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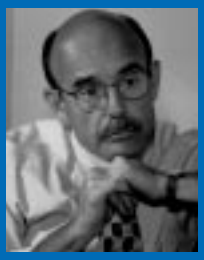
RESOURCES

RESOURCES FOR THE FUTURE RESEARCH THAT MAKES A DIFFERENCE

The Science of Environmental Policy



Paul R. Portney

Prolonged and intense debate on smog, soot, and greenhouse gases has fixed attention on an important related matter: the proper role of science in environmental decisionmaking. In this issue of *Resources* James Wilson and J.W. Anderson point out that "sound science" (which everyone claims to support) is never "neat science." That is, carefully done studies, conducted by unbiased researchers, sometimes come to very different—occasionally diametrically opposed—conclusions. This divergence permits the many opposing parties in a policy debate to claim that sound science supports their positions.

In the last issue of *Resources*, Michael Toman summarized the natural scientific debate surrounding climate change. The current issue extends our attention to the social science underlying climate change policymaking, as Ian W.H. Parry takes a critical look at the so-called "double dividend" hypothesis: the idea that policies to curb carbon dioxide emissions not only can provide environmental benefits but improve the efficiency of the U.S. tax system as well. (No cigar when it comes to this apparent windfall, Parry says. Reducing carbon emissions may even increase what economists call the "deadweight losses" associated with the tax system depending on the polices employed.)

As we go to press, EPA has just announced its decision to tighten the ozone standard and set a new standard for fine particulate matter. Part of the controversy surrounding this decision centered on the science policy matters that Wilson and Anderson discuss. But part involved the cost of meeting the standards, which Alan Krupnick warned Congress could be significant. (See "Goings On.")

That environmental protection costs money certainly doesn't mean we can or should write it off. As Krupnick testified, he and others are now looking for low-cost ways in which tighter air quality standards can be implemented. Nor is Parry suggesting that we forego all action to cut carbon emissions. But just as RFF researchers so often do, both he and Krupnick point out the need to balance the burden on the economy against the benefits to be had—benefits we depend on science to help identify and verify.

Complications notwithstanding, identifying environmental benefits and weighing them against associated costs is one of the foundations of good public policy. It is a science as well as an art that we at RFF think about every day.

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GOINGS ON

On climate at Kellogg

RFF President Paul R. Portney participated in what was billed as a high-level dialogue on climate policy at Northwestern University's J. L. Kellogg Graduate School of Management in May. Industry CEOs, the heads of environmental organizations, university deans and professors, and government officials gathered to discuss how to protect our climate and our robust economy, too.

Portney told participants that, when it comes to global warming and climate change, "I talk to no one privately who doesn't express concern about the problem and the need to begin doing something about it. This includes at least some," Portney added, "whose public position is, 'This is not a serious problem and we shouldn't waste time on it.' Increasingly, leaders in the business community are saying that it wouldn't hurt to buy a *little* insurance—that's a big change in attitude."

Portney made his remarks after Undersecretary of State for Global Affairs Timothy Wirth kicked off the event with a U.S. position statement on climate change negotiations. With regard to the approach that Wirth outlined, Portney said the Clinton administration "deserves great credit" for incorporating a number of principles into its preferred approach on climate policy, including the need to take a long-term view and to allow trading in carbon reduction efforts to minimize costs.

Noting that the United States has "taken heat" for its insistance on a trading approach, Portney also praised the administration for insisting that less developed countries participate along with developed ones in the carbon dioxide emission reduction process.

Where Portney parted company with the U.S. position was in wanting to see the government specify preferred reduction targets and a timetable for meeting them before the global conference on emission reductions in Kyoto, Japan in December. Portney said he would also like to see the government move to bring down the costs of doing something about the problem.

"We're talking about 'real money'—and real consequences for energy-intensive industries," he said. According to current estimates (admittedly uncertain), it will require an implicit tax of about $100 per ton of carbon to meet the apparent U.S. goal, a cost that will eventually be borne by consumers. The reduction effort would knock about 1 percentage point off the annual growth rate of the U.S. gross domestic product, at least temporarily, which would amount to about $70 billion a year. This amount is about half of what we now spend each year on all federal environmental programs, he pointed out. To help bring down costs, Portney concluded, will require a greater push on energy research and development.

Cheaper ways to cleaner air

EPA's tighter national ambient air quality standards (NAAQS) will be "incredibly expensive" to implement, Senior Fellow Alan Krupnick told Congress in April. The expense will be high, he added, even though EPA Administrator Carol Browner has "clearly endorsed cost-effectiveness as a major criterion" for developing an implementation strategy to further reduce ozone and fine particles in the air.

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Krupnick has spent years studying issues associated with the Clean Air Act and the design of environmental policies. Currently, he co-chairs the committee that he said "Browner hopes will develop ideas for reducing the costs of meeting the new standards." That committee—the Federal Advisory Committee Act (FACA) Subcommittee for Ozone, Particulate Matter, and Regional Haze Implementation Programs—will continue to meet through 1997. Its goal is to provide EPA with input and, if possible, consensus recommendations on developing a pollution control strategy scheduled for proposal next June. Specifically, the FACA subcommittee is assessing ways to achieve cost-effective emissions reductions that allow NAAQS attainment and reductions in regional haze.

But the group—whose members include industry and environmental advocates—"cannot work miracles," Krupnick warned. The former want cost reductions, the latter greater certainty of standard attainment. Meanwhile, the states want greater autonomy from EPA. Even if consensus is reached, there is no guarantee that the recommendations will be as cost-effective as they might be, Krupnick added. The negotiation process will demand some trading off of cost savings for certainty. And EPA may choose to ignore what the FACA subcommittee recommends; it is only an advisory body.

"EPA may come up with what it considers better ideas, or it may find that some suggestions run afoul of the Clean Air Act," such as implementing a regional system of caps on the amount of nitrogen dioxide industry is allowed to emit and of trade among firms of their allowances. Indeed EPA is "severely limited by the Clean Air Act in its ability to implement new ideas," Krupnick said.

Urging Congress to ease the act's constriction, Krupnick outlined measures that he

GOINGS ON

believes offer some promise of reducing implementation costs below what they otherwise would be. He cautioned, however, that his recommendations were no indicator of what the FACA subcommittee might recommend.

Based on ideas that his group has been discussing to help cut implementation costs, Krupnick suggested a regional cap and trade program for nitrogen oxide emissions, and regional air management partnerships to address the long-range transport of both ozone and fine particulate matter. He also suggested that emissions reduction progress should be tied to the location, type, and concentration of pollutants, rather than assume that all tons of emissions are equally detrimental, and that states should receive credit now for programs that will reduce emissions in the future. New sources of emissions that participate in a cap and trade system and wish to locate in areas not in attainment with air quality standards should be permitted to trade emission allowances in exchange for meeting abatement technology requirements.

To allay fears of prohibitive costs, a ceiling could be placed on what a firm has to pay per ton of emissions. A "Clean Air Fund" could be established to cover the costs of reducing pollution outside of the state implementation plan process. In lieu of abatement, polluters might have the option of paying into the fund the ceiling price per ton of emissions. Greater emphasis should be placed on real-time monitoring of mobile (vehicular) emissions through new technologies, such as remote and on-board sensing. As for area sources, focus should be placed on controlling "episodic" noncompliance with air quality standards.

Krupnick offered his opinions on implementing the revisions to the NAAQS before the U.S. Senate's Committee on Environment and Public Works, Subcommittee on Clean Air, Wetlands, Private Property, and Nuclear Safety. In a separate panel before the same subcommittee, he testified on the merits of the revisions themselves.

Find the complete text of Krupnick's comments on both panels at *http://www.rff.org/testimony.*

Commerce in space: How U.S. can help

As a long-time analyst of the commercial use of space technology, RFF Senior Fellow Molly Macauley offered her views to Congress this spring on how government can foster burgeoning commercial ventures into satellite remote sensing—one of the most promising transfers of technology from the public to private sector in years. As reported in the spring issue of *Resources,* Macauley has a research grant from NASA to study the ongoing economic—as well as privacy, security, and other—implications of American companies selling images photographed by privately owned satellites in outer space.

In her May testimony before the U.S. House Committee on Science's Subcommittee on Space and Aeronautics, Macauley praised much of the proposed policy designed to make way for commercial remote sensing as "carefully crafted." But Macauley cautioned against fettering the industry further, at least unless any prospective law or regulation is first subjected to a careful weighing of its pros and cons.

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Despite a good start, moreover, Macauley said that some refinement is still needed of the relationship between the government and the new private owners and operators of high-resolution spacecraft. She cited industry concern about what is considered a slow-paced licensing process and the absence of an effective way to appeal denials of requests for licenses or licensing amendments. In response to such criticism, she recommended a "fast track" approach like the one the Food and Drug Administration uses to handle some categories of new drug approval requests. She also suggested that the government consider developing a "one-stop-shop" point of contact not just for routine licensing but for responding to proposals from industry regarding new activities or innovations.

She urged Congress to stop government subsidies of the cost of distributing remote sensing data, questioning the legitimacy of the burden placed on taxpayers and noting the ironic tendency of such subsidies to lead to data of poor quality. Intellectual property rights also require some attention, she said.

With regard to research and development, the government might provide industry with facilities for testing hardware, evaluating data quality, and supporting basic research, in addition to providing data vouchers or augmenting research grants with funding for data purchases. Another relatively straightforward way that government might help out would be to auction off its used spacecraft once research missions have been completed.

"Government's role here is not without limits, however," Macauley added, and the industry will probably step into the breach to set up and fund some research on its own, she said.

Find the complete text of Macauley's comments at *http://www.rff.org/testimony*

What the Science Says:

How We Use It and Abuse It to Make Health and Environmental Policy

by James D. Wilson and J.W. Anderson

Under an ideal scenario, only the best science, pure and undefiled, would flow directly into policy as it is made to protect human health and the environment. But that wish isn't realistic. The best assurance of good public policy seems to lie not only in scientific knowledge per se but in open debate, caution, and a regulatory system capable of self-correction.

Environmental policy is always based on science—up to a point. But defining that point is often a matter of fierce dispute and political combat. Then the quality of the science involved becomes an issue.

Decisions are easiest when threats and benefits are immediately visible to the naked eye. No one questioned, for instance, the proposition that burning soft coal in fireplaces and furnaces meant smoky skies over St. Louis. When people got sufficiently tired of the smoke, as they finally did in 1937, this source of home heating was outlawed with no argument over causation. But much of the modern environmental protection movement has been a response to menaces that are invisible, indirect, and detectable only through advanced technology. The effect has been to draw subtle and complex scientific issues into the arenas of politics.

The debates burn hottest where scientific uncertainty is the greatest and economic stakes are the highest. Scientific uncertainty comes in many forms.

About-Face on Thresholds

When science changes, environmental regulation has great difficulty adapting. One dramatic example is the issue of carcinogens' thresholds—whether there are doses below which carcinogens have no adverse effect on health. On that one, the consensus among scientists has reversed twice in less than fifty years.

Until the 1950s, it was a settled principle of toxicology that every poison had a threshold below which the dose was too slight to do harm. But with rising anxiety about the environmental causes of cancer, especially in the context of the debates about nuclear radiation and weapons testing, it began to seem more prudent to assume that carcinogens generally had no thresholds. One result was the famous Delaney Clause that Congress wrote into the 1958 Food, Drug, and Cosmetics Act.

The Delaney Clause banned all carcinogens from any processed food. At the time Congress, like the experts advising it, was under the impression that

carcinogens were few and readily identifiable. But over time research found more and more substances that, if fed to rats in sufficiently massive amounts, could cause cancer. Some were naturally present in common foods—including orange juice. At the same time the increasing sophistication of measuring techniques identified traces of widely used pesticides and fungicides in many foods.

The regulatory system generally responded to these unwelcome findings by ignoring them. But at the same time the science was changing. Improved understanding of the processes by which cancers originate and develop made it seem increasingly likely that thresholds exist after all. The regulators themselves became convinced of that, although the Delaney Clause remained the law. The Food and Drug Administration quietly whittled away at the clause until the courts told them to go no farther.

There's a high cost to society when government must enforce laws that make no sense to the people charged with enforcing them. It engenders cynicism among the regulators, and among the public it erodes confidence in both the law and its enforcement. But while Congress increasingly understood that the law was unenforceable, it refused to consider any reform that might be attacked as lowering the standard of health protection.

Lawsuits Force the Issue

A lesson for science policy lies in the way this paralysis was ended. It wasn't the advance of science that did it, although the science was certainly advancing. Instead, as often happens in environmental affairs, the issue was forced by litigation—in this case, litigation brought by people who wanted the Delaney Clause enforced more literally. In 1992 a federal appellate court decision raised the prospect that the Environmental Protection Agency would be required to ban many widely used pesticides, with drastic implications for farmers' crops and retail food prices. That got the attention of Congress, and last year it replaced Delaney's flat ban with a more realistic standard of "reasonable certainty" of no harm. According to its authors, the phrase was intended to mean a lifetime risk of cancer of no more than one in a million. With this change, the law is now back in conformity with scientific opinion and the regulators' actual practice.

Opinion Masked As Science

If it is possible to draw up a list of the circumstances that generate strife over the application of science to policy, along with changing science, disputes among scientists must also be near the top. To many laymen, certainty and precision is the essence of science: as they understand it, a scientific question can have only one right answer. But especially in matters of public health, it is often essential to make policy decisions long before the science is entirely clear. When people's lives and welfare are at stake, it is not possible to wait until every technical doubt has been resolved.

The situation is frequently aggravated by scientists who underestimate the uncertainties in their own work, leading them to blur the line between science and policy. Endless examples have turned up in the congressional hearings this year on the EPA's proposals to revise the air quality standards for ozone and particulate matter. The EPA's Clean Air Science Advisory Committee (CASAC) set up a special panel of experts on ozone, and the panel came to general agreement that, within the range of standards under discussion, there was no "bright line" to distinguish any of them as being "significantly more protective of public health" than the others. Setting the standard, they said, was purely a policy choice. But the law specifically authorizes CASAC panels to offer policy advice, and more than half of the panel went on to offer EPA their various and conflicting personal opinions as to where the standard should be set. CASAC is deliberately organized to represent a wide range of views and interests.

The policymakers, most of them trained as lawyers, seized whichever of these personal opinions agreed with their own and cited them as the voice of science itself. In congressional hearing after hearing, EPA's Administrator, Carol Browner, defended her proposed standards as merely reflecting "the science." Her adversaries then quoted back to her the opinions of scientists who disagreed, some of them members of CASAC and others officials of the Clinton administration.

A more productive way to approach policy choices is to acknowledge uncertainty and take it explicitly into account. Do you go on a picnic if the weather report forecasts a 60 percent chance of rain? Do you commit society to a complex new air quality regulation if there's a 40 percent chance that it will not provide health benefits as intended? Attempting to

quantify risk is an important step in making policy decisions. Unfortunately, it violates the current style of politics, in which it is safer to minimize responsibility and discretion by suggesting that decisions are determined solely by the science.

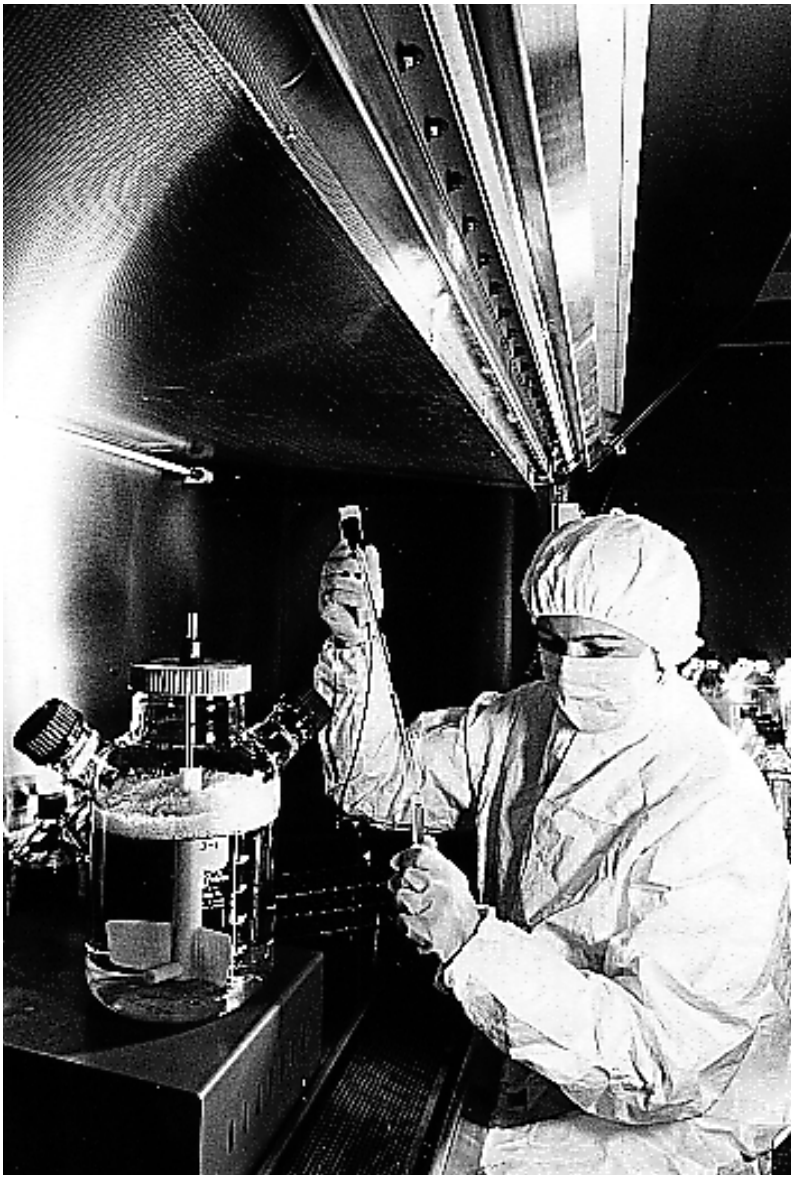
But which science? Toxicology looks for the mechanisms of damage to health at the molecular level, in terms that can be demonstrated in the laboratory, and tends to dismiss anything less specific as mere speculation. Epidemiology, on the other hand, sees reality in the statistical associations between the presence of a pollutant and the evidence of damage. As Mark Powell, a fellow in RFF's Center for Risk Management, has pointed out in his discussion paper on EPA's use of science in setting ozone policy, the tension within the agency between the toxicologists and the epidemiologists is as old as EPA itself. On clean air, CASAC is similarly divided.

In the current round of the debate over clean air rules, the policymakers who support tighter standards cite the epidemiologists. Those who resist tighter standards cite the toxicologists. At present the differences between the two specialties' positions on particulate matter is substantial, and there is no one view that represents settled and accepted scientific truth.

Science As Proxy for Other Issues

In the vehement debates over science, scientific uncertainty often becomes the proxy for other issues—in the case of the Clean Air Act, for the forbidden subject of economic costs. The act prohibits EPA from taking costs into account in setting standards. Opponents of proposed regulations, unable to pursue their argument that the costs will outweigh any prospective benefits to health, go after the scientific basis of the regulations instead.

Confusion also arises when science asks the wrong question—sometimes because the law requires it. Here again the Clean Air Act provides examples. To take a prominent one, the act wants science to tell the regulators what effects each of six common pollutants has on human health. Since the pollutants are regulated separately, the health effects have to be studied separately. Scientists have been trying to tell the regulators for some years that it would be far more useful to investigate these pollutants mixed together, in the "soup" that people actually breathe, because the presence of one compound can affect the impact of another. But Congress has never responded to that advice because the concept of mixtures doesn't fit easily into the existing statutory framework for regulation. When environmental reality collides with statutory tradition, it's not always the statute that gives way.



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Funding scientific research that is relevant to regulatory decisions is both possible and badly needed.

Sometimes the Wrong Battle

Science, or what seems to be science, can sometimes

be flatly wrong. The process of scientific inquiry is self-correcting over time. That is its greatest strength. But policy doesn't always wait for the corrections.

The Superfund program originated, notoriously, in response to mistaken and exaggerated scientific judgment. The Love Canal, in Niagara Falls, NY, had been well known locally as a toxic chemical dump that was leaking insecticide into Lake Erie. But it suddenly became a national news story, and a symbol of a new range of hidden environmental dangers, when in the summer of 1978 the state's health commissioner declared it a threat to the health of people living there. It was an election year in New York, and suddenly politicians at all levels, including President Carter, were competing to show concern and protect the residents. The following year a scientific consultant to the local homeowners association reported findings that indicated a wide range of threats to health. Then another consultant engaged by EPA reported evidence of high rates of chromosome damage among residents. Those claims established the atmosphere in which Congress began to draft the Superfund legislation.

Subsequently, review panels within EPA severely criticized the contractor's chromosome report, and a special committee of scientists set up by the governor of New York dismissed all of the health findings as inconclusive. But by the time that happened, the Superfund bill was approaching final passage. It is not entirely coincidental that, of all the major federal environmental laws, Superfund has produced the fewest benefits to health and welfare in relation to the costs it has incurred and the litigation it has generated.

It would be pleasant to think that some mechanism might be invented to allow the best science to flow, pure and undefiled, directly into policy. But that's hardly realistic, amidst the turbulence of rapidly developing science and especially in a field that, like environmental and health protection, has emerged as one of the leading battlegrounds of national politics. The best assurance of good public policy seems to lie in open debate, caution, and a regulatory system capable of self-correction.

Research Needs Funding

One point on which improvement is both possible and badly needed is the funding of scientific research relevant to regulatory decisions. Private and public spending in this country to meet the federal requirements for pollution control and abatement is in the range of $140 billion a year. Congress gives EPA less than half of one percent as much to spend on all its scientific and technological work for all purposes, a sadly disproportionate effort to ensure that environmental rules have the best possible scientific base.

It's not only the general pressure to cut the budget that inhibits adequate spending on science to support environmental regulation. Concerns about global warming have led to substantial outlays of federal science money on other purposes, and on other agencies than EPA. Currently, the EPA science budget is only about 10 percent of total federal spending on environmental scientific research and development.

The purpose of balancing the budget is to enhance the economy's efficiency and promote future growth. But budget cuts won't help the economy if they lead to the waste of resources on misguided policy.

James D. Wilson is a senior fellow and resident consultant in RFF's Center for Risk Management. J.W. Anderson is a former member of the *Washington Post*'s editorial page staff and RFF's current journalist in residence.

This article benefited from the comments of **Mark R. Powell**, a fellow in the Center for Risk Management, who is completing a book on the EPA's use of science. On that subject he has published eight case studies as RFF discussion papers. See page 17 to order copies.

Reducing Carbon Emissions

Interactions with the Tax System Raise the Cost

by Ian W.H. Parry

Reducing the amount of carbon dioxide Americans pump into the atmosphere will involve economic costs. These costs are larger than previously thought because emissions reduction policies are likely to aggravate economic distortions created by the tax system. But most of this added cost can be avoided if the policy chosen to reduce emissions raises revenues for the government and these revenues are used to cut other taxes.

Continued accumulation of heat-trapping gases in the atmosphere raises the prospect of future global warming and associated changes in climate. Many countries will attend a conference this December in Kyoto, Japan to consider steps to reduce emissions of carbon dioxide (CO_2)—the most important heat-trapping gas. Introducing emissions targets may produce important benefits in terms of avoided future climate change. Nonetheless, it makes sense to consider which policy approaches might reach these objectives at the lowest economic cost to each country. Recent research suggests that much will be at stake in this respect: the costs of even modest reductions in CO_2 emissions may differ substantially under different types of regulatory policies. To understand why requires a look at how these policies may interact with taxes that already exist in the economy.

The Tax-Interaction Effect

Government spending in the United States is financed primarily by taxes on labor and capital income. Putting aside the potential benefits from these spending programs, the taxes tend to "distort" economic behavior. That is, they reduce employment and investment below levels that would maximize economic efficiency. For example, because personal income taxes reduce take-home pay, the partner of a working spouse may be discouraged from joining the labor force, an older worker may retire earlier, or a worker with one job may be discouraged from working additional hours in a second job. Employers are likely to hire less labor if social security taxes make employees more expensive. Similarly, capital gains and corporate income taxes reduce the incentives for individuals to save and for firms to invest in new production capacity.

Environmental taxes and regulations tend to discourage economic activity because they raise the costs to firms of producing output. Typically, this leads to a lower overall level of employment and investment in the economy. These "spillover" effects of environmental policies in labor and capital markets add to the distortions created by the tax system. The resulting economic cost has been termed the *tax-interaction effect*.

What would happen if a tax on carbon emissions (as proposed by the European Union) were introduced? The new tax would increase the costs to firms of purchasing coal and oil in particular, which in turn would increase the cost of electricity and gasoline. Most likely, firms would scale back their production activities a little in response to these higher costs,

leading to a fall in the level of investment and employment (as happened, for example, in the 1970s when the price of energy increased). But employment and investment are already "too low" because of pre-existing taxes in the economy. This aggravation of distortions created by the tax system would be part of the overall economic cost of a carbon tax.

This is not the end of the story, however, because a carbon tax would raise revenues for the government. These revenues could be used to reduce other taxes in the economy, such as personal and corporate taxes, and thereby reduce the distortion in the level of employment and investment. The economic gain from this so-called *revenue-recycling effect* could reduce the overall economic costs of a carbon tax significantly.

The Rise and Fall of a Hypothesis

Considerable confusion has arisen recently about the implications of tax distortions in the economy for the costs of carbon and other environmental taxes. In particular, a number of analysts have mistakenly argued that there would be a "double dividend" from environmental taxes. These analysts have correctly pointed to the potential benefits from the revenue-recycling effect, but have failed to recognize the cost from the tax-interaction effect.

Essentially, the double dividend hypothesis asserts that environmental taxes can both reduce pollution emissions and reduce the overall economic costs associated with the tax system. At first glance, this hypothesis seems to be self-evident, if the revenues raised are used to reduce other taxes that discourage work effort and investment. In some European countries, where high taxes, among other factors, have contributed to double-digit unemployment rates, the double dividend hypothesis has been particularly appealing. If environmental tax revenues were used to reduce taxes on labor income, so the hypothesis goes, unemployment and pollution might be reduced simultaneously. More generally, some people have argued that it is better to finance government spending by taxing economic "bads," such as pollution, rather than economic "goods," such as employment and investment.

Economists generally agree that revenue recycling would reduce the net economic cost of environmental taxes. However, recent studies suggest that environmental taxes are likely to *increase* rather than *decrease* the costs associated with the tax system overall. As Lans Bovenberg (Netherlands Bureau for Economic Analysis), Lawrence Goulder (Stanford University and RFF), and others have demonstrated, the adverse effects on employment and investment caused by environmental taxes are generally not fully offset, even if the tax revenues are used to reduce other taxes. That is, the tax-interaction effect dominates the revenue-recycling effect.

Thus, if there were no environmental benefits, it would be better to finance public spending by taxes on, for example, labor income rather than on pollution emissions. Why is this? A tax creates economic costs by inducing households and firms to consume and produce less of the taxed activity and more of other activities. The greater the shift away from the taxed activity, the greater the cost of the tax. Taxes on labor income can only be avoided by people working less and spending more time at home. In contrast, environmental taxes have a much narrower focus, and are easier to avoid. A carbon tax can be avoided by an overall reduction in the level of production and employment. However, it can also be avoided by a change in the composition of production away from goods that use a lot of electricity (such as electric ovens and heating appliances) to ones that do not (such as natural gas ovens and heating). Tax economists have long argued that the economic costs of raising revenues are smaller under taxes that have a broad coverage compared with taxes that have a narrower focus.

Of course, this does not mean that environmental taxes should not be implemented. Instead, the environmental and revenue-recycling benefits should be weighed against the costs of reduced production and the loss from the tax-interaction effect. Indeed, recent research generally supports carbon taxes so long as the tax rates are not too high (that is, so long as they do not exceed the incremental value of environmental benefits).

CO_2 Permits versus a Carbon Tax

Instead of imposing a carbon tax, the government may reduce CO_2 emissions by requiring that firms have a permit for each unit of CO_2 emitted. By controlling the total quantity of such permits it gives to firms, the government could limit total CO_2 emissions to a target level. This permit program would cause a similar

reduction in production, employment, and investment, as would a carbon tax. The reduction in employment and investment would add to the distortions created by the tax system, leading to the same cost from the tax-interaction effect.

Whether CO_2 permits could also produce the benefit from the revenue-recycling effect would depend on whether the permits were auctioned by the government or given out free to existing firms. If the permits were auctioned off, the government could use the revenues to reduce other taxes in the economy. But if the permits were given out free, as in the case of the existing permits program for sulfur dioxide emissions, no revenue would be collected and there would be no potential for a revenue-recycling effect.

The table below summarizes the benefits (denoted by '+') and costs (denoted by '–') of carbon abatement policies. The benefits from a carbon tax consist of the potential gains from reducing future climate change (the environmental benefits), and the revenue-recycling effect. The costs consist of the reduced production from industries affected by the tax and the costs of exacerbating tax distortions in the labor and capital markets, or tax-interaction effect. Economists have traditionally focused on (1) and (3) and neglected (2) and (4). This has led to some overstatement of the benefit-to-cost ratio from carbon taxes because the tax-interaction effect generally dominates the revenue-recycling effect.

The Benefits and Costs of Carbon Abatement Policies

Policy	Environmental benefits (1)	Revenue-recycling benefit (2)	Loss of production (3)	Tax-interaction effect (4)
Carbon tax	+	+	–	–
CO_2 permits	+	?	–	–

+ denotes benefits – denotes costs

CO_2 permits would produce three of the same effects as the carbon tax: namely, the environmental benefits from reduced future climate change, the cost from reduced production, and the tax-interaction effect. However, the benefit from the revenue-recycling effect could only be obtained if the government auctioned the permits.

Can the Policies Make Society Better Off?

Recent collaborative work by Lawrence Goulder, Roberton Williams, and myself suggests that the tax-interaction effect can raise the overall cost of policies to reduce emissions by a potentially substantial amount. For example, we estimate that the economic costs to the United States from using (non-auctioned) permits to reduce CO_2 emissions by 10 percent below current levels increases by 400 percent when the cost of the tax-interaction effect is taken into account! If instead the permits were auctioned—or a carbon tax were levied—and the revenues were used to finance cuts in other taxes, we estimate that the overall cost of this policy would be reduced by 75 percent.

On top of this, we estimate that the overall economic costs of a free CO_2 permit program would outweigh the environmental benefits—unless these benefits exceeded $25 per ton of carbon reduced. Estimates by William Nordhaus (Yale University) suggest that the benefits from reducing carbon emissions may be *below* $25 per ton, although there is much dispute on this point. If so, *even though the policy would correct a market failure associated with carbon emissions, the benefit would be more than offset by the costs of adding to distortions caused by the tax system*.

In contrast, a policy to reduce emissions that produces the revenue-recycling effect can produce a favorable benefit-to-cost ratio as long as environmental benefits per ton are positive. Thus, a CO_2 emissions reduction policy might produce an overall benefit to society only if it raises revenues for the government.

Other Considerations

It is important to keep in mind, however, that the benefit estimates from reducing CO_2 emissions are highly speculative at this stage. They do not take into account the (hopefully small) possibility of drastic changes in climate should global warming disturb some unstable mechanism within the climate system. Nor are the potential ecological impacts well understood. We simply do not know enough yet to judge whether global warming will turn out to be a very serious problem or not.

Moreover, there are other factors to consider in the choice of policy instruments to reduce CO_2 emissions. For example, affected industries may oppose a carbon tax that requires them to reduce emissions *and* pay

taxes to the government more than a free CO_2 permits program. Other important considerations include the potential impact of a given policy instrument on the private incentives to develop more energy-efficient technologies.

Nonetheless, minimizing the economic costs of any action to reduce CO_2 emissions that might be agreed to in Kyoto this December is desirable, not only for its own sake, but also for the likelihood of the agreement to stand the test of time. Recent research warns that even modest emissions reductions might be especially costly if the policies used do not raise revenues for the government that are returned to the economy in other tax reductions.

Ian Parry is a fellow in the Energy and Natural Resources Division. Lawrence Goulder, Paul Portney, Dallas Burtraw, and Marie France provided valuable comments on an earlier draft of this article.

This article is based in part on Parry's paper "When Can Carbon Abatement Policies Increase Welfare? The Fundamental Role of Distorted Factor Markets," written with Lawrence Goulder and Roberton Williams. The paper is available in the RFF discussion paper series. See page 17 to order a copy.

Recycling Revenues

Other Ways to Benefit

Are there other ways that carbon tax revenues might be used to reap economic benefits besides cutting other taxes? Yes, if the revenues were used to reduce the federal budget deficit. In that way, less tax revenue would be required in future years for interest payments and repayment of principal on the national debt. As a result, taxes could be lower, implying less distortion of employment and investment. Of course, in this case the benefits from revenue recycling would occur in the future rather than the present.

The answer is "it depends" if the revenues were used to finance additional public spending. The huge bulk of government expenditure in the United States consists of transfer payments, such as pensions, or expenditures that substitute for private spending, such as medical care and education. Loosely speaking (and ignoring distributional impacts) the benefit to people from a billion dollars of this type of spending is a billion dollars. If instead the revenue were used to reduce other taxes—say the personal income tax—the economic benefits would be greater. Not only would people get a billion dollars but the lower tax rates would favorably alter relative prices in the economy. The rewards for work effort and saving would increase, thereby encouraging more employment and investment. In contrast, increased public spending would not alter relative prices.

However, governments also provide "public goods" that, for various reasons, the private sector may not provide such as defense, crime prevention, and aid to needy families. People may (or may not) value an additional billion dollars of spending on these goods at more than a billion dollars. If they do, the benefits from this type of revenue recycling may be as large as (or even larger than) the benefits from reducing taxes.

The Politics of Protecting Species

Like any law, the Endangered Species Act is hardly administered in a political vacuum. Among other things, the act allows citizens to petition administrative agencies to add an animal to the Endangered Species List as either "threatened" or "endangered" and to request hearings and submit comments about listings proposed. So just how political is the process? Do "cute critters" get priority? Do economic considerations creep in, even though the act forbids their use as criteria for deciding which species should be protected?

In one of RFF's noontime seminars open to the public this spring, Fellow Amy W. Ando offered her preliminary findings on how much political maneuvering and cost-benefit considerations influence the way the endangered-species listing process works. Ando found that the U.S. Fish and Wildlife Service does not appear to be bending rules to favor furry friends over endangered invertebrates. But interest groups and legislators do influence the listing process in ways consistent with their perceptions of the costs and benefits of species protection.

Using data from 1989–1994, Ando conducted a duration-time analysis of additions to the Endangered Species List. Ando's statistical analysis shows that mechanisms designed by Congress to allow public participation in the process are effective, and that members of oversight committees have direct influence over the process. Interest groups and subcommittee members influence the speed at which a species moves through the stages that ultimately lead to its being listed for protection.

In the early part of the process, interest group support can make the difference as to whether a species moves out of administrative limbo and onto a list or is instead demoted from active candidacy. Supporting petitions can reduce the time a candidate species spends in the pre-proposal administrative process by over a year. The influence of congressional subcommittee members at this stage is just as large, the direction of their support varying with the interests of their prime constituents.

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But opponents to a listing can launch a counteroffensive of delay. Ando found that once a species has been proposed for listing, hearing requests add over six weeks to the wait for final listing, and uncontested opposing comments may increase the expected length of a proposal period by almost fourteen weeks. Supporting comments have accumulating influence in the opposite direction, however. Support can, in fact, overwhelm the opposition by the time each side has submitted five hundred comments, according to her estimates.

The fact that costs and benefits are legally excluded as criteria for deciding whether or not a species will make a list has led some to criticize the Endangered Species Act as doing a poor job of allocating society's resources among species, Ando noted. However, her statistical analyses show that, in practice, endangered-species listing decisions are not immune to cost-benefit considerations. How people stand to gain or lose from the protection of a given species seems to be one of the driving forces behind their intensity of support or opposition. That pressure has real effects on the administrative process.

Should we then be content with the economic balancing achieved by this convoluted process? Ando notes that the route through which cost-benefit considerations enter the process is not ideal. Interest group expectations of the costs and benefits involved in protecting a species may be colored by ideological outlook and level of affluence. Furthermore, she finds that groups that support species protection seem to neglect some of the benefits, such as differential contribution to biodiversity, when deciding how much of a rally of support to offer a particular listing.

Would explicit consideration of cost and benefits be better? Ando acknowledges that rigid cost-benefit analysis of the protection of endangered species may be problematic for several reasons, one of which is the moral squeamishness we have about choosing whether to let a species go extinct. However, her research throws into relief the fact that economic considerations do figure into the process of regulatory decisionmaking.

For now, Ando concludes that interest groups on both sides of the endangered-species debate should recognize that they already have an important "seat at the negotiating table," while proponents of the "Noah's Ark" approach to species protection should realize that no legal mandate can completely exclude economic considerations from the process.

See page 17 to order Ando's related discussion papers.

INTERVIEW

The National Parks: Valuing a Treasure As an "Island Free"

Jim Maddy is the president of the National Park Foundation, the organization created by Congress to raise private sector support for the national park system. He is also a member of the RFF board. He spoke recently with J.W. Anderson, RFF's journalist in residence and a former member of the Washington Post's *editorial page staff. Their conversation is set out below.*

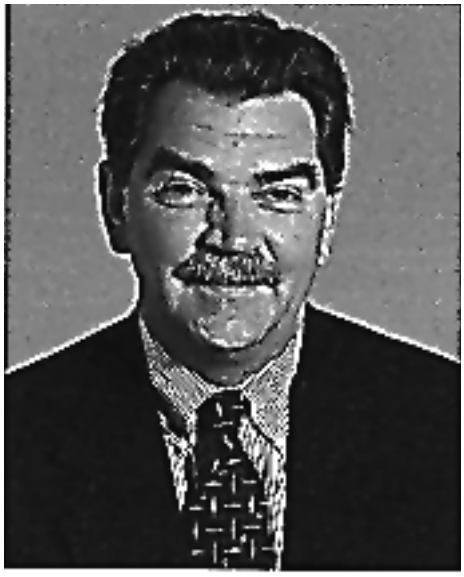
RFF: Every generation seems to use the parks a little differently. Do you have a sense of change now in the expectations of people coming to the parks, and things they want to do there?

Maddy: Visitors know not to feed the bears any more. Most people come and go without building a campfire. The long-term trend is to be very careful before adding any more roads or buildings in the parks.

There is movement toward keeping the park pristine, keeping the park natural, taking more literally the admonition to build in the park only the minimum necessary for the convenience of the visitor.

Increasingly people will see the national park as a place that is so special and under such great pressure—being 'loved to death' is the cliché—that they will understand that it's better to leave cars and pets and baggage, literally and figuratively, outside the park. They'll recognize the importance of leaving as much of the commercial activity as possible outside the park. They'll want to see the park as an island free of commerce, free of congestion, free of intrusion of man-made things and problems such as air pollution, water pollution, and trash. No one is going to go through parks with a wrecking ball and take down restaurants and lodges. But there is going to have to be a compelling case to build anything new inside the boundaries of the park. And that's a big switch.

This country used to set aside a Civil War battle site and then put the visitor center right where the historical action



took place. Now most people agree that's exactly where the visitor center shouldn't be. It should be someplace else, so people can actually see what General Lee saw and pretty much the way he saw it.

RFF: What needs to be done next? Does it all come down to the federal budget?

Maddy: Nearly everyone agrees that the appropriations are too small. There is some disagreement about the likelihood of getting appropriations to rise high enough and fast enough to solve the problem before some resource is lost or before permanent damage is inflicted on some of these parks. Particularly in the historic and cultural parks, if the structure and foundation of the buildings aren't maintained and the roof is not kept in sound condition, parts of our nation's history will be lost. The classic examples are the roof leaking at Independence Hall and the adobe crumbling throughout the Southwest.

There are two schools of thought on this. Both schools agree that conservationists should bring all the pressure they can possibly bring to bear on Congress to increase the appropriations for national parks and other public lands protection systems. In one school of thought there is sometimes a sense that efforts to relieve this pressure even in a modest way outside the appropriations process could be counterproductive—that in today's budget climate and today's fractious political atmosphere in Congress, any excuse to put off an increase in appropriations will be

seized upon by people in both parties.

The second school of thought says yes, there's not enough money there. It would be very desirable to have the increased appropriations and from time to time some increase can be achieved. But this second school of thought (and that's where I would put myself and certainly the National Park Foundation) believes that we're going to have to invent new ways to supplement appropriated funds.

If we really do expect not only to keep the parks from deteriorating, but also to expand and improve national parks, we are going to have to reach out to private funds, somehow find some ways private sources of funding can supplement appropriated funds.

The purpose of that support is not only to save the resource or try to catch up with some of the deferred maintenance, but also to extract the full measure of value from the parks that's there for the benefit of the public. And here I am thinking about education programs for people of all ages, and life-changing opportunities to bring young people into national parks in a way that could have a big, bold, measurable impact on their lives at a crucial time.

There is unlimited, just unlimited, potential for national parks to improve the education that we get as Americans, to improve the quality of our lives. But it costs money to get to that value. Congress is struggling to fully fund the maintenance and protection of national parks. Private sources are the best hope to fund expanded education programs based on park resources.

RFF: You had legislation in the last Congress?

Maddy: The National Park Foundation supported legislation in the last Congress that would have made it possible to find out what it is worth to a company to be able to advertise the fact that, unlike its closest competitors, it was very generously providing support for the national parks. I would like to test the value of that. I would like to know what it is worth to one firm in each of several separate business sectors to have "bragging rights" about being a substantial financial contributor to the parks.

My guess is that somewhere between $80 million and $100 million a year could be generated for many, many years. I think it is worth a try.

If the public and Congress had a better idea of just how many trillions of dollars this asset represents on the national balance sheet, they might be more likely to adequately fund park maintenance.

What happened to this legislation last year is that quite a number of organizations that are strong defenders of the environment and strong defenders of national parks, organizations that the National Park Foundation certainly considers allies, objected to some of the specific language in the legislation. We need to see if these things can be worked out before another bill is taken to the Hill. I would say it is more important to get it right than to get it fast. If it takes us a couple of more years to get it right, I think it will be well worth it.

RFF: What can economics do for the parks?

Maddy: One very straightforward thing that economic analysis could do for the parks would be to assign a value to them. Surely, it is true that you can't measure the full value of national parks in dollars. I'll stipulate that, but I do believe it is possible to make a meaningful estimate of their economic value. It would only be some small fraction of their total value to the country and to the society, but even the small fraction of the value that could be reduced to dollars, I suspect, is a very impressive number. Sometimes I think if the public and if members of Congress had a better idea of just how many trillions of dollars this asset represents on the national balance sheet, they might be more likely to adequately fund park maintenance.

One of the things the Park Service itself has identified to which RFF could contribute enormously is improving the ability of all of us to understand the national parks as central features of regional economies.

Every once in a while, through inadvertence, there is a chance to do a controlled experiment. A park will close because of a natural disaster, as happened this winter in Yosemite with the flooding. There is an opportunity right now to think of this as a laboratory for economists. What impact does it have on tax receipts of local governments and on local economies?

There's something magical about national parks. Put that brown sign out on the interstate or put that special little marker on the fine print of a highway map and hundreds of thousands of people will go to that spot and look around to see what's there. When they see the words "national park" on a highway marker they'll change their plans. They'll do whatever it takes to get there because the title "national park" conveys a guarantee of quality and value.

ANNOUNCEMENTS

Gilbert F. White 1997 winners

J. Daniel Khazzoom and Robert T. Walker are the winners of RFF's 1997 Gilbert F. White Postdoctoral Fellowships. Awarded annually since 1980 in honor of the retired chairman of the RFF board, the fellowships support postdoctoral research in the social or policy sciences in areas related to natural resources, energy, or the environment.

Khazzoom is a professor of quantitative studies at San Jose State University. His research involves the efficiency and equity aspects of pay-at-the-pump auto insurance, and other transportation and environmental issues. Khazzoom will be in residence at RFF from the end of October 1997 through July 1998.

Walker is an associate professor in Florida State University's Department of Geography. Recently, he received a Fulbright fellowship for three months of study in the Brazilian Amazon, where he is interviewing farmers and collecting data related to his study of land use and land tenure security.

Walker plans to be at RFF from December 1997 to August 1998, where he will continue his research on the socioeconomic causes of rain forest destruction. He wants to test the idea that giving small farmers inviolable rights to agricultural produce will discourage them from transient farming and the consequent clearing of more forest.

RFF releases two new books

Renowned Yale University economist William Nordhaus has developed many innovative approaches for analyzing complex environmental questions. He applies them to the possible phaseout of nuclear power in Sweden in *The Swedish Nuclear Dilemma: Energy and the Environment*. While making a major contribution to the phaseout debate, this book has value that extends well beyond the Swedish issue, to the careful and well-informed consideration of environmental and energy questions that industrialized nations and developing regions now face. The Swedish parliament has recently moved closer to eliminating nuclear energy, even while repeating commitments to reduce the greenhouse-gas emissions associated with fossil fuels. Nordhaus's Swedish Energy and Environmental Policy (SEEP) model quantifies the economic fallout of such a path.

In Sweden, a 1980 advisory referendum called for phasing out nuclear power. Parliament declared that no new nuclear reactors would be licensed and that existing reactors should not operate beyond the expected lifetime of the youngest one. This said to many that the phaseout would be complete by 2010. Numerous developments since 1980, however—technological, environmental, economic, and political—necessitated a fresh look at the referendum. Yet parliament has just reaffirmed its intention to make Swedish energy nuclear-free. Should the Swedes reconsider the phaseout in light of recent information and circumstances? What would be the cost of implementing such a phaseout?

Nordhaus discusses and models the impact of new factors such as deregulation of electricity generation, global climate–change policies, the decline of Sweden's economic growth and the rethinking of its welfare state. What are the costs and benefits to eliminating nuclear power? What are the economic ramifications of various energy and environmental options? Is a phaseout the most prudent approach? *The Swedish Nuclear Dilemma* casts these important questions in a new light, and it sets the stage for more informed analysis of similarly difficult issues where economic and environmental goals clash.

William D. Nordhaus is A.Whitney Griswold Professor of Economics at Yale University and the author of several books, including *Managing the Global Commons*. He is also co-author, with Paul Samuelson, of *Economics*, soon to enter its 16th edition.

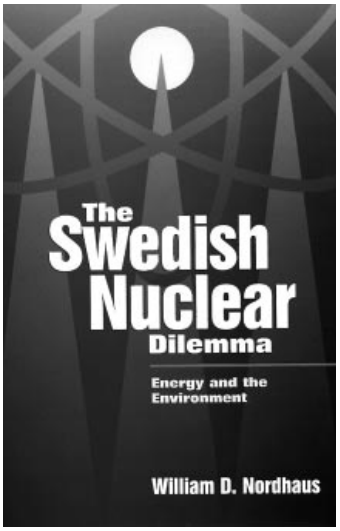
Economic Analyses at EPA: Assessing Regulatory Impact

For years, the Environmental Protection Agency has been conducting programmatic "economic analyses," also known as Regulatory Impact Analyses (RIAs), to assess the economic effects of its regulatory efforts. This important new volume explains the purpose of these analyses, along with their design, execution, conclusions, and their ultimate impact on environmental rules.

Richard Morgenstern, formerly director of EPA's Office of Policy Analysis, has assembled twelve original case studies of RIAs performed over the past decade on matters such as lead in gasoline, ozone depletion, asbestos, clean drinking water, and sewage management. The contributors, most of whom actually worked on these RIAs, provide detailed examination of why and how they were performed. The case studies critique the nature, amount, and quality of data used by the EPA in their benefit-cost and cost-effectiveness analyses as well as the use (or abuse) of the results in final decisionmaking. The authors illustrate how the analyses take into account difficult issues such as discounting, risk, nonmonetized benefits and costs, and equity.

Morgenstern provides the necessary historical context and the legal framework for requiring and conducting EAs. He describes new procedures outlined by the Clinton administration and synthesizes the case studies into thoughtful cross-cutting conclusions, drawing important lessons that will improve future analyses.

Richard D. Morgenstern is a visiting scholar at Resources for the Future, on leave as associate assistant administrator at the U.S. Environmental Protection Agency. In 1996–97 he was Gottesman Distinguished Professor of Economics at Yeshiva University.



The Swedish Nuclear Dilemma: Energy and the Environment

William D. Nordhaus, *Yale University*

"Nordhaus's treatment of the Swedish nuclear question is an excellent piece of applied environmental economics. It is also an insightful analysis of an issue that has played a significant role in Swedish economic and energy policy for over fifteen years."—**Lars Bergman,** *Stockholm School of Economics*

"Far from dismal himself, Nordhaus applies the dismal science to display the tradeoffs among energy costs, nuclear risks, toxic pollutants and global warming. The skill of application and clarity of presentation offer rewards for the reader interested in any of these issues, not to mention the reader interested in Sweden."—**William W. Hogan,** *Harvard University*

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"Morgenstern's book should be required reading for anyone who is seriously interested in sound environmental policy."—**Jonathan Lash,** *World Resources Institute*

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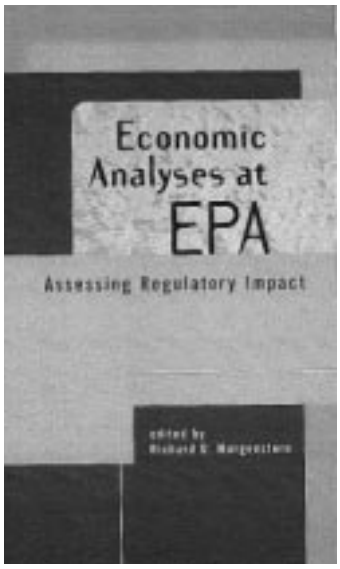

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INSIDE RFF

State visit

Members of the State of Pennsylvania's Joint Conservation Committee dropped by RFF for a "get-acquainted" session while they were in Washington to meet with their state's congressional representatives. The visit to RFF was the idea of the committee's executive assistant, Craig Brooks, to acquaint state officials with the research and public education projects that RFF conducts. The committee members spoke with researchers whose work on solid waste, forests, and water resources is germane to the concerns of the bipartisan group, which provides the Pennsylvania legislature with research and oversight on environmental and natural resource issues.

Along with Brooks, Representative Greg Vitali from the Philadelphia suburbs, Richard Fox, the committee's executive secretary, and Tony Guirrieri, a research analyst, met with RFF senior fellows Molly Macauley, Roger Sedjo, Ken Frederick, and Mike Toman.

Committee members expressed interest in Macauley's findings on the interstate waste trade in light of Pennsylvania's desire to say no to future imports of New York City refuse. Macauley has found that the limits that Congress is considering putting on the interstate waste trade may actually increase the number of interstate waste shipments as well as increase disposal costs for some regions of the country, including states in the Northeast.

The committee members talked with Sedjo about forest management and clear-cutting and about his project to study the impact of weather on trees, especially in the Northeast. With Frederick they discussed relicensing hydroelectric dams and the implications for water use in Pennsylvania.

Coming away from a visit they apparently found useful, the committee members said they plan a return trip to RFF, and next time will bring along other state officials.

Japanese energy analyst is visiting scholar

Hiroki Kudo, a senior economist at Japan's Institute of Energy Economics, arrived at RFF in July for a two-year stint

Hiroki Kudo

as a visiting scholar. Kudo has made a specialty of forecasting energy supply and demand. During his stay at RFF he plans to study U.S. policy on global warming and to assess U.S. energy policy with regard to its implications for Japan.

Kudo has also expressed an interest in looking at telecommuting in line with his long-term studies of lifestyle and energy consumption. With regard to the latter, he hopes to make comparisons between the United States and Japan and to prepare for some energy-related modeling.

Kudo received an M.A. in environmental economy from Tzukuba University in 1991.

Stiglitz joins RFF board

Joseph E. Stiglitz has joined RFF's board of directors. He is the World Bank's vice president for development economics and chief economist.

Before taking on his post at the bank earlier this year, Stiglitz chaired President Clinton's Council of Economic Advisers. Over the course of his distinguished career, he has been a senior fellow at the Institute for Policy Research and a professor of economics at Princeton and Stanford universities. He received a Ph.D. in economics from the Massachusetts Institute of Technology.

In 1979 the American Economic Association honored Stiglitz with the John Bates Clark Award for outstanding accomplishments by an economist under the age of 40.

Stiglitz was elected at the board's annual meeting in April along with Catherine G. Abbott,

Joseph E. Stiglitz

James H. S. Cooper, and Frank E. Loy (see *Resources*, Spring 1997). RFF's board of directors is responsible for overall governance of the organization. Each board member is eligible to serve as many as three one-year terms.

RFF Wednesday Seminar Series

The RFF Wednesday Seminar Series resumes in September and continues throughout the academic year. RFF research staff members and invited scholars and policymakers discuss current research projects and/or public policy issues.

Seminars are held in the seventh floor conference room of Resources for the Future, located at 1616 P Street N.W., Washington, D.C. (walking distance from both the Dupont Circle and Farragut West metro stations). You are welcome to bring your lunch. Presentations begin at 12:30 and end at 2:15 p.m. Registration is not required. Space is limited.

For a schedule, call (202)328-5000 or access *http://www.rff.org/seminars*

DEVELOPMENT

Plan ahead for 1997 taxes with RFF's Gift Fund

Although the April 15th deadline for filing taxes is well behind us and the year-end scramble for receipts (and deductions!) is still months away, now is the time to begin planning for your 1997 taxes. The RFF Gift Fund is an option we encourage you to consider, particularly if you face a significant tax burden on highly appreciated securities.

A contribution to the RFF Gift Fund will simplify your charitable giving for years to come while offering advantages that a private foundation cannot. All that is required to set up your personal, professionally managed account is a contribution of cash or securities, such as appreciated stocks, bonds, or mutual funds. These funds qualify for an immediate income tax deduction at their full fair-market value and are exempt from capital gains taxes. All income generated from your contribution will remain in your account and will compound tax-free until you determine your giving preferences.

Unlike other such funds, there is no fee for the RFF Gift Fund. The only requirement is that your gifts must go to tax-exempt charitable organizations under Internal Revenue Service code sections 501(c)(3) and 170(c). No distribution to the RFF General Fund is required, although we certainly encourage such gifts.

In addition to obtaining the benefit of an immediate tax reduction, making a contribution to the RFF Gift Fund offers you advantages that setting up a private foundation does not. First, your tax deduction will be bigger since you can deduct the full market value of appreciated stock contributed to the RFF Gift Fund. Moreover, you avoid the administrative and reporting requirements involved in establishing a private foundation.

If you would like to receive RFF's newsletter on planned giving options or information about charitable trusts, gift annuities, gifts of appreciated securities, bequests, and other types of planned gifts, please contact RFF Vice President–Finance and Administration Ted Hand at 202–328–5029.

RFF receives two gift commitments

RFF is very pleased to announce two significant commitments for planned gifts. RFF Board of Directors Chair Darius W. Gaskins Jr. (left) recently established a charitable remainder trust worth more than $1,000,000. Former RFF Board member William D. Ruckelshaus named RFF as the beneficiary of a charitable bequest of $200,000. These commitments demonstrate the outstanding leadership of the RFF board of directors, and help guarantee the organization's long-term financial well-being. Thank you, Darius and Bill!

PATRICK DEASON PHOTOGRAPHY

Send your contribution by September 30th!

Contributions to RFF from individuals have increased steadily over the last five years, a trend we hope will continue in 1997. We are grateful to each and every supporter who has helped to make the work of RFF possible. Our fiscal year ends September 30th. If you have not sent in your contribution, please do so now so that we might thank you in our 1997 Annual Report.

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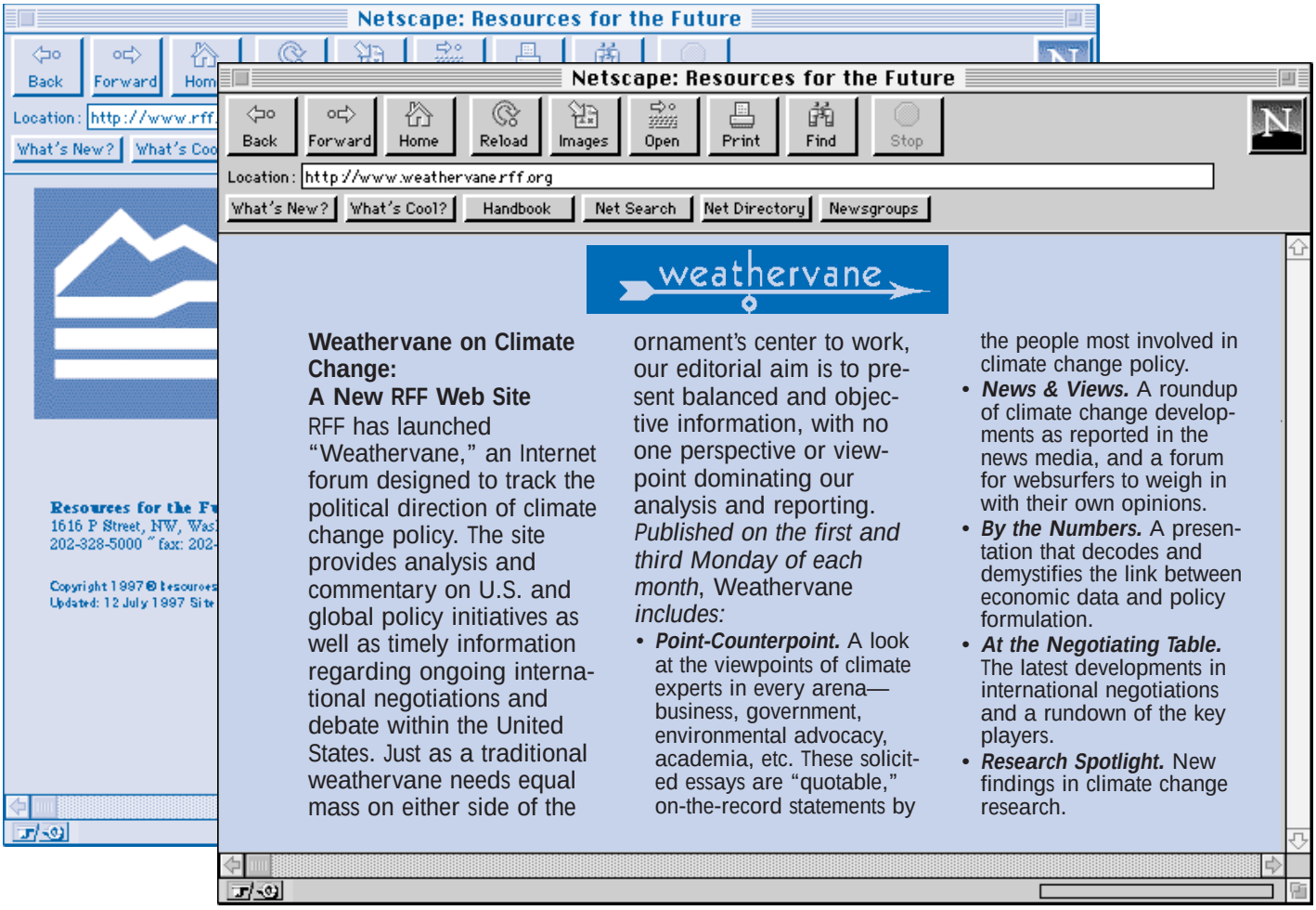

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