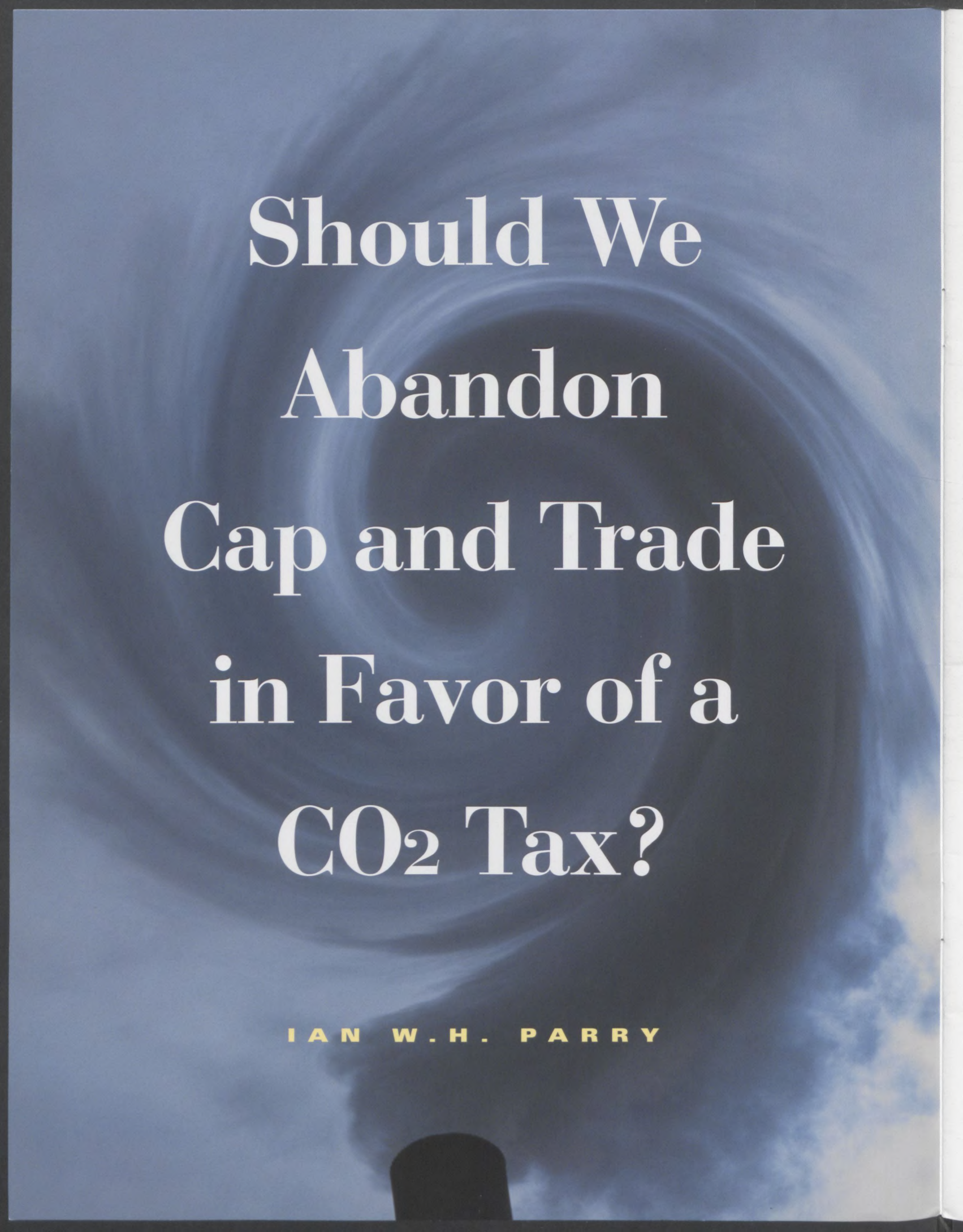
In addition, little is known about the toxicity of nanotechnology. What we do know, Sass said, is that generally, the smaller the particle, the more harmful. As an example, she pointed to particulate matter, which is known to cause heart and lung problems in humans.

Her solution? "Prohibit untested or unsafe uses."

Maynard pointed out that in addition to technical risks, perceived risks must be addressed. Consumers concerned about the possible negative effects of nanotechnology in sunscreen, for example, can choose products that don't use the technology. "If we're going to see nanotechnology succeed, we're going to have to address the scientific uncertainties, but we've also got to address uncertainty in the minds of consumers," he said.

Merzbacher likened nanotechnology to the Wild West, a new frontier characterized by a frenzy of research and sometimes hyperbolic news coverage. "Behind the wave of the frontier," she said, "there's order that follows. The agencies that have the responsibility for oversight are paying attention."

The seminar was moderated by RFF Senior Fellow Terry Davies, who has written a report, *EPA and Nanotechnology: Oversight for the 21st Century*, while working as a senior adviser to the Project on Emerging Nanotechnologies. "This is an extraordinary technology; some people have referred to it as the second industrial revolution," he said in his opening remarks. "Whether that's hype or not, I'm not sure, but it gives you some idea of both the broadness and depth of the technology." ■



Should We Abandon Cap and Trade in Favor of a CO_2 Tax?

IAN W.H. PARRY

With solidifying scientific evidence that global warming is occurring, the birth of carbon emissions trading in Europe, and various mitigation initiatives at the state level, pressure on the federal government to control carbon dioxide (CO_2) has reached fever pitch. In May, President Bush announced that the United States will work with other nations to establish a new, post-2012 framework on greenhouse gas emissions, with an emphasis on adaptation and energy-efficient technologies. Meanwhile, following the success of the sulfur-trading program imposed on the power sector, the momentum in Congress is clearly for some form of cap-and-trade permit system: at least half a dozen climate proposals active in Congress mandate or recommend such systems. But before Congress passes new legislation, there is a serious alternative to consider: a CO_2 tax.

A CO_2 tax has a number of advantages over pure emissions trading systems. In particular, if the revenues are used to reduce other taxes, the policy may benefit the economy overall. And by fixing the price of CO_2, the tax also avoids problems that might be caused by permit price volatility under an emissions trading regime.

How to Design a CO_2 Tax

Ideally, a CO_2 tax would be imposed on fossil fuel suppliers according to the amount of carbon that will be released into the atmosphere when the fuel is combusted. As with the permit price under the alternative cap-and-trade system, the tax would be passed forward into the prices of coal, natural gas, and petroleum products, and ultimately in the price of electricity and other energy-intensive goods. Higher prices would encourage the adoption of fuel- and energy-saving technologies across the economy and a shift from carbon-intensive fuels, like coal, to natural gas and renewable fuels. A system of tax credits could also be incorporated to encourage forestry expansion to sequester CO_2 or the inclusion of carbon capture and sequestration technologies in the construction of new power plants.

From an economist's perspective, the tax should reflect the costs to the world from the future global warming potential of CO_2. These costs encompass damages to agriculture, protection of valuable coastal land against sea-level rises, health impacts from the spread of tropical diseases, the risk of extreme climate change scenarios, and so on. Estimating these costs is a formidable and controversial challenge, given the enormous uncertainty over future climate change scenarios. Most mainstream economic assessments value the damages from today's emissions at around $\$5–\$15$ per ton of CO_2. But obviously damages could be much

Before Congress passes new climate legislation, there is a serious alternative to consider: a CO_2 tax.

greater if, as many argue, more weight should be given to ecological effects, the well-being of future generations, or the risk of abrupt climate change. The damage per ton of CO_2 increases over time, meaning that the tax should ramp up each year. Congress could periodically review this CO_2 tax "escalator" and adjust it in light of new evidence on the seriousness of global warming.

Suppose, for the sake of argument, that a tax of $10 per ton of CO_2 were implemented now: it would reduce annual CO_2 emissions by roughly 5 percent and currently raise annual revenues of about $55 billion, or about 6 percent of federal receipts from individual income taxes. If all this CO_2 tax revenue is recycled in an across-the-board cut in income taxes, how would this affect the economic impact of the tax?

Economic Effects of CO_2 Taxes

Income taxes impose costs on the economy as they distort household behavior in a variety of ways. For example, by lowering take-home pay, they can encourage some people to stay home rather than go out to work, and they discourage people from saving because part of the returns are taxed away by the government. Taxes also encourage too much spending on goods that receive special tax preferences. For example, the deductibility of mortgage interest from income taxes encourages people to spend more on housing than they otherwise would, while the exemption of employer-provided medical insurance from income and payroll taxes leads to an excessive amount of workplace compensation provided in the form of these fringe benefits.

Leaving aside the benefits from slowing climate change, CO_2 taxes also distort the economy in different ways. In particular, they induce costly investments throughout the economy to conserve on energy, and they induce industry to use cleaner, more expensive fuels than they otherwise would. And by driving up energy costs, CO_2 taxes would also have a harmful impact on economic activity and employment, which exacerbates some of the distortions created by income taxes.

Although there has been some dispute among analysts, recent research studies suggest that up to a point, raising extra revenue from CO_2 taxes may involve smaller overall economic costs than raising that extra revenue from income taxes. This means that shifting some of the tax burden off income and onto CO_2 may reduce the overall distortions created by the tax system, providing a positive economic benefit (in addition to the climate benefit); put another way, moderate CO_2 taxes of $10 or $20 per ton may have very small and perhaps even negative costs.

But the debate over what to do with the revenues from a CO_2 tax goes beyond offsetting incomes taxes. Some analysts have suggested that the revenues should instead be used to reduce the federal budget deficit, which would lower the burden on future, rather than current, taxpayers. However, when new revenue sources accrue to the Treasury, rather than being automatically offset by tax reductions elsewhere, some of the extra revenue might ultimately finance more public spending, which may not have the same social value as cutting distortionary taxes. Moreover, cutting the deficit might have the perverse effect of reducing pressure for badly needed reforms to the entitlement system.

Is It Feasible?

Three practical arguments are made against the CO_2 tax shift. First is that influential producer groups—refineries, steel companies, airlines, and electric utilities, for example—must be compensated if climate legislation is to go forward, and that this compensation is easily

provided by giving away free permit allowances to firms under a cap-and-trade system. Second is that voting for any new tax—even if offset by tax reductions elsewhere—can be electoral suicide for members of Congress. For example, the first Clinton administration failed to implement a broad energy tax, despite a major effort. Third, even if a tax regime does go forward, based on how Congress has used new revenue sources in the past, CO_2 tax revenues may end up being wasted in special-interest spending, rather than being used to substitute for other taxes.

Transitory tax relief and exemptions could also be provided to adversely affected industries under a CO_2 tax. However, a danger here is that such compensation schemes open up the floodgates to any number of lobby groups claiming to be deserving of compensation. One of the key arguments for CO_2 taxes over cap and trade is seriously undermined if a large portion of the revenue is used up in compensation schemes rather than used to cut other taxes.

Perhaps the revenue-neutral CO_2 tax will be in the political wilderness for some time, though no one can predict what might be politically feasible down the road with different leadership and more concern among the general public about global warming. Al Gore, at least, argues for using CO_2 tax revenues to lower payroll tax rates. But in the meantime, it is critical that policymakers fully appreciate the magnitude of the additional economic benefits that could be exploited if we were to go the tax route, with judicious use of revenues.

If CO_2 tax revenue is recycled in an across-the-board cut in income taxes, how would this affect the economic impact of the tax?

Taxes versus Permits: A Closer Look

If a cap-and-trade system is implemented with all permit allowances given away for free, instead of a revenue-neutral CO_2 tax, the cost to society is the economic efficiency gains that could have been realized from recycling new revenues into income tax reductions. I would put this extra cost at roughly $20 billion per annum, for a near-term 5 percent emissions reduction, and around $35 billion for a 10 percent emissions reduction. Clearly, there is an awful lot at stake here.

Another advantage of using CO_2 tax revenues to lower personal income taxes is that the benefits are spread over most households as compensation for higher electricity and fuel prices. And the tax cuts could be tilted in favor of lower-income groups by extending the earned income tax credit, for example. In contrast, studies have shown that freely allocated permit systems can be highly inequitable; the reason is that firms receiving allowances reap windfall profits, which ultimately accrue to individual stockholders, who are concentrated in relatively high-income groups.

The potential volatility of carbon permit prices (if not addressed through other design features) is another potentially serious problem with emissions trading programs. Price volatility can arise because the supply of permits is fixed by the government but the demand for permits may vary considerably year-to-year with changes in fuel prices and the demand for energy. In contrast, a CO_2 tax fixes the price of CO_2, allowing the amount of emissions to vary with prevailing economic conditions. Uncertainty over the future price of CO_2 may deter CO_2-saving investments with high up-front capital costs, such as carbon capture and sequestration technologies. CO_2 price volatility may also deter applied R&D efforts at firms to develop cleaner technologies for the future.

Moreover, ideally the marginal costs of reducing emissions should be equated from year to year, accounting for discounting of future costs to the present. This equality is roughly achieved under a CO_2 tax that rises at the rate of interest over time because in each period firms should reduce emissions until the cost of extra abatement equals the savings in tax payments. However, it is not achieved under a cap-and-trade system. For example, in years when

the demand for energy is strong, the marginal costs of meeting the cap may be very high, implying that the cap is too tight; in contrast, when the demand for energy is slack, the marginal costs of meeting the cap may be very low, implying that the cap is too lax. In this regard, an influential study by my colleague William A. Pizer, an RFF Senior Fellow, suggests that the net benefits over time (climate change benefits less emissions compliance costs) under a cap-and-trade system might be only a small fraction of the net benefits under an appropriately scaled CO_2 tax.

At first glance then, the economic arguments for abandoning cap and trade in favor of a CO_2 tax shift appear to be overwhelming. However, permit systems can be designed to at least partly, if not fully, overcome some of their handicaps. Revenues can be raised under a permit system if the government auctions allowances rather than giving them away for free. Most climate bills now under consideration envision a transition to more permit auctioning over time. But, unfortunately, the transition to permit auctioning is slow, and at the moment the bills do not offset the auction revenues with other tax reductions.

As for permit price volatility, this can be contained to some extent by including a "safety valve" provision and allowing firms to bank unused permits. With a safety valve, firms can buy additional permits from the government in periods when the permit price reaches a trigger level; this keeps a cap on prices when the demand for permits is high. And with permit banking, in periods when the demand for permits is slack because abatement costs are low, firms have an incentive to hold over some allowances for use in future periods when higher permit prices are expected. This mechanism helps to create a floor under permit prices.

Action to put a price on CO_2 is long overdue; each week that the United States procrastinates, China opens at least one new coal plant.

An Opportunity for American Leadership

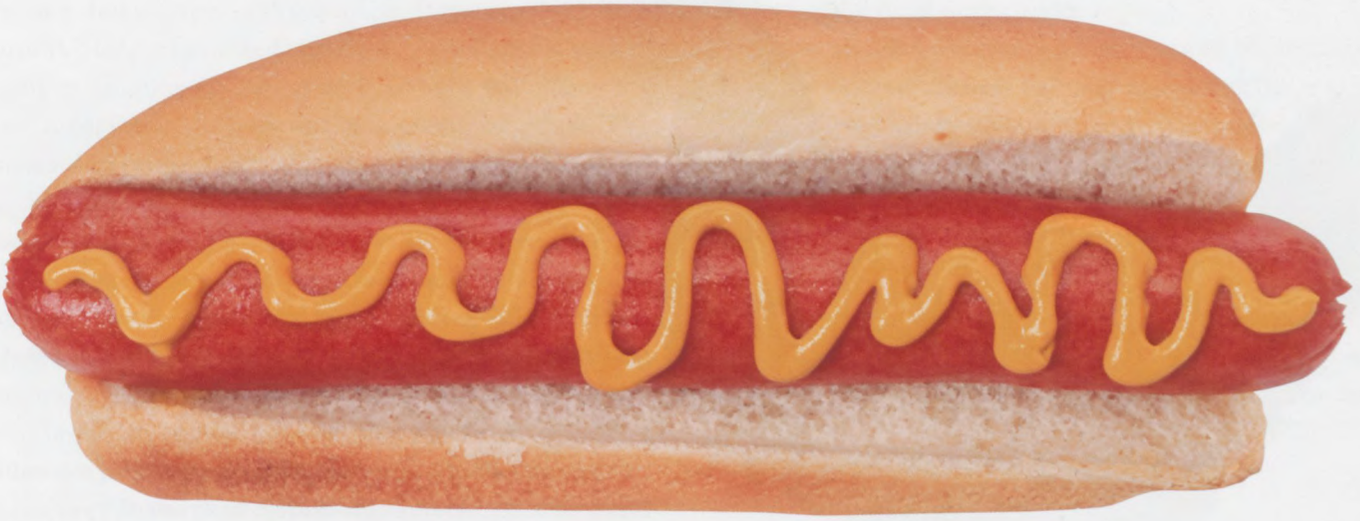
Although the appropriate design of cap-and-trade systems can help to blur some of their differences with tax-based approaches, in my view, the economic case for a revenue-neutral CO_2 tax is overwhelming. The costs of the policy are small, perhaps even negative, and it provides a stable business environment for long-term investment decisions.

Clearly, the practical obstacles to any policy placing a price on CO_2 emissions, let alone a revenue-neutral CO_2 tax, are very challenging. Nonetheless, action to put a price on CO_2 (through either taxes or permits) is long overdue. Each week that the United States procrastinates, China opens at least one new coal plant. Given that the United States is currently the world's largest producer of CO_2 and not part of the Kyoto system, it is the obvious country to lead the world into a successor to Kyoto. And the sooner the United States acts, the sooner international attention will shift toward bringing the rapidly developing nations into an international emissions control regime. ■

I am very grateful to John Anderson, Charles Komanoff, William Pizer, and Phil Sharp for very valuable comments on an earlier draft of this article.

Further Reading

For more discussion of the differences between CO_2 taxes and cap and trade, particularly as part of an international agreement, I recommend William D. Nordhaus, 2007, "To Tax or Not to Tax: Alternative Approaches to Slowing Global Warming," *Review of Environmental Economics and Policy* 1: 26–44.

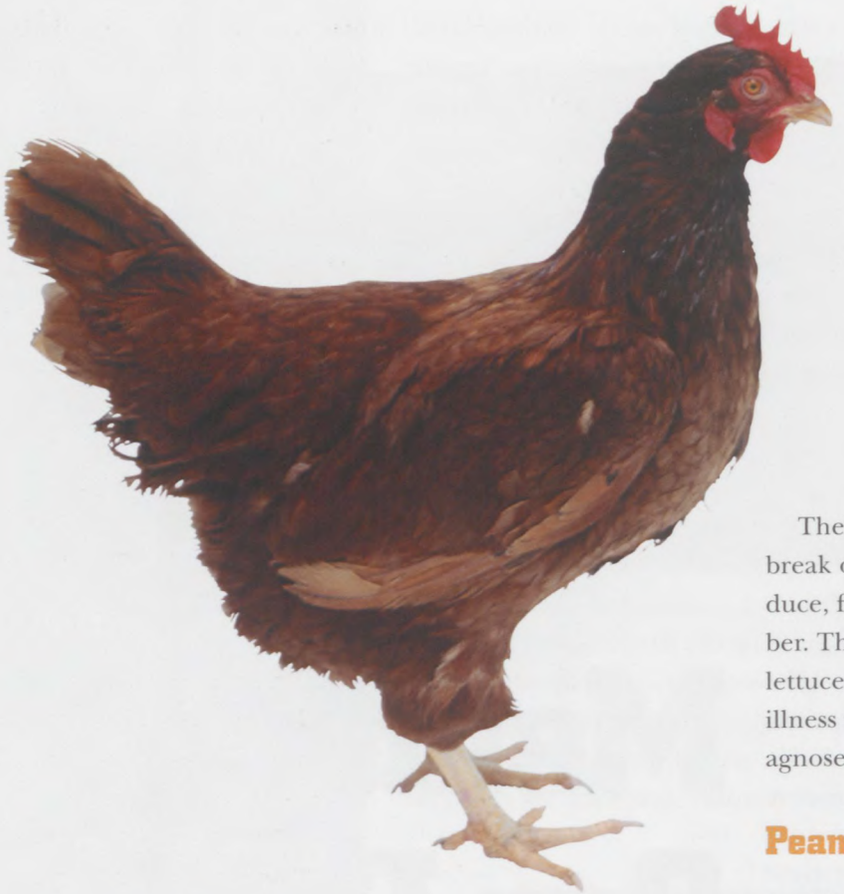


Mending Our Food Safety Net

Sandra A. Hoffmann

Paul Krugman recently announced in a *New York Times* op-ed that he was doing something risky—he was eating a salad. He meant to shock. And he did. Americans are accustomed to assuming that their food is safe, but Paul Krugman was more right than he may have known. Eating food is a bit like walking a high wire. Risky, yes, but with skill and the right support system—like a good safety net—it can be done safely. But events of the past year have left many consumers wondering if there aren't some serious gaps in the system of private and public efforts that assure the safety of the U.S. food supply.

Consumers want to take food safety for granted and there are sound economic reasons for this. Managing most aspects of food safety is simply not to consumers' comparative advantage. There are significant economies of scale and gains from specialization in managing food safety in complex modern supply chains. And while they will always need to watch for spoilage and handle food properly, many modern food safety failures are difficult for consumers to observe. Spinach contaminated with *E. coli* O157:H7 looks pretty much like uncontaminated spinach. The food industry also prefers that food safety be taken for granted because jittery consumers can mean loss of business, or worse, collapse of a market segment. The U.S. beef industry suffered daily losses of $27 million following the announcement in December 2004 that a single cow had tested positive for mad cow disease. And in general, government officials find life a bit more pleasant when they're not scrambling to fix food safety crises. Yes, everyone prefers that food safety stays below consumers' radar. But this past year it didn't.



Don't Eat Your Spinach

It all started with Popeye's favorite food. In September 2006, many U.S. consumers woke to news of the Centers for Disease Control and Prevention (CDC) announcing a multistate outbreak of foodborne illness associated with *E. coli* O157:H7 in ready-to-eat spinach. The U.S. Food and Drug Administration (FDA) called for bagged fresh spinach to be removed from grocery stores across the country and warned people not to eat uncooked fresh spinach. Many consumers were surprised to learn that even washing would not remove bacterial contamination that had found its way into the plant tissue.

E. coli O157:H7 is a particularly virulent strain of *E. coli* that produces a toxin that can cause kidney damage. By the time this outbreak ended, 199 people in 26 states were reported ill: of those, 102 were hospitalized, 31 developed kidney failure, and 3 died.

A very prompt and exhaustive investigation into the September spinach outbreak narrowed the contaminated product to prepackaged spinach produced on August 15, 2006, during a single shift, at one plant in California's Salinas Valley. But no one has yet been able to sort out exactly how the contamination occurred. In October, FDA announced the end of the outbreak, saying fresh spinach was "as safe as it was before the outbreak."

Then in early December, CDC announced a second outbreak of foodborne illness caused by *E. coli* O157:H7 in produce, followed by another smaller outbreak later in December. These outbreaks were ultimately traced to prepackaged lettuce from California's Central Valley. A total of 80 cases of illness were reported, with 61 people hospitalized and 9 diagnosed with kidney failure.

Peanut Butter and What?

In February 2007, newspapers across the country reported a new outbreak, *Salmonella* in another American staple, peanut butter. By early March, CDC reported that 425 people from 44 states had been sickened, 71 of whom were hospitalized. Government investigators traced the source of the illnesses to a peanut butter plant in Georgia. ConAgra estimated that its recall of Peter Pan and Great Value peanut butter cost $50–$60 million. Because peanut butter is cooked, outbreaks are rarely associated with the product. FDA investigators worked with plant managers to identify the source of the bacteria. Moisture from a leaking roof had activated dormant *Salmonella* in the Georgia plant and contaminated the product in the short time between its final heat treatment and jarring.

Now, the Focus Is on China

U.S. consumers had not even had a chance to stop talking about contaminated peanut butter, when, on March 16, several major U.S. pet food manufacturers announced a voluntary recall of 6 million packages of pet food. More than 14,000 dogs and cats had been sickened after eating their products. FDA forensic scientists determined that wheat gluten from China used to thicken "gravy" in the products was contaminated with melamine, a plasticizer with high nitrogen content. FDA later found that Chinese rice gluten ex-

ported to the United States for use in pet food also contained melamine. In late April, FDA and U.S. Department of Agriculture (USDA) announced that more than 6,000 hogs and as many as 3 million chickens may have been fed melamine-tainted feed; some had entered the human food supply. The agencies determined that the potential human exposure from this use of melamine was far too low to pose a threat to human health and allowed the meat on the market, even though melamine is not approved for human or animal consumption. In a story that could be right out of Sinclair Lewis' *The Jungle,* investigators learned that Chinese firms often add melamine to gluten as a cheap means of making the gluten appear higher in protein content than it really is.

Then on June 1, just as the pet food news was beginning to die down, FDA advised consumers to throw out toothpaste labeled as made in China due to concern that it might contain diethylene glycol, a sweet-tasting substance found in some antifreeze. Diethylene glycol can cause kidney and liver failure and is banned from use for human consumption in the United States. But Chinese counterfeiters have found it profitable to substitute it for more expensive glycerin, a closely related substance that is approved as a safe food additive. Last year, 365 reported and 100 confirmed deaths occurred in Panama when counterfeit glycerin from China that was mixed in cold medicine turned out to be diethylene glycol. Most of the dead were children.

On June 28, FDA announced that it would be detaining certain farm-raised Chinese fish and seafood at the border until the shipment was proven to be free of antibiotics not approved for aquaculture use in the United States. Over the prior six months, FDA had repeatedly found that farm-raised seafood from China contained carcinogenic antimicrobials. They also found residues of fluoroquinolones, a new class of antibiotics relied on as one of medicine's "last defenses" for serious human infections when other antibiotics fail. U.S. authorities ban use of fluoroquinolones in animal production because this practice has been shown to decrease its effectiveness in treating human disease.

Who Is Minding the Store?

The U.S. public is used to seeing a major food safety story every few years—Alar in the late 1980s, *E. coli* 0157:H7 in ground beef in the 1990s, a "mad cow" or two that never entered the food supply in the past few years. Small foodborne illness outbreaks or recalls occur regularly and large ones every few years. But to have five major product-safety stories in 12 months—that's unusual. It may be simply that the press was sensitized by the spinach outbreak, so other food safety stories that usually would have been on page 18 ended up on page 1 of the morning paper. It may be that anxiety about changes in trade patterns, and China's dominance in manu-

facture of consumer goods has fed into the snowballing story on Chinese food safety.

But it may be that the American consumer is right to be asking, what's up with the food supply? And why is Paul Krugman, someone who writes on such weighty issues as labor and international finance, filling *New York Times* column space with commentary on food safety?

Congressional committees have held an almost continuous series of hearings since last fall, responding to each food safety crisis in turn. In early May, FDA appointed a food safety "czar" to direct development of an agencywide strategy for addressing food safety crises. On July 19, President Bush announced the creation of a Cabinet-level commission to address food safety issues with imports from China. So it does appear that there's more to recent events than simply newspaper sensationalism or consumer jitters.

Where Do We Go from Here?

First, we need a diagnosis. Paul Krugman blames his risky salad on Milton Friedman, the conservative University of Chicago economist who, in 1999, called for the elimination of both the food and the drug sides of FDA. Krugman also blames the dominance of an ideology, legitimated by Friedman's work, that sees little role for government. He would likely see the more concrete diagnoses and associated remedies being offered as symptomatic of this underlying malady.

But just as food may be inherently riskier than Krugman realizes, the political situation may also be worse. In federal food safety policy circles, Friedman's neo-conservative view that government is neither needed nor useful is met with defensiveness from food safety professionals and advocates, including many major U.S. companies. A purposeful or unintentional policy of inattention and underfunding of food safety programs is met with a call for "more inspection, better labeling, and stronger standards."

It's as though two bulls had locked horns, each trying to push the other back over some unseen line. Little creativity is likely to emerge from such a shoving match. So the solutions that are being promoted—restoring FDA funding, hiring more import inspectors, consolidating food safety agencies to improve coordination, replacing visual inspection of chicken carcasses with testing for bacteria—are incremental when real creativity is exactly what is needed.

The underlying problem is that U.S. food law is antiquated, and we have not had the vision or political will to make reforms of the depth that are required to address the problems we face. Meat and poultry are regulated under acts that are essentially unchanged from their original adoption in 1906. FDA regulates most of the remainder of the food supply under a 1938 statute. In 1906, line inspection was at the forefront of industrial quality control. Federal meat and poultry inspection legislation still mandates visual inspection of each carcass as it comes down the line. Effectively, our food safety statutes still largely embody an early 20th-century perspective on quality management.

The news is not all bad. We have learned a tremendous amount about product quality and safety management since 1906. Statistical process controls were not even developed until the 1920s. They weren't widely applied in industry until Total Quality Management (TQM) guru W. Edwards Deming helped turn around postwar Japanese manufacturers' reputation for poor product quality. The 1970s and 1980s saw widespread adoption of TQM concepts in U.S. and European industry. These lessons and others from risk management in environmental quality management are available for gleaning.

Within the constraints of their antiquated statutory authority, federal agencies have worked to incorporate some of these lessons into food safety regulation. In the 1990s, both FDA and USDA adopted Hazard Analysis and Critical Control Point (HACCP) regulations. These regulations require food-processing plants to adopt more modern quality control systems and put government in the role of monitoring whether these systems are in place and functioning properly. Plant managers developing HACCP systems analyze where hazards are likely to enter their production plant, identify critical points in the system for controlling the hazard, and develop a system of monitoring those points and a plan for actions to take to bring the system back under control if needed.

HACCP provides an analogy for the ways drafters of a new food safety statute need to think about the role of government in food safety management. Of course, government's role is to manage safety in the entire food supply, not at one plant or even one firm. But the basic roles are broadly the same. Industry will likely always be one step ahead of government in recognizing the rapid changes in technology and supply chains we're experiencing. This calls for rethinking the relative roles of government and industry. The news here is good too because economists and business managers have developed much more sophisticated tools for understanding and tracking changes in industrial structure as well as new approaches to using incentives and quality management systems at an industry level. Many of these lessons are being applied by industry and government successfully in areas as diverse as supply-chain management and environmental regulation.

Information will be the foundation to using modern quality management to improve the food safety system. We need to commit to funding improved, regular, public data collection and analysis if we want a safer food supply. In designing HACCP regulations, USDA conducted nationwide baseline studies of the prevalence of microbial hazards throughout the meat supply. Only now, 20 years later, is USDA able to repeat that monitoring effort. FDA has no such studies. This kind of information needs to be collected more widely and more regularly. Similarly, better and more timely information is needed on human disease incidence—the most recent estimate of U.S. foodborne disease dates back to 1999. And regular, focused collection of economic data on changes in sourcing, costs, and trade flows will also be needed.

Conventional wisdom in food safety circles is that real policy change only comes in the face of real crisis. Because U.S. consumers take food safety for granted and because the system has worked reasonably well for a long period, it is difficult to get legislators to step up and expend political capital on significant reform. But significant reform is what is needed. Incremental solutions like restoring funding, appointing a food safety czar, consolidating agencies, and even eliminating the "silos" around regulation of different food products, will not do the job. Bringing food safety governance into the 21st century will require applying 20th-century quality management lessons to food safety administration. Government agencies have to take on the role of system safety manager rather than line inspector. ■

I would like to thank Richard Williams (George Mason University), Glenn Morris (University of Florida), and Mike Doyle (University of Florida) for their helpful comments. All errors are, of course, my own.

From Oilfields to Energy Farms

A BRIEF LOOK AT THE ENVIRONMENTAL CONSEQUENCES OF BIOFUELS

Roger A. Sedjo

The environmental consequences of our addiction to oil are well known, but what happens when our energy feedstocks are counted by the acre, not the barrel? Global use of biofuels, principally ethanol, has surged over the past decade. Once at the farthest edge of financial viability, biofuels are now a multibillion-dollar industry, with a seemingly green horizon. However, the devil is in the details.

Unlike oil, the type of biofuel and where it is "farmed" matter a great deal when tallying up environmental pros and cons. Government regulations and price supports have shaped the evolution of the ethanol industry in Brazil and the United States, the predominant global producers. In the former, ethanol is produced from sugarcane at costs competitive with petroleum prices. In the latter, the price of corn and the land it's grown on has been steadily rising, as oil companies compete with food and feed producers for a commodity that is at the core of our economy.

And other countries across South America, Africa, Asia, and Europe are shifting agricultural and forestry practices to find better, cheaper sources of ethanol from switchgrass, palm oil, and wood.

The biofuels market today represents the 21st-century equivalent of the Oklahoma land rush in 1889. Oil companies, grain producers, politicians, and venture capitalists are racing to claim available land, niche markets, and the latest promising technologies. To help sort out the signal from the noise, here we will take a closer look at the economic and environmental implications of the major biofuel categories.

Economic Viability

Ethanol, often referred to as the first generation of liquid biofuels, has had a head start as an alternative transport energy source in the United States, due, in large part, to substantial subsidies and use requirements imposed to meet Clear Air Act considerations. Many areas of the country require that ethanol meet a certain percentage mix with gasoline, for example, 15 percent. This requirement is often put in place at certain times of the year to reduce pollution emissions.

Ethanol's recent rapid growth in the United States was

triggered by the recent dramatic rise in oil prices and the 2005 Energy Policy Act, which mandates that 7.5 billion gallons of the nation's annual gasoline consumption, roughly 5 percent, come from renewable fuels by 2012. Subsequently, the president has proposed quintupling that figure; plans now call for a required increase in the portion of gasoline combined with ethanol so that total ethanol could increase fourfold by 2020.

The long-term economic viability of corn ethanol is questionable because it requires a high degree of protection: ethanol has received a 51 cents per gallon subsidy since 1978 and is protected from imports by a 54 cents per gallon import tariff, which has discouraged the import of cheaper sugarcane-based Brazilian ethanol. The result of these subsidies and recent higher oil prices has seen corn prices double in the past three years as ethanol use now consumes about 20 percent of the nation's corn supply. At the same time, financial returns on ethanol have been favorable and corn planting has expanded, causing land rents to double. Furthermore, land has been withdrawn from other uses, primarily soybean farming, to accommodate the growing demand for corn.

Cellulosic feedstocks, the second generation of liquid biofuels, are comprised of wood, grasses, and certain agricultural wastes (see the box on page 19 for a description of the actual processes for converting cellulose into biofuel). Currently, the costs of cellulosic ethanol are high due to the difficulty in breaking down the tough cellulose. However, progress is being made in developing new low-cost enzymes to do the job.

Cellulosic ethanol will have potential advantages in that various types of waste material can be used to produce it, including waste wood from mills, wastes for grain production and processing operations, and harvested trees and grasses. The efficacy of such materials as a feedstock depends importantly on the volume of their availability and the costs of collection.

In the United States, switchgrass, a summer perennial native to North America, appears particularly attractive. It is capable of high yields on annual rotation, averaging 11.5 tons per acre per year, enough to make 1,150 gallons of ethanol in one test. An advantage is that it is usually suitable for production on lands often viewed as marginal for high-value

grains and other higher-valued crops. Another possible grass feedstock is a mix of high-diversity native grassland perennials that can be produced on agriculturally degraded land, require low inputs, and thus need not displace food production nor cause loss of biodiversity via habitat destruction. The evidence also suggests that grasses typically are low input and exhibit carbon dioxide (CO_2) balances that are far better than for high-input grain ethanol.

Wood is another cellulosic feedstock. Forests planted in fast-growing species can generate about 5 tons of wood per acre per year on rotations of 10 to 15 years. New trees, with improved growth through breeding, show the possibility of doubling that level. Trees have benefits similar to grasses in that they can be grown on sites that are marginal for most agriculture. Also, compared to grasses, trees have a longer rotation, reducing the necessity of a short planting and harvesting cycle, thereby lowering costs. Of course, the longer rotation also lengthens the gap between investment and payout. Another advantage of trees over grasses is that wood is less perishable, providing flexibility in harvesting, storage, and use.

Rising energy demand for corn has already created serious land-use conflicts in this country prompting farmers to shift production of other essential food commodities, like soybeans, over to corn.

Carbon Emissions and Biofuels

A recurring question with biofuels relates to their net greenhouse gas (GHG) emissions. The use of the biofuel itself does not generate net GHG emissions, since carbon releases are offset by the fact that the feedstock renews itself. However, various processing stages have net emissions releases. Corn cropping involves planting, harvesting, and transport operations, as well as the application of fertilizers. In addition, processing corn feedstock to ethanol usually requires fossil fuel energy and, consequently, substantial GHG emissions. A recent study by the Natural Resource Ecology Laboratory analyzed the capacity of various biological feedstocks to reduce GHG emissions; the results showed that cellulosic biomass (switchgrass and hybrid poplar) can reduce GHG emissions by about 115 percent when compared to petroleum. Reed canary grass, the next best, can reduce GHG emissions by 85 percent. Noncellulosic biomass (corn ethanol and soybean biodiesel), in last place, could reduce GHG emissions by only 40 percent.

Let's pause for a moment; 115 percent—how does that work? Cellulosic biofuels can offset the CO_2 emissions associated with planting, harvesting, transport, and related farm operations by sequestering atmospheric CO_2 and converting it into organic carbon in biomass and soil. In short, the carbon capture is naturally occurring in the feedstock, just as a stand of trees absorbs and stores CO_2. Grasses typically require only modest energy and pesticide inputs compared to grains. A similar argument can be made for trees with respect to energy and land disturbance. All these considerations suggest cellulose can reduce net carbon emissions compared to grains, which release a good deal of CO_2 emissions when converted into ethanol, as well as other environmental damages associated with production.

Land-Use Implications

Should biofuels become globally important, substantial land-use adjustments are likely. Rising energy demand for corn has already created serious land-use conflicts in this country: the price of corn-based foodstuffs has risen significantly, and corn land rents (the lease value of farmland) have risen even more dramatically, prompting farmers to shift production of other essential food commodities, like soybeans, over to corn.

Cellulosic biofuels also would involve land-use adjustments. However, much of the expansion of grasses and forest would occur on land that is marginal for other crops, like pastureland, because the land types involved are usually different.

Trees are most likely to become important sources of biofuel in conjunction with forest industry activities, like pulp mills, where large volumes of waste wood are available. As is common now in the forest industry, most new sources of raw wood would likely come from planted forests.

Outside the United States, sugar cane is currently in widespread use to produce ethanol in Brazil. The process appears to be efficient and inexpensive because the primary feedstock is the waste from the sugar production process. Sugar cane may become an attractive source of feedstock for biofuels in other countries with large sugar-cane production. In this case, land-use changes may not be required in sugar-cane-producing regions except for very large levels of production.

Finally, palm oil is considered a potentially economically competitive feedstock source for biodiesel and has its own set of land-use implications. In countries like Indonesia and Malaysia, palm plantations have existed for decades, but market forces are prompting more to be established. In many cases, plantations are being established on land that was previously forested. ■

Trees are most likely to become important sources of biofuel in conjunction with forest industry activities, like pulp mills, where large volumes of waste wood are available.

The Technology of Cellulosic Biofuels

There are three general approaches for producing biofuels from cellulose.

In **bioconversion,** cellulose can be converted to biofuels through processes that use enzymes to break down the cellulose bonds and convert the sugars to biofuels or through processes that use fermentation or heat to convert the cellulose to gases that can then be converted to biofuels. The process differs from that used for corn in that it requires a greater amount of processing to make the sugar available to the microorganisms that are typically used to produce ethanol by fermentation. Once the sugars are isolated, a fermentation process is undertaken. Cellulosic materials, however, are much more difficult than grains to break down into their various sugars. The bioconversion process typically uses a combination of physical or chemical pretreatment and enzymatic hydrolysis to convert lignocellulose into its components. The sugar components of the cellulose are then processed fuel products, like ethanol. A current limitation in this process is the need for improved low-cost enzymes.

The **thermochemical** process, sometimes called the third generation of biofuels, involves an integrated refinery approach that converts the gaseous constituents of wood—carbon monoxide and hydrogen—into a synthetic gas, essentially the same approach used with coal as the feedstock. The "syngas" can be used either directly as energy to produce electricity for the mill or can be exported via the grid. It also can be converted to a biologically based synthetic fuel through a catalyzed chemical reaction known as the Fischer-Tropsch process: carbon monoxide and hydrogen are converted into liquid hydrocarbons of various forms, principally a synthetic petroleum substitute for use as lubrication oil or fuel.

A final alternative process for producing cellulosic ethanol is that of **hemicellulose extraction.** Here, wood chips are soaked before they enter the pulping process, and the hemicellulose is removed and used for producing ethanol. This process is resource efficient in that some of the hemicellulose would have gone to waste in the ordinary pulping process. This process has the advantage of requiring no enzymes but is possible only on a small scale.

Inside RFF

Chevron Vice-Chair Robertson Joins RFF Board

The best energy you can find is energy you don't use," says Peter J. Robertson, vice-chair of the Board of Chevron Corporation and a new member of the RFF Board of Directors. Energy efficiency is one tool for meeting the world's growing demand for fuel, and Robertson believes that market-based policies permit consumers and companies alike to choose the lowest-cost approaches to reducing their energy use.

PETER J. ROBERTSON

Robertson is also a strong supporter of market-based policies to reduce greenhouse gas emissions. As an example, he cites the European Union's Emissions Trading Scheme, which enabled Chevron to develop a geothermal energy project in Indonesia. "Not only was it more efficient than trying to further reduce emissions in Europe," Robertson says, "it helped a developing nation tap into a clean renewable energy source."

He sees huge opportunities in a market-based system to benefit countries such as China. "If China were as energy efficient as the United States was back in 1970," he says, "we could save 16 million barrels of oil a day," but with the right economic incentives, "China could leap straight to the most modern technologies for efficiency and emissions reductions."

Robertson believes that energy producers have a responsibility to foster sustainable development and thereby contribute to economic and human progress. "At the end of the day, we are still investing in the fossil fuel business," he says, but because demand for energy is expected to soar, "diversity in fuel sources is a critical issue." Chevron has established research and development projects with leading universities to develop alternative and renewable energy, with emphasis on second-generation cellulosic biofuels. "We're learning what works and what doesn't, what can be industrialized to scale up to make a difference," Robertson says.

A native of Scotland, Robertson holds a degree in mechanical engineering from the University of Edinburgh and a master's in business administration from the Wharton School. His career at Chevron has spanned 35 years. During this time he has managed European operations, strategic planning, and exploration and production in North America and overseas.

With his extensive experience in the energy field and firsthand knowledge of how public policy affects energy company operations, Roberts hopes both to contribute to RFF's mission and to learn in his time on the RFF Board. "RFF has been using economics to develop rational policies for important issues," he says, "and energy is the most important issue facing both the nation and the world." ■

RFF has been using economics to develop rational policies for important issues, and energy is the most important issue facing both the nation and the world.

RFF Council Meeting Report: Looking at the Barriers to Green Power's Growth

Green power—electricity generated from renewable sources—is a noble idea that is getting a lot of attention these days. But coverage in the mainstream press doesn't tell the whole story; the hard numbers, in terms of installed capacity, are pretty small. Estimates vary somewhat, but roughly 2.5 percent of domestic power generation is derived from the following sources: biomass, geothermal, wind, and solar. Coal is still king throughout much of America and will be for a while to come.

Despite this seemingly grim outlook, the consensus view was optimistic at RFF's recent spring Council meeting, "Renewable Energy and Electricity: Which Way Is the Wind Blowing?" Speakers from across the policy landscape, from industry to government, described the political and geographic constraints, highlighted the patchwork of success stories from state to state, and looked to what it will take to push green power beyond business as usual.

Success depends on how you phrase the question, the speakers said. What works in the "sovereign nation of California" is highly dependent on local conditions, said Paul Clanon, the executive director of the state's Public Utilities Commission. With a highly Democratic populace, a crusading, famous Republican governor, and an economy equivalent to that of many European states, there's plenty of po-

We need to think on a much larger scale, well beyond putting a solar panel on your garage roof.

— Shalini Vajjhala

Speakers at the recent RFF Council meeting in Washington addressed the theme "Renewable Energy and Electricity: Which Way Is the Wind Blowing?". Clockwise from top left: David Hawkins, director, Climate Center, Natural Resources Defense Council; Paul Clanon, executive director, California Public Utilities Commission; Shalini Vajjhala, RFF fellow; Karen Palmer, RFF senior fellow.

litical will to institute sweeping changes, such as a new mandate that 30 percent of California's power come from renewable sources by 2030.

The potential for green power to grow also depends heavily on where you can put it, said RFF's Shalini Vajjhala, the conference organizer. While in California there is a push for huge solar photovoltaic installations, on the East Coast, citizen opposition has stymied the development of wind farms, like the Cape Wind project off the coast of Massachusetts. In all of these cases, high costs are also a major factor. For example, 70 percent of the total costs for utility-scale wind turbines are in the installation. Add in the costs of supporting infrastructure, like power lines, and you have a wide range of factors that weigh heavily on which technologies are funded and built, she said.

Howard Gruenspecht, deputy administrator, Energy Information Administration, also spoke at the meeting.

Policy discussions about renewable energy tend to be fragmented, Vajjhala said. Too often the focus is on individual technologies or industries or end uses. This is not to discount what's happening in California and elsewhere, she said. "We need to think on a much larger scale, well beyond putting a solar panel on your garage roof."

Need for a New Constituency

David Hawkins, director of the Climate Center at the Natural Resources Defense Council and an RFF board member, reminded the audience that business-as-usual projections regarding the fate of renewable energy should not be regarded as destiny: "They are forecasts that assume no policy changes or carbon constraints." But real change is possible and not for the reasons one might expect, he said.

Existing technological and economic barriers can be crossed with support for large-scale investments that help spur necessary institutional improvements, such as streamlined permitting procedures and system upgrades like added transmission capacity. The real barrier, Hawkins said, is the lack of an organized political constituency for renewables. The coal industry has large, well-organized supporters—including the National Mining Association, Association of American Railroads, and United Mine Workers of America—that stand behind the status quo fuel mix, he said.

"We've got to build a comparable constituency that doesn't really exist at the scale that is needed," he said. Politicians need to know that "if they vote for a renewables scenario, they can get reelected."

Consumers also need to learn to think strategically, said Karen Palmer, RFF Senior Fellow. "Buying green power today will lower the cost to our children of continuing to fight global warming tomorrow."

The one-day meeting also addressed policy drivers for moving forward as well as the potential trade-offs. Other speakers included Howard Gruenspecht, deputy administrator, Energy Information Administration; RFF Fellow Carolyn Fischer; Andrew Ertel, president and CEO, Evolution Markets, Inc.; Revis James, director, Energy Technology Assessment Center, Electric Power Research Institute; and Leon Lowery, legislative aide, Senate Committee on Energy and Natural Resources. ■

RFF sponsors a summer internship program in which students from around the world work with the research staff. Pictured here are some of this years' interns, from left:
Top row: RFF President Phil Sharp, Daniel Miles, Rebecca Lewis, Elizabeth Skane, Ian MacKenzie, Xiang Liu, Romulo Romero, Catherine Mdoe, Alex Doyne, and Santiago Guerrero.
Bottom row: Dustin Tasker, Amanda VanEpps, Gabriel Feingold, Tess Stafford, Erin Myers, and Mikaela Schmitt.

RFF Awarded $4 Million in New Grants for Research on Public Health and Climate Policy

Grants totaling nearly $4 million have been awarded to Resources for the Future to support new research on public health issues and climate and energy policy.

The gifts include $1.7 million from the Robert Wood Johnson Foundation for continuing research on antibiotic resistance; approximately $675,000 from the Bill & Melinda Gates Foundation for research on malaria; grants of $750,000 and approximately $150,000 from the Doris Duke Charitable Foundation to support climate policy research; and $500,000 from the Simons Foundation to support climate-related activities.

"These grants represent continuing confidence in the value of our independent research toward resolving some of the most critical issues of our time," says RFF President Phil Sharp. "They will allow us to build on an already substantial reservoir of impressive work."

Focusing on Policies to Combat Infectious Diseases

The Robert Wood Johnson funding will provide support for the next phase of the "Extending the Cure" project that seeks effective policies and incentives to counteract the growing problem of antibiotic resistance. Senior Fellow Ramanan Laxminarayan headed a team that completed a major report in March that outlines a variety of measures that could be implemented—some through legislative and regulatory actions and others through market incentives—that can tackle this public health threat.

"The second phase of this work will define in greater detail the policy measures that government, pharmaceutical companies, consumer groups and other stakeholders must consider to preserve our arsenal of antibiotics as a national resource," says Laxminarayan. "We will be working with a wide range of collaborators and stakeholders in the field to provide a policy blueprint for consideration by Congress and regulatory agencies."

The Gates Foundation grant will support research and an international conference to examine the scientific merits of a multiple drug regimen against malaria, explore the practicality of using policy and market mechanisms to influence antimalarial drug use, and design a rational, global antimalarial drug policy.

Exploring America's Post-Kyoto Climate Role

A major part of the support from the Duke Foundation will be directed to production of a report by the end of 2008 that will outline key elements of a post-2012 international architecture on global climate change that can serve as the basis for a strategic U.S. position. The report, along with supporting documents, would be completed for use by an incoming administration, when the international community will be looking to the United States for new ideas and leadership.

"Our analysis will focus on the most important and vexing question: how to engage developing countries, notably China and India, in meaningful participation in a global program to reduce greenhouse gas emissions," says Ray Kopp, RFF senior fellow and director of the Climate Technology Policy Program. "We will produce a series of policy analyses that will provide impartial advice, independent modeling results, and practical options to the governmental bodies and private sector stakeholders charged with designing emissions caps and other international regimes."

Part of the Duke funding will support the Harvard Project on International Climate Agreements led by RFF University Fellow and Board Member Robert Stavins and RFF Fellow Joseph Aldy. The project will help identify key design elements of a scientifically sound, economically rational, and politically pragmatic post-2012 international climate policy architecture.

Support from the Simons Foundation will be directed across a broad range of climate-related RFF research, including exploration of policy initiatives in California to curb emission of greenhouse gases in the utility and transportation sectors.

Mark Heising, director of the Simons Foundation, notes that RFF's long-standing research expertise in climate policy was a key reason for the new grant. "For the foreseeable future, global climate change will be at the top of the nation's policy agenda," Heising says. "We believe Resources for the Future's objective and deep understanding of climate policy will pay real dividends for policymakers trying to deal with this complex issue." ■

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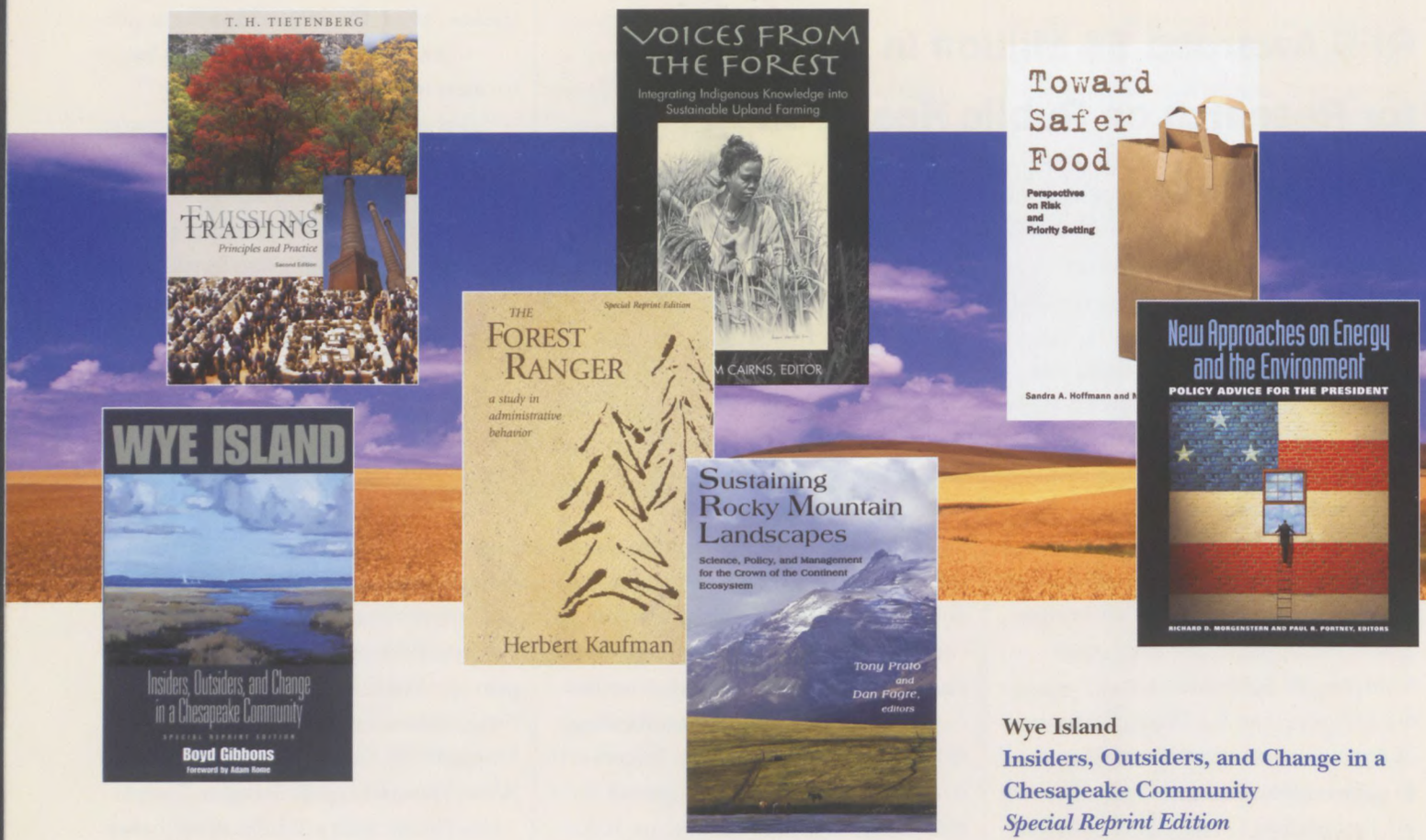

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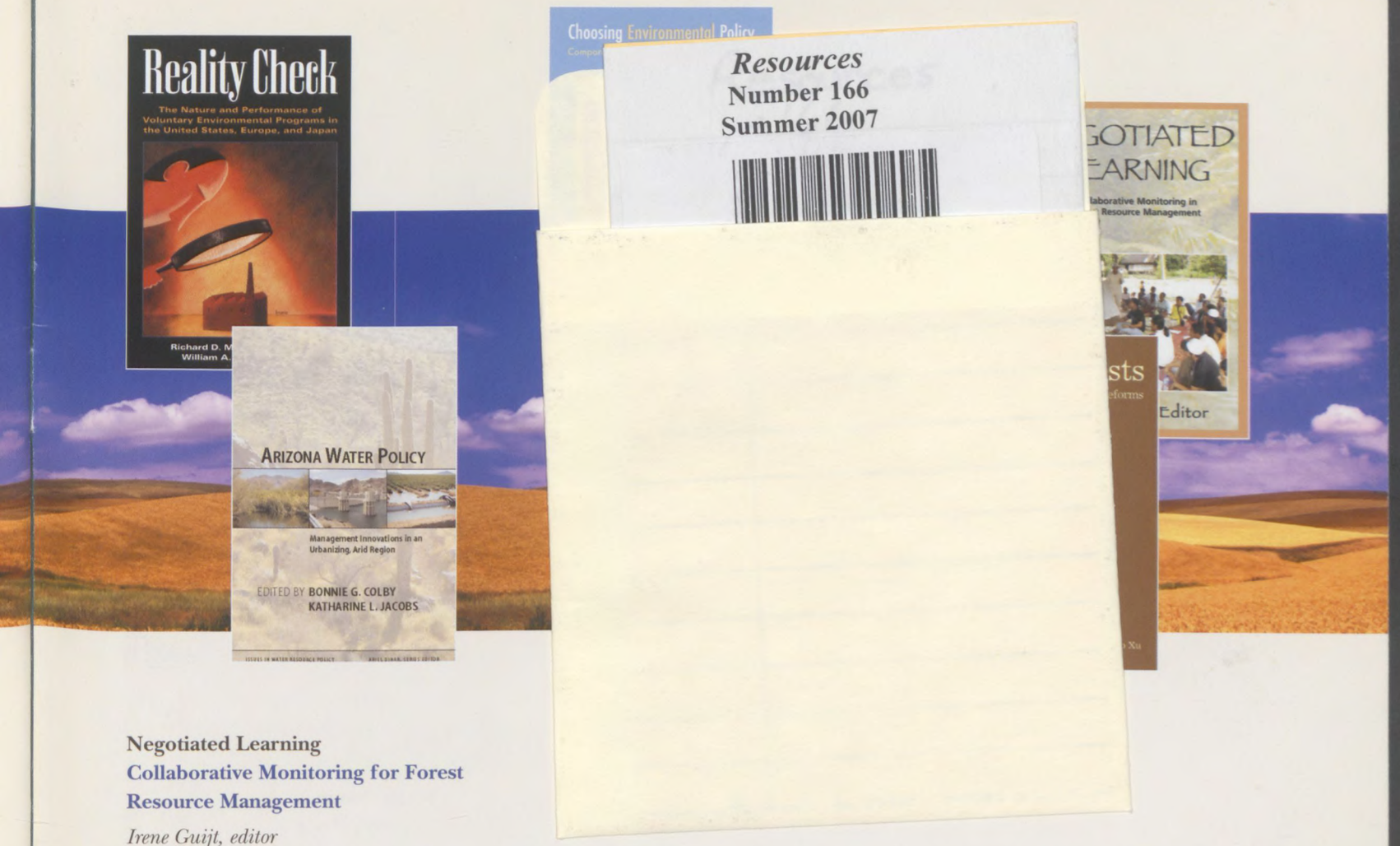

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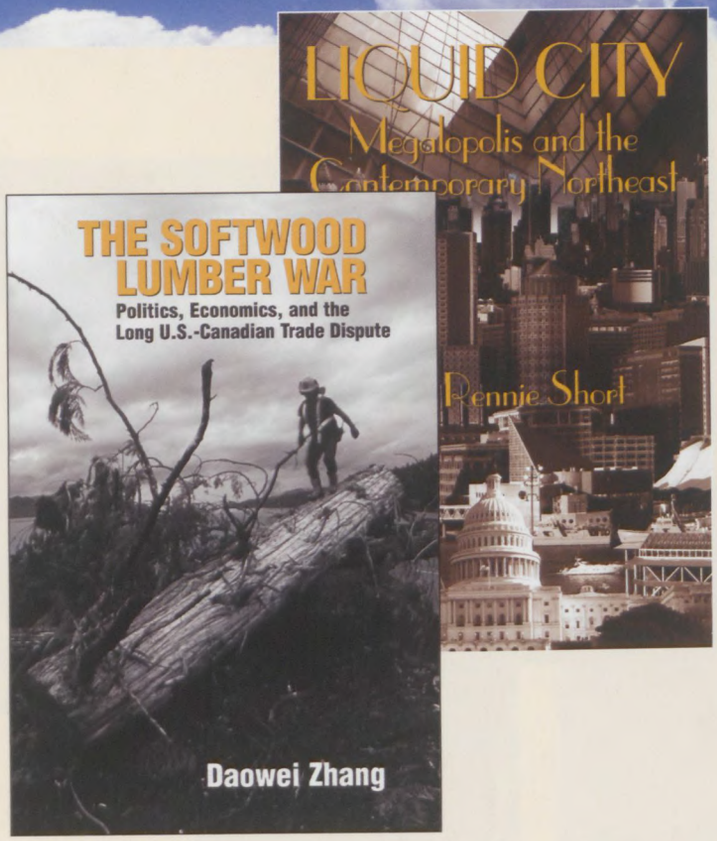

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