

RESOURCES

RESOURCES FOR THE FUTURE

RESEARCH THAT MAKES A DIFFERENCE

3 **Goings On**

RFF/State Dept. conference links climate change, technologies, U.S. business ☞ Integrating pollution control by statute ☞ Gas prices: falling steadily ☞ Valuing acid rain reductions

FEATURE

5 **Public Opinion on the Environment**

Everett Carll Ladd and Karlyn Bowman

Polling data are seen to reveal changes in U.S. environmental attitudes and politics that spell challenges for both political parties.

8 **From the Candidates**

The President of the United States and his Republican challenger respond to three questions posed by *Resources* regarding key environmental policy concerns.

10 **Climate Change and Its Consequences**

Michael A. Toman, John Firor, and Joel Darmstadter

Humans are probably changing Earth's climate, says a U.N. panel, and—despite uncertainties—new actions are called for.

14 **Rights-Based Fishing: Transition to a New Industry**

Would controlling access to the world's fishery resources through property rights reverse the fisheries' potentially ruinous decline?

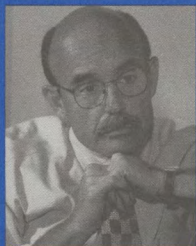
18 **Cleaning Up the Nuclear Weapons Complex: A Herculean Challenge**

Regulatory gaps and overlaps impede safety, environmental protection efforts.

20 **Cross-Media Pollution and the Chesapeake Bay**

Recognizing air and water interactions is key to cost-effective strategies.

Environmental Policy, Public Opinion, and the Role of RFF



Paul R. Portney

Americans are busy collecting information and impressions during this campaign season as we prepare to cast our votes in the upcoming presidential election. RFF thought readers of *Resources* would like to know what the two leading candidates for the presidency think about several important environmental policy questions—so we asked them. We're pleased that President Clinton and Senator Dole accepted our offer to address the three policy questions posed to them, and we hope you will find their responses illuminating and instructive.

I firmly believe the candidates took the time to respond to us based on *Resources's* long record of providing impartial analysis of environmental issues and on the stature and seriousness of its readership. You should share our satisfaction over their appearance here.

Americans across all classes and social groups now care deeply—if not always loudly—about the fundamentals of environmentalism, according to Everett Carl Ladd's and Karlyn Bowman's analysis of the polling data they present in the lead article of this issue of *Resources*. Indeed, it would be hard to gather much support for opposing the notions of, say, safe drinking water, clean air, or safeguarding natural treasures.

But—how safe is safe, how clean is clean enough? Ladd and Bowman discern, within the generalized support for environmental well-being, a growing national concern over the impact that pursuit of environmental goals is having locally on matters relating to land use and economic growth. Increasingly, Americans are looking for ways to make careful decisions about the use of natural resources and the environment.

Well, RFF's charter is to provide just the kind of information needed to make such decisions. Our commitment to take seriously threats to the basic integrity of the global environment is reflected in our work on climate studies, as can be seen in this issue's feature article on the latest U.N. report about global warming. The issue's third feature article—on the growing crisis within the world's fisheries—carries forward work begun here decades ago to identify equitable, effective ways to realize economic benefit from a delicate resource.

Whether it's pointing out the manner in which pollution control costs can be overestimated, figuring out ways to translate into monetary terms some of the physical results from improved air quality, or puzzling through the regulatory maze that hinders effective cleanup of the nation's nuclear weapons sites, this issue of *Resources* illustrates clearly RFF's ongoing commitment to finding ways to balance conscientious protection of the environment with social well-being.

Paul R. Portney



RESOURCES FOR THE FUTURE
1616 P Street, NW
Washington, DC 20036-1400
202-328-5000

FAX: 202-939-3460
E-MAIL: info@rff.org
WORLD WIDE WEB:
<http://www.rff.org>

OFFICERS

President, Paul R. Portney
Vice President—Finance and Administration, Edward F. Hand

BOARD OF DIRECTORS

Darius W. Gaskins Jr., Chair
Jodie T. Allen, John C. Borum,
Anthony S. Earl, Lawrence E. Fouraker,
Robert E. Grady, F. Henry Habicht,
Robert H. Haveman, Thomas C. Jorling,
Donald M. Kerr, Frederic D. Krupp,
Henry R. Linden, Thomas E. Lovejoy,
James D. Maddy, Karl-Göran Mäler,
Frank L. Matthews, Mark A. Pisano,
Paul R. Portney, Robert M. Solow,
Edward L. Strohbehn Jr., Linda C.
Taliaferro, Victoria J. Tschinkel,
Mason Willrich

RESOURCES STAFF

Managing editor, Richard Getrich
Editors, Marie France, Eric Wurzbacher
Contributing editor, Chris Kelaher

Published since 1959, *Resources* (ISSN 0048-7376) is a quarterly publication containing news of research and policy analysis regarding natural resources and the environment. The views offered in *Resources* are those of the contributors and should not be attributed to Resources for the Future, its directors, or its officers. Unless otherwise noted, articles appearing in *Resources* may be reproduced, providing appropriate credit is given and a copy of the reproduced text is sent to *Resources*.

Resources is sent to individuals and institutions without fee. To receive copies or to change an address, write to *Resources* at RFF; e-mail info@rff.org; or call 202-328-5025. The publication is also available in microform through University Microfilms International, 300 North Zeeb Road, Dept. P.R., Ann Arbor, MI 48106.

Printed on recycled paper.



GOINGS ON

RFF, State Department sponsor conference on climate change, world economy, U.S. business

RFF and the U.S. Department of State cosponsored a conference on June 18 to examine linkages among climate change, evolving global technology markets, and U.S. business practices. Senior government officials, prominent U.S. business people, environmental leaders, and other experts participated in "Climate Change: Evolving Technologies, U.S. Business, and the World Economy in the 21st Century," held at the U.S. Department of State. Undersecretary of State Timothy E. Wirth and RFF President Paul Portney hosted the conference.

Participants explored the implications for U.S. domestic markets, exports, and foreign investments of potential efforts

by U.S. companies to account for climate change in their strategic planning. Panels focused on changing technologies for generating power, moving people and goods more efficiently, changing industrial practices, fostering sustainable development and technological cooperation with developing countries, and identifying likely responses to climate change by the banking and insurance communities and in the agricultural and forestry sectors of world trade.

Keynote speakers for the event were John H. Gibbons, assistant to the President for science and technology, and Robert C. Stempel, chairman and executive director of Energy Conversion Devices, Inc. and former chairman and chief executive officer of General Motors Corporation.

A concluding plenary panel

addressed the topic "How Will American Business Be Affected at Home and Abroad by Climate Change and Evolving Technologies?" Participating in the panel discussion were Paul Portney of RFF; Jonathan Lash, president of the World Resources Institute; Darius Gaskins, chairman of RFF's board of directors and former president and chief executive officer of the Burlington Northern Railroad; James L. Wolf, vice president for energy and environmental markets at Honeywell, Inc.; David Hales, director of the U.S. Agency for International Development's Center for the Environment; Franklin Nutter, president of the Reinsurance Association of America; and Robbin S. Johnson, corporate vice president for public affairs at Cargill, Inc.

RFF cosponsored the conference as part of its new program of research, policy analysis, and outreach on climate change issues. The program aims to improve general understanding of issues central to assessing the need for possible policy interventions and designing reliable and cost-effective climate policies both domestically and in an international context. ☰

Integrated statute for environment is RFF meeting topic

Does the current approach to environmental protection discourage effective and efficient pollution control? RFF's Center for Risk Management convened a conference in early June to

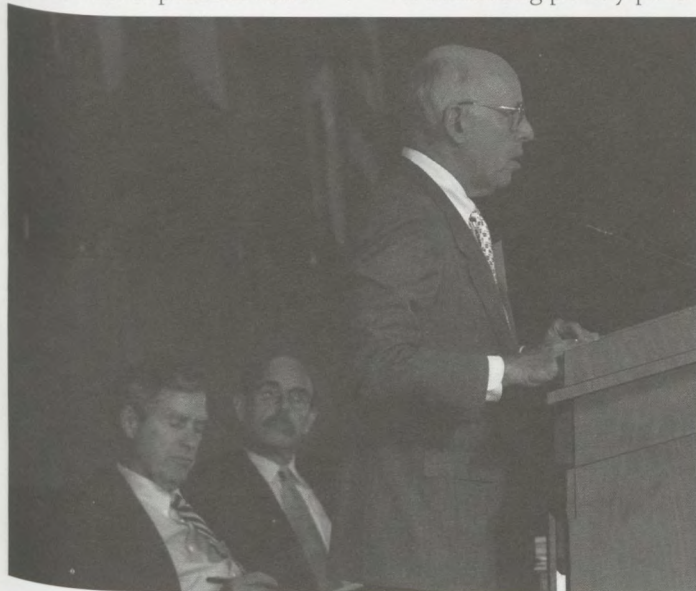
consider the promises and pitfalls of efforts to reduce fragmentation in the U.S. pollution control system, including the idea of replacing the current welter of environmental laws with a single, integrated environmental statute.

The pathbreaking "Conference on Integrated Environmental Legislation" drew some 120 participants from government, industry, and



Former EPA Administrator William D. Ruckelshaus, chairman of the advisory council of RFF's Center for Risk Management, presented the concluding speech at RFF conference.

environmental groups. Speakers included Lois Schiffer, assistant attorney general for environment and natural resources; Steve Shimberg, staff director of the Senate Environment and Public Works Committee; Chuck Williams, commissioner of the Minnesota Pollution Control Agency; Thomas Zosel, manager of environmental initiatives for the 3M Corporation; and Michael McCloskey, chairman of the Sierra Club.



Undersecretary of State Timothy E. Wirth and RFF President Paul Portney listen to remarks by keynote speaker John H. Gibbons, assistant to the President for science and technology, at RFF/State Department conference.



GOINGS ON

Former U.S. Environmental Protection Agency Administrator William D. Ruckelshaus, who serves as chairman of the advisory council of RFF's Center for Risk Management, gave the closing speech at the conference, which was sponsored by the U.S. Department of Energy and the Environmental Protection Agency. ☞

Reducing acid rain: What are the benefits?

In the public mind, acid precipitation may no longer seem of particular environmental or economic concern. After all, an entire section—Title IV—of the 1990 Clean Air Act Amendments was dedicated to acid precipitation reductions, which have been occurring at much lower cost than originally predicted. Nevertheless, it is critical to know if the benefits from these reductions will be worth the costs, and the federally funded National Acid Precipitation Assessment Program (NAPAP) is charged with the task of finding out.

In support of NAPAP, the U.S. Department of Energy has funded development of the Tracking and Analysis Framework (TAF), an integrated assessment modeling effort for which RFF is translating into monetary terms some of the physical impacts from improved air quality.

Specifically, RFF researchers David Austin, Dallas Burtraw, and Alan Krupnick are studying the

benefits associated with reduced sulfur dioxide (SO₂) and nitrogen oxide (NO_x) emissions with regard to human health, recreational visibility, residential visibility, and freshwater sport fish populations. The researchers have compiled a collection of primary, peer-reviewed valuation studies and are applying them to the TAF project. In addition, they are developing their own health-effects model to handle data from the atmospheric scientists on the TAF computer modeling team. For evidence of change, they are examining the frequency and consequences of human respiratory disease, as well as the visibility range within national parks and the condition of sport fishing in freshwater lakes.

The valuations that the RFF team is using are the end result of the TAF computer model, which simulates production of SO₂ and NO_x emissions under alternative policy scenarios. Each alternative leads to a different emissions reduction forecast out to the year 2035. For each forecast year, RFF is estimating the health improvements and the value of these and other types of improvements that have occurred beyond a baseline scenario.

The first phase of the TAF project will be completed by early autumn 1996.



Find out more about the TAF model at

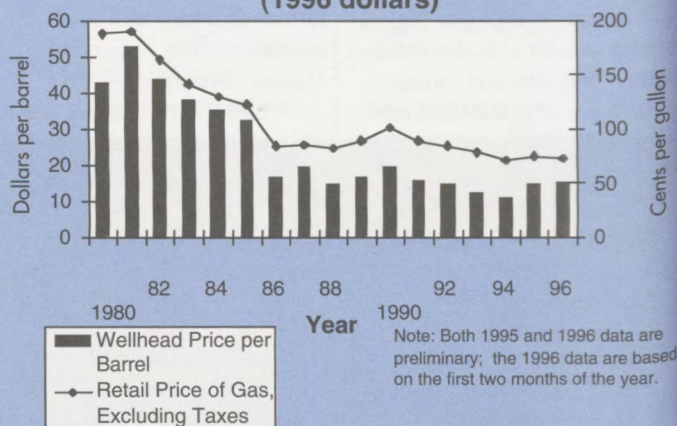
<http://www.lumina.com/tafist/taf.html>

Resource Facts Getting Real about Energy Prices

A short-term spike in gasoline prices this spring prompted President Clinton to draw down the nation's Strategic Petroleum Reserve for only the third time in history and then-Senate Majority Leader Bob Dole to call for a rollback of the 4.3-cent federal gas tax. Despite these actions, however, prices at the pump have since leveled off, and the real prices both of gasoline and crude oil have been falling steadily in the United States since 1981.

Adjusting for inflation, the 1996 price of crude oil and the price of gasoline, excluding taxes, are less than half what they were in 1981. Based on the latest available yearly data, the average fuel efficiency of passenger cars increased from 15.9 mpg in 1981 to 21.4 mpg in 1994. When this increased fuel efficiency is taken into account, the average fuel cost per mile driven fell from 12.11 cents per mile in 1981 to 3.38 cents per mile in 1994.

Crude Oil and Gasoline Prices
(1996 dollars)



(Sources: PennWell Publishing, *Energy Statistics Sourcebook*, 10th Edition, August 1995; API, *Basic Petroleum Data Book*, Vol. XV, No. 2, July 1995)

As an occasional feature, Resources presents facts of interest about energy, natural resources, and the environment.



Public Opinion on the Environment

by *Everett Carl Ladd and Karlyn Bowman*

Large majorities of Americans are deeply committed to a safe and healthful environment, say the authors, and polling data indicate significant endorsement of Democratic stewardship. Yet an evolution in environmental attitudes and devolution in environmental politics foretell challenges for both political parties.

Aspate of recent news stories would seem to suggest that the Republicans in Congress, properly chastened, have backed away from an aggressive environmental agenda that was seen by most Americans as extreme. The description of the GOP retreat may be accurate. The change in public attitudes, however, occurred not within the past two years, but earlier—at a point when the need for a healthy environment became a settled issue in American consciousness.

Settlement of an Issue

In the late 1960s and early 1970s the idea that we should make a substantial commitment to the environment was not widely shared. Today it is. Large majorities of Americans across all classes and social groups are deeply committed to a safe and healthful environment. As is the case for most areas involving health, Americans want the federal government to play a substantial role. When we as a society agree on ends, we tend to leave the means by which those ends can be accomplished to our elected representatives. People want to clean up toxic waste sites; most don't have a clue about the pros and cons of the legislation to reauthorize Superfund. We believe costs should be taken into account when considering environmental legislation; we aren't knowledgeable about what precisely tradeoffs should be.

The transformation of the environment from an issue of limited concern to one of universal concern is complete, and, today, survey after survey shows that most Americans have turned their attention to other things.

In January 1996 Roper Starch Worldwide repeated a question the polling firm began asking in 1974 concerning the problems most troubling to Americans. In the new asking, 12 percent of those polled said pollution of air and water was one of the things they were most concerned about. This finding was very much in line with responses throughout the 1990s. Nearly four times as many (47 percent) said they were concerned about crime and lawlessness.

Also in January 1996, Princeton Survey Research Associates gave people a list of fifteen national problems and asked them to choose the most important ones. The environment ranked fourteenth. (See the table on the next page.)

CBS and the *New York Times* asked Americans in an open-ended survey in late May about the most important problems facing the country, and the environment did not make the list. Two percent volunteered in response to a separate question in the poll that the environment was a problem in their communities, but again the issue ranked far behind issues such as crime.

Democratic Party Hegemony

A "settled" issue like the environment can return to national prominence if people feel their political leaders are not mindful of their concerns. For instance, in the early 1980s, many people felt two of President Reagan's appointees, Interior Secretary James Watt and EPA Administrator Anne Gorsuch Burford, did not share their commitment to the environment, so the issue had national intensity again.

Relative Importance of National Problems, January 1996

	Most important ^a	Important ^b	Less Important ^c	DK/R ^d
Crime and drugs	78	20	2	2
Children's welfare ^e	73	23	3	1
Public education	69	27	3	1
Government spending ^f	64	28	6	2
Low moral, ethical standards	59	33	8	3
Government/political system	56	33	8	3
Poverty, homelessness	54	37	8	1
Welfare system	52	35	9	4
Unemployment, jobs	51	38	10	1
High taxes	42	43	14	1
Standard of living	42	46	11	1
Race relations	39	46	14	1
Excessive government regulation	38	28	19	3
Environmental problems	36	47	16	1
Illegal immigration	35	41	22	2

Notes: Exact wording of categories of importance was: a One of the most important b Important, but not most important c Not too important d Didn't know or refused to answer

e Indicates concern of insufficient attention and guidance for children f Includes federal deficit

Source: Princeton Survey Research Associates (for Knight-Ridder News Services), January 1996.

Whether people will view the Republican congressional leadership this way in November remains to be seen. Democrats are generally more favorably disposed than Republicans to federal oversight activities, and they have done a better job than Republicans in talking about Washington's responsibility for environmental protection. This is a partial explanation for national Democratic strength on the issue. But polling data collected recently show no significant change in Democrats' margins on handling the environment.

In a mid-March Gallup poll, 62 percent of those surveyed approved of the job Bill Clinton was doing handling the environment. The President performed more impressively on this issue than any of the other nine issues the pollster tested. On each of the seven occasions Gallup has posed the question since 1993, Clinton has received similar high ratings. In January 1993, for example, 60 percent approved of the job he would do.

Pollsters also ask which party is better able to handle the environment. In the late 1960s and early 1970s, neither party had a clear advantage, but since then, Democrats have maintained a significant lead. The May NBC News/*Wall Street Journal* poll, for one, gives the Democrats a 28 point advantage over the GOP (45 to 17 percent) on the issue. But that number has changed hardly at all over the past four years. The Democrats' lead over the GOP on handling the environment is typically so large that substantial numbers of Republicans agree about the superiority of Democratic stewardship of the environment.

Democratic hegemony on the issue in national surveys doesn't tell us much about the power the environment has had in national elections. In 1984, 1988, and 1992, 4, 10, and 5 percent, respectively, said the environment was the most important issue to them in casting their ballots. (See the table on the next page.) At the national level, then, the issue is not significant for most voters. Still, in each of these elections, this small group citing the environment has voted overwhelmingly Democratic. But even these data do not present a complete picture. They fail to capture an evolution in environmental attitudes and a devolution in environmental politics that will present challenges to both parties.

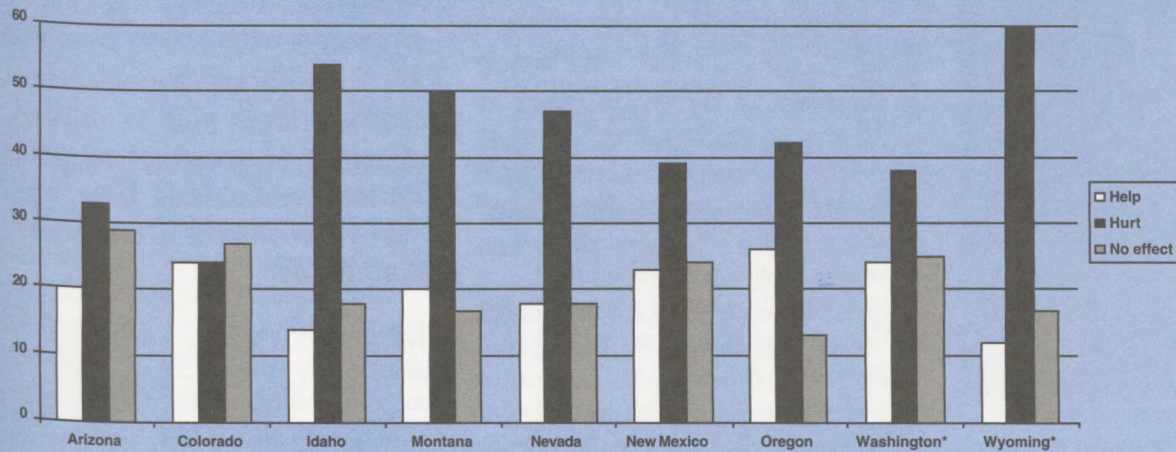
Thinking Globally, Voting Locally

As the environment has declined in national intensity, it has become more potent politically at the state and local levels where people are dealing with hard choices involving competing interests. We saw evidence of this transformation in elections in 1994 and again this year.

On election day in 1994, voters in nine western states were asked by the exit polling consortium of the four networks whether the Clinton administration's land use and environmental policies had hurt, helped, or had no effect on their states. Majorities of voters in

FROM THE CANDIDATES

Effects of Clinton's Land Use and Natural Resources Policies: Voter Opinion in Nine Western States, Election Day, 1994



Note: Montana and Washington were senatorial contests; all others were gubernatorial contests.
 Source: Voter News Service (VNS; a consortium of ABC, CBS, CNN, and NBC) state exit polls.

eight of the nine states indicated that the policies had hurt their states. They voted decisively for Republican candidates. (See the chart above.)

In the Oregon special Senate election this year, 12 percent of people who indicated to the same polling consortium that they voted said the environment was the most important issue in casting their votes. They voted overwhelmingly (72 percent) for Ron Wyden, the Democrat. But a close reading of the election poll shows that "the environment" was defined as Republican candidate Gordon Smith's record in the state legislature as well as his company's environmental performance. Eighty eight percent had heard about an environmental issue "concerning the company owned by [Republican] Gordon Smith." While 51 percent said this had no effect on their vote, 4 times as many said that this knowledge had made them less (26 percent) rather than more (6 percent) likely to vote for Smith. Not surprisingly, Wyden won the "less likely" group by a huge margin. Strong pluralities said that the Clinton agenda and, separately, the Republican agenda had no impact on their vote.

In this new political atmosphere where state and local environmental issues have assumed primary importance, the political repercussions of the issue are less predictable. What is clear from the survey data is that no significant transformation of environmental attitudes appears to have taken place nationally since November 1994.

Everett Carl Ladd is executive director of the Roper Center at the University of Connecticut. Karlyn Bowman is a resident fellow at the American Enterprise Institute. This article is adapted from their monograph: *Attitudes Toward the Environment: Twenty-Five Years After Earth Day* (AEI Press). For a copy of the monograph, contact AEI Press, c/o Publisher Resources Inc., 1224 Heil Quaker Blvd., P.O. Box 7001, La Vergne, TN 37086-7001. To order by phone, call 1-800-269-6267.

The Environment As a Voting Issue: Exit Polls, 1982-1992 (selected years)

Year	Exit pollster	Most important issue ^a	%	How the voters voted			
				Voter category	%	Opposite category	%
1982	CBS/NY Times	Unemployment	38	Democratic	68	Republican	33
		Environment	3				
1984	LA Times	Government spending	22	Mondale	75	Reagan	25
		Environment	4				
1988	CBS/NY Times	Helping middle class	25	Dukakis	66	Bush	34
		Environment	10				
1990	VRS ^b	Education	26	Democratic	55	Republican	44
		Environment	21				
1992	VNS ^c	Economy/jobs	12	Clinton	72	Bush	14
		Environment	5				

Notes:
 a As compared with the environment
 b Voter Research and Surveys
 c Voter News Service
 Sources: Surveys from the organizations listed above.



FROM THE CANDIDATES

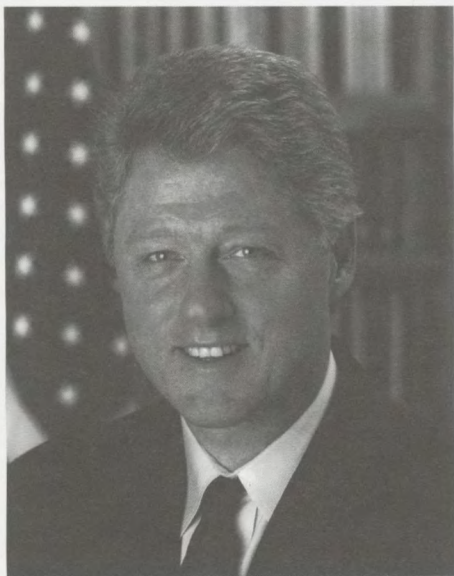
With an eye on the upcoming election, RFF asked the two leading candidates for the presidency to respond to three environmental policy questions. Printed below are the verbatim responses supplied by their respective campaign staffs.

RFF: Should cost be one of the factors that regulatory agencies consider when setting health standards, as under the Clean Air Act or the Occupational Safety and Health Act?

Clinton: For laws such as the Clean Air Act or OSHA that set standards based on public health and safety, cost should be taken into account in the implementation of the standard. During his first year in office, President Clinton issued an executive order to require the use of cost-benefit analysis and sound science to support regulatory actions.

President Clinton opposes regulatory "reform" legislation that would make it more difficult—or impossible—to protect our families' health and provide them with safe air to breathe, clean water to drink, and healthy food to eat.

President Clinton strongly opposed



both the Contract with America and Senator Dole's bills for regulatory "reform," as they would have rolled back a generation of health, safety, and environmental laws.

President Clinton's and Vice President Gore's reinventing government efforts have shown that health and environmental standards can be met with a more efficient and less bureaucratic approach that does not endanger our health.

Dole: Yes. We should ensure that the resources we as a society dedicate to solving a problem are reasonably related to what we gain in the end. Costs and benefits—including those that are nonquantifiable—need to be balanced when deciding the appropriate levels of health protection to target. When it comes to costs we need to recognize not only compliance costs to industry but diversion of time, labor, intellectual capital, and other resources that might address the greatest health risks first and achieve better health overall for more people.

We fool ourselves if we assume that costs are not considered currently when setting health standards. So far, we have winked at the notion. But it is fairer to be honest with the American people about the overall costs and benefits of a regulatory decision.

Bob Dole has sponsored legislation to ensure that benefits justify costs for any major federal regulation, using risk assessment and sound science as tools. Regrettably, the Clinton Administration opposed that effort.

RFF: Should additional measures be taken now to control emissions of greenhouse gases like carbon dioxide? If so, what form should these measures take?

Clinton: Yes. The latest international assessment by almost 2,500 scientists concluded that human greenhouse gas emissions have already had "a discernible human influence on global climate." Failure to act now could subject us to unacceptable economic costs and environmental harm from climate change—including losses in coastal regions from sea level rise, increased fatalities from heat stress, the spread of tropical diseases to our nation, and more frequent and severe storms. Climate change is a global problem that requires a global solution.

President Clinton and Vice President Gore are working to fully implement their Climate Change Action Plan, issued soon after taking office. This plan includes more than fifty largely voluntary measures to cut emissions of greenhouse gases. These measures cut energy use and save money. The business community has been strongly supportive. Yet the Republican Congress dramatically cut these programs. The Clinton Administration is also vigorously pursuing a meaningful and realistic international agreement under the Framework Convention on Climate Change to reduce greenhouse gas emissions on a global basis.

Dole: Most scientists agree that a natural greenhouse effect exists, and that concentrations of greenhouse gases are increasing in the atmosphere. However, no agreement exists on whether or how to address the issue. Even the United Nations expert

panel on climate change has recognized this uncertainty. Further research is needed to determine if responses to atmospheric buildup of greenhouse gases are required, and, if so, what the responses should be.

Despite scientific uncertainty about the role of human activity in climate change, the Clinton Administration has leapfrogged over scientific inquiry and now favors narrow measures to further cut greenhouse gas emissions. The Administration has abandoned the voluntary approach to reducing greenhouse gases that was the keystone of the 1992 UN climate change convention and the key to the United States' marked reduction in such emissions since that time.

President Clinton has chosen to go further in the wrong direction of command-and-control regulation at a time when he claims to want more flexibility to find the most efficient environmental solutions. Instead of voluntary measures, he advocates binding targets and timetables, which would be very costly, both to our economy and to our lifestyle.

Let's approach this issue in the right way. The United States should be at the forefront of the search for a scientifically sound approach to global climate change. Let's not retreat to command-and-control regulation with little scientific grounding. U.S. companies, such as American auto manufacturers working to develop a new generation of vehicles, should continue to be encouraged to pursue advanced research that may reduce greenhouse gases over the long term. U.S. companies should be encouraged to work with foreign governments and their industries to share emission reduction technologies with those countries that need them most.

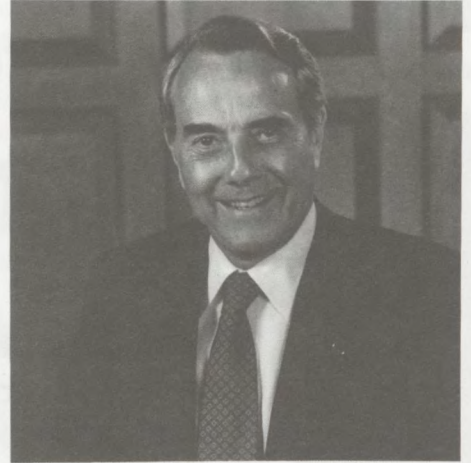
And once the science is clearer, the responsibility of addressing international climate change should be shared by all countries, not disproportionately by the United States.

RFF: Should the federal government compensate property owners whose land is rendered less valuable as a result of environmental or natural resource protection policies? How would compensation be funded while meeting deficit reduction goals?

Clinton: President Clinton has acted throughout his term to protect private property. Any American who is willing to work hard and play by the rules should be able to buy a home and provide for his or her family in a neighborhood that is free from crime, drugs, and toxic contamination. The so-called "property rights" or "takings" legislation introduced as part of the Republicans' Contract with America and in the Senate by Bob Dole does not protect private property. These measures say that no one is required to follow the law unless they are paid to do so. This is not what President Clinton believes is the meaning of citizenship. These Republican measures would cost taxpayers tens of billions of dollars and weaken safeguards for public health, safety, and the environment. President Clinton would veto such legislation because it is bad for property owners, taxpayers, and the environment.

Dole: If the government restricts the use of your private property to construct a highway, expand a military base, or create a national park you will be compensated. Even if you retain title to your land or can use other parts of your property, you are compensated for that portion used by the government for public benefit. Such compensation is required by the Fifth Amendment to the U.S. Constitution. And the Supreme Court has affirmed that it is the law of the land.

That the government wants to restrict



the use of your private property to protect the environment should not affect your right to compensation, as long as the property is contributing to the public good. In fact, incorporating such compensation into policies to protect wetlands or other natural resources would give landowners the incentive to be good environmental stewards, while overregulation without fair compensation would not.

Today, litigation against the government by aggrieved landowners costs the Treasury hundreds of millions of dollars. According to the Congressional Budget Office, legislation to protect private property rights in environmental protection cases would preclude needless costs and expensive litigation, helping to eliminate the federal deficit and balance the budget. Such legislation would also encourage the government to assess the impact of its regulations before issuing them and to work with landowners, not against them.

But private landowners should not be paid if their land is regulated to prevent pollution, which is harmful activity, often referred to in common law as a "nuisance." This is a legitimate exercise of the government's police power. As a strong supporter of legislation ensuring clean air and water, Bob Dole has fought to punish polluters, not to compensate them. ☺



Climate Change and Its Consequences

by Michael A. Toman, John Firor, and Joel Darmstadter

Are humans changing the climate? In its latest assessment, scientists on the Intergovernmental Panel on Climate Change say we probably are, and the consequences could be serious. But uncertainties about risks and response costs make it difficult to formulate a specific long-term action plan. The potential risks the panel identifies, however, are sufficient to warrant additional actions beyond those now under way in the United States and other countries.

The Intergovernmental Panel on Climate Change, an international group of scientists, economists, and decision theorists convened by the UN, recently completed its second assessment of the current state of knowledge regarding human-induced changes in the Earth's climate and possible consequences. The goal of stabilizing atmospheric greenhouse gas concentrations—which the nations of the world agreed to under the 1992 Framework Convention on Climate Change, and which the IPCC is charged with helping to effect—is difficult, touching as it does on national interests in varying ways. Thus controversy, including the allegation that politics has tainted the science, has arisen over the IPCC's latest findings (just as it did after the panel released its first report in 1990).

In this article, however, we focus on the substance of the reports that the IPCC's three working groups most recently produced, with particular emphasis on issues related to the use of fossil fuel and emissions of carbon dioxide—the greenhouse gas that contributes most to climate change. The three groups assessed the available information on (1) effects of human activity on climate conditions through modifications of the atmosphere; (2) potential impacts of this climate change, along with the technical potential for mitigating and adapting to it; and (3) socioeconomic conse-

quences of climate change, including human responses to potential impacts.

Human Impacts on Climate: State of the Science

A striking feature of the new IPCC assessment is the conclusion by Working Group I that a human cause for the climate change now observed is likely, not just possible—a much stronger conclusion than the one reached in the first assessment. Five years ago, the IPCC stated that although all signs pointed to human-induced climate change, crucial evidence for cause and effect was not yet available. The evidence then available indicated that atmospheric greenhouse gas concentrations had increased in the previous 130 years and that the global climate had warmed; however, when complex computer simulations of climate processes were applied retrospectively, they predicted a larger warming than had actually occurred and did not adequately represent climate changes in different regions and at different altitudes.

The latest generation of models can now replicate the past with greater realism. In particular, new models include analysis of the cooling effect of aerosols—tiny particles—in the air formed from sulfur emitted during the burning of fossil fuels.

By including in their analyses the cooling effects of

aerosols and stratospheric ozone depletion, most of the latest studies have detected a significant climate change and, in the conclusion reached by Working Group I, show that the observed warming trend is "unlikely to be entirely natural in origin." The balance of evidence suggests a "discernible human influence on global climate."

Despite recent improvements, climate models are still unable to project the details of climate change on a regional scale, complicating assessment of potential impacts and response options. A further complication is the possibility that future climate change will be neither gradual nor continuous, but abrupt and surprising, as Working Groups I and II caution repeatedly.

Potential Natural Impacts

What constitutes a "dangerous" level of interference with the climate is a complicated question. In its latest assessment, the IPCC addresses many impacts of climate change, including the effects on agriculture, forestry, terrestrial and marine ecosystems, hydrology and water resource management, human health, human infrastructure, and financial services. While the potential impacts of climate change are broad, some aspects of human society are more sensitive than others. In particular, more highly managed systems like agriculture, where skills and resources for investing in adaptation are available, may be less sensitive than less managed systems like wilderness areas. However, some of the adverse effects of climate change may fall disproportionately on poorer, less-adaptive parts of the world.

The IPCC puts greater emphasis than it has in the past on the potential adverse effects of climate change on human health. Periods of sustained higher temperatures not only could increase mortality but also foster the spread of disease through greater water contamination and a wider geographic dispersion of disease-carrying organisms such as mosquitoes.

The ability to quantify future damage and adaptation potential varies greatly across sectors. The physical consequences of a given magnitude of sea level rise, or the impacts of climate change on agricultural yields and forest conditions, can be projected with higher confidence than, say, impacts on wetlands and fisheries. Yet even when confidence is high that a certain effect will occur if climate changes, its magnitude cannot be predicted precisely.

Working Group II also points out that damage to ecosystems and human structures arising from such other causes as population growth, industrial expansion, and changes in land use could combine with effects of climate change to push already stressed systems "over the edge." Particularly if climate change were very rapid, damage could be severe and long-lived, perhaps irreversible. However, such rapid change may be unlikely and is difficult to predict.

Socioeconomic Consequences

Decisionmakers contemplating public policies to deal with climate change need to understand the socioeconomic consequences that might follow from the physical and biological impacts of climate change. Uncertainties about these consequences are compounded not only by remaining scientific questions but also by diverse views about how socioeconomic consequences should be defined and measured.

The latest IPCC assessment notes the practical limits of conventional benefit-cost analysis as applied to climate change issues. Climate change involves risks of natural impacts that would be very long term, spanning multiple generations. Moreover, these impacts could be very large in scale and not so readily offset by substituting other capital investments. Such risks are not easily incorporated into conventional benefit-cost analysis.

Nevertheless, Working Group III rightly asserts that an economic benefit-cost assessment can help guide decisionmaking when coupled with an assessment of other factors. These include impacts that are not easily monetized and the distributional effects of climate change within and across generations.

In reviewing the available evidence on the economic impacts of climate change, Working Group III looked at a number of potential effects. These include impacts on agriculture and forestry, effects on water supplies, damages from sea-level rise to coastal areas and expenditures to protect them, increased mortality risks, effects on fisheries and wetlands, and effects of changes in conventional air and water pollutants.

But the group's assessment was not exhaustive. For lack of data, several important impacts of possible climate change either were only partly addressed or not addressed at all. These include broad ecosystem damages and the consequences of increased nonfatal illnesses. Moreover, the estimates reflect individual

damage components, without fully accounting for the effects of multiple stresses brought on by forces other than climate change. The estimates also are based primarily on a single scenario in which the global climate has reached equilibrium after a doubled atmospheric CO₂ concentration. This formulation does not capture the cost of adjusting to climate change or the possible consequences of even higher greenhouse gas concentrations.

Aggregate damage estimates under these assumptions, expressed as a percentage of GDP to provide a sense of scale, tend to cluster around 1 to 1.5 percent for advanced industrial economies and 2 to 9 percent for developing countries. For some individual countries—say, small island states subject to flooding from sea-level rise—substantially higher costs could be incurred. Clearly, a number of thorny issues related to adaptive capacity and equity lie beyond estimates of aggregate damages.

The range of estimates for individual types of damage is wide, and the assessment recognizes the possibility of benefits, such as a longer growing season in some locations (leaving aside the costs of adjusting to climate change). Moreover, all damage figures are point estimates, lacking probability ranges or confidence intervals, and in many cases the estimates are simply educated guesses.

Effectiveness and Cost of Response Options

Emissions of CO₂—almost all generated by burning fossil fuel—account for about two-thirds of all enhanced heat trapping by greenhouse gases. Greater efficiency in the conversion and use of energy would obviously slow emissions, but no meeting of the minds exists on what it would cost to increase energy efficiency. Indeed longstanding differences of opinion about that cost enter into the IPCC's debate over the cost of reducing greenhouse gas emissions.

Some analyses reviewed by the IPCC indicate that decreases in energy use of 10 to 30 percent can be achieved at low or even negative cost by widespread adoption of technologies that people do not use now because of such market barriers as lack of information, uncertainty about product performance or lifetime costs, high up-front costs, the distorting effect of energy subsidies, and the "chicken and egg" problem created by low initial purchase volume and high initial price. By reducing these barriers, the argument goes,

government policies could reduce greenhouse gas emissions very cheaply.

Economists accept the idea that energy and other markets do not always work effectively, which certainly is the case in many countries. But many economists remain skeptical that the apparent lack of interest in more energy-efficient products necessarily is a market failure, citing other explanatory factors such as customer dissatisfaction with some product attribute that overwhelms consideration of its energy efficiency.

Accordingly, some of the analysts whose studies Working Group III surveyed do not believe barriers to widespread adoption of technologies are a major problem, at least in advanced economies where markets generally work, or that their elimination offers a truly cost-effective way of lowering mitigation costs. Thus their estimates of these costs are often higher than the technological state of the art would imply. For example, these latter analyses suggest that the cost to OECD countries of stabilizing carbon dioxide emissions at 1990 levels over the next several decades could range from -0.5 percent (a small net increase in GDP) to as much as 2 percent of GDP. (In evaluating these estimates, it is important to keep in mind the fact that GDP is not an accurate measure of social well-being.)

Moreover, these estimates tend to assume use of the most cost-effective emissions control policies, such as carbon taxes or emissions trading. If the policies put in place were actually less cost-effective, the estimated economic burden would increase.

Regardless of one's position in this debate, an important conclusion to arise from Working Group III's review is that the total costs of meeting a long-term target for reducing greenhouse gas concentrations in the atmosphere may be reduced substantially by stretching out the time period of emission reductions and providing emission sources with flexibility in the timing of reductions. Such flexibility could cushion abatement costs by reducing premature obsolescence of existing capital and permitting greater development and deployment of new, efficient technologies.

With regard to the eventual necessity for global participation in curbing greenhouse gas emissions, the IPCC notes the tension between that ideal and the need to respect the economic development priorities of the world's lower-income countries. Yet by meeting those priorities, poorer countries might expand their

capacity to cope with climate change stresses, in addition to raising their living standards.

If fairness and implementation issues can be resolved, the IPCC points out that significant opportunities exist for international cooperation to lower the costs of emission reductions. These opportunities include "joint implementation" projects in which richer countries make investments in reducing emissions in poorer countries. Properly structured, such projects can convey tangible economic and environmental benefits to recipient countries while lowering the total costs of greenhouse gas emission reductions.

As for permitting countries some flexibility as to when and where emissions are reduced, while it is true in principle that such flexibility can increase economic efficiency, in practice the ability to do so may be constrained by political considerations. Permitting delays in emissions reductions may lack credibility because of skepticism that governments will honor previously made commitments to pursue aggressive reductions. Developing countries also have expressed suspicion about the motivations for joint implementation and a desire for more concrete action by developed countries themselves.

To overcome these concerns may require developed countries to carry out greater and more immediate emissions reductions than a simple analysis of economic efficiency would indicate.

The IPCC assessment also considers the way in which adaptation measures—for example, improved water management—can contribute to both economic efficiency and increased resiliency to weather fluctuations and climate change. Indeed, given the IPCC's conclusion that some climate changes have already been set in motion, some adaptation is already essential as well as desirable in order to avoid some of the costs of mitigation. More detailed attention to adaptation is needed in future assessments, however.

Final Comments

Based on the insights, information, and findings of the IPCC's second assessment, it is now much more difficult to argue that human activities are not changing the climate. It is also now easier to argue that the impacts of climate change may be substantial, surprising, and unfair.

Unfortunately, the continuing uncertainties about the scale and nature of climate change, its

consequences, and the costs of response make it difficult to specify a long-term plan of action at this time. Legitimate debate continues about what constitutes—and how best to avoid—a "dangerous" interference with the climate system.

For our part, we believe that the latest IPCC assessment justifies some degree of policy intervention that goes beyond actions to improve economic efficiency *without* reference to climate change, although neither the United States nor the other industrialized nations have yet to exhaust all opportunities for these "no-regrets" actions. While the potential risks are difficult to quantify, the IPCC assessment strongly suggests that they are not zero. Given that society is not impervious to risks, some anticipatory efforts to reduce threats as well as efforts to improve the understanding of their magnitude are called for.

The task is not easy. The second assessment underscores the challenge of understanding and responding to the ecological and socioeconomic aspects of climate change and other closely intertwined global problems, as well as the need for further understanding of how the climate is affected by human activities. Climate scientists need to focus on the regional manifestations of climate change and the variability of these changes; impact studies must become more quantitative and effective adaptations need to be better identified; and economists must extend and supplement their tools for assessing the consequences of global change and the costs of policy responses.

The opportunities, as well as the needs, for new approaches in these fields are substantial. To reap these opportunities, governments and other sources of research funding should maintain or increase their budgets for climate change analysis, and a greater share of future research budgets should be allocated to ecological and socioeconomic research.

Michael A. Toman and Joel Darmstadter are senior fellows in RFF's Energy and Natural Resources Division. Until recently, John Firor headed the Advanced Study Program at the National Center for Atmospheric Research, where he is now a senior research associate.



Find out more about the IPCC at
<http://www.unep.ch/ipcc/ipcc-0.html>.

To order bound copies of the latest available working group reports, contact Cambridge University Press, Dept. P.J.L., 40 West 20th St., NY, NY 10011-4211; fax: 212-691-3239.



Rights-Based Fishing

Transition to a New Industry

North Atlantic fisheries off New England and maritime Canada have collapsed, and throughout the world yields from many ocean fishing grounds are declining precipitously. Reversing the process may require abandoning the tradition of free and open access to the ocean's resources in exchange for a "closed-access" system based on property rights.

The story is certainly not news: many of the world's ocean fisheries are being pushed toward possibly ruinous declines. True, we have yet to see skyrocketing prices or long lines at the seafood counter. Long-established fishing communities, however, are threatened, as are some traditional, often centuries-old ways of life. Sporadic armed conflict has even broken out in some territorial waters. And the equilibrium of coastal marine ecosystems, already taxed by pollution and other development pressures, is further threatened by progressive decimations of many marine species and populations.

Many Americans may be aware of the collapsed North Atlantic fisheries off New England and maritime Canada. The problem, though, is global and growing, and we know why: overfishing. The practice results from the tradition of free and open access to fishery resources that itself stems from the traditional principle of freedom of the seas. As a result of overfishing, too many fishermen and manufacturers now pursue and process fewer and fewer—and generally smaller—specimens. (See the sidebars for some details on the extent of overfishing and overcapacity of fishing fleets.) Can anything be done to turn this situation around?

Property Rights As a New Paradigm

Broad command-and-control regulatory approaches, typically based on some version of open access, clearly are not working. Management areas, for instance, seem to be too large to reflect accurately the local conditions and interests of the fishermen themselves. Even when

control has been regionalized, as in the United States with its nine regional fisheries management councils, the decisionmaking powers tend to reside in those with vested interests in short-term gains rather than the long-term health of the fisheries. Ocean fisheries management needs the cooperation of those who work the seas, much as the preservation of terrestrial biodiversity and ecosystem management require the willing assistance of private landowners.

Would creating and using property rights among fishermen work to control both open access and overcapacity—and, thereby, overfishing? Systems could be designed to set quotas on catches permitted or limit the number of licenses issued. Such systems have in fact been used around the globe with increasing frequency since the 1970s, but mostly at local and regional levels. Such *rights-based fishing* assumes that fishermen, if allowed exclusive use rights and thus included more directly in fisheries management decisions, will clearly see the benefits of managing for the long-term health and productivity of their fisheries.

A leading proponent of this approach is economist Francis T. Christy, a founding researcher at RFF who coauthored *The Common Wealth in Ocean Fisheries* for RFF in 1965. The book foresaw conditions worsening through depletion of stocks, decreased economic returns, and increases in local conflicts.

Now an independent consultant in fisheries management and economics to such clients as the Food and Agriculture Organization of the United Nations and the International Institute for Fisheries Economics

and Trade, Christy sees rights-based fishing rapidly becoming the dominant paradigm throughout the industry. Such an approach can best reflect local and regional conditions and user needs. In his view, extending the use of these property-rights approaches throughout all fisheries is the most efficient way to control the entwined problems of open access and overcapacity (see the sidebar on the latter).

Comparing Open and Closed Access

Managing fisheries based on open access, Christy contends, removes fishermen from the center of the stage where they belong. Public officials tend to encourage decisions that create and preserve jobs. Often these jobs are in the processing industries, whose owners have a vested interest in keeping the fishermen from having property rights, and thus some control over supply and pricing. Highly publicized "fishing derbies"—intensive, frenzied "seasons" of a few days or even less—have been a traditional management response to some collapsing fish stocks, but they do not give fishermen much leverage in the market with the processors.

Traditional fisheries management is further hindered by incomplete and imprecise biological information about the fish, as well as by the often prevailing notions that what's good for the fish is good for humankind and that governments, given correct information, will make the correct decisions. Conservation controls, even when improving fish stocks, can damage economic interests and still not ultimately remedy overfishing. The status of the scientific information is such that management decisions tend to be risky and short term, based on a hope that a fishery's condition might really be better than available information indicates. The need for impartial analysis, economic appraisals in particular, is too often ignored. Further, in some countries basic economic and social information—numbers of boats, or data on labor, wages, and prices—is sketchy or absent.

Existing management can, though, sometimes open itself to the input of fishermen to good effect. The North Pacific Management Council, one of the U.S. regional councils, has created with participating fishermen a quota system for several of the region's fisheries. Where customers once could purchase only frozen fish from this region—the result of previously

constrained seasons—truly fresh Alaskan halibut, pulled from the water only 36 hours earlier, is now available in most cities. The fishermen share the benefit, since such a product is worth more on the market than the frozen version. Once the fishermen have greater involvement in fisheries management, notes Christy, they will have greater incentive to invest in and heed scientific advice.

Isolated instances to the contrary, however, problems are seemingly intractable—especially in the longest-used fisheries such as in the Northeast Atlantic. Some industry watchers contend that only by reaching the breaking point will certain fisheries be opened to new management solutions.

The fishing industry is characterized by its diverse groups of stakeholders, with few common, nonconflicting interests to be discerned even locally, and any management consensus is difficult to achieve. "The greater the reduction of the players, the greater the likelihood of common interests," Christy observes. "So narrow the field." Creating property rights in fisheries is one way to do this.

Controlling Access through Property Rights

The new paradigm of property rights for fisheries has as its core the relatively old-fashioned concept of exclusive use rights. Two basic approaches are available for creating some form of property rights for, and thus controlling access to, a given fishery. One is the use of *individual quotas* and especially individual transferable quotas; these seem to be the most widely used, and generally most successful, approaches. Simply put, the total allowable catch is estimated by management and divided into shares. Since one's catch is fixed, so are one's total revenues—hence a motivation to reduce harvesting costs. Alternatively, a *licensing limit* system could limit the means of access—generally, fishing vessels. This approach is best suited to a fishery with many ports or offshore opportunities to offload catch (such as New England's), which make any quota system difficult to enforce.

Locally controlled user rights can help fine-tune these systems to ensure maximum sustainable net revenues or a certain level of employment. Exclusive user rights have long been used by small-scale local fishermen with fishery resources adjacent to their own community, especially for relatively sedentary animals

like shellfish. Expanding this to larger fisheries and more mobile sealife remains a challenge (although tuna companies in the Philippines have successfully controlled local access by limiting the type of fishing gear used). The goal in all cases, though, is to convey more authority for the use of a fishery, including monitoring and surveillance, to its primary users.

"The track record for individual quotas and individual transferable quotas is fairly good," according to Christy. "They have led to increased rents and the removal of excess capital." New Zealand has become the leader in ITQs, with thirty-two species-specific agreements. Australia is a close second: its division with Japan of much of the southern bluefin tuna fishery is illustrative. Using relatively low quota allocations, many in the Australian part of the fishery had to decide whether to buy more quota or sell out. In the two years following the start of the ITQ system for that fishery, the number of boats in use dropped by 50 percent. Researchers estimated that the capital so employed in the boats was \$10 to \$12 million less

than under other management schemes. The system also focused catches on larger, more valuable specimens, with the value of the catches increased three- to fourfold. (Highly esteemed by sushi diners, a premium bluefin can sell for between \$6,500 and \$11,000 at auctions in Tokyo.)

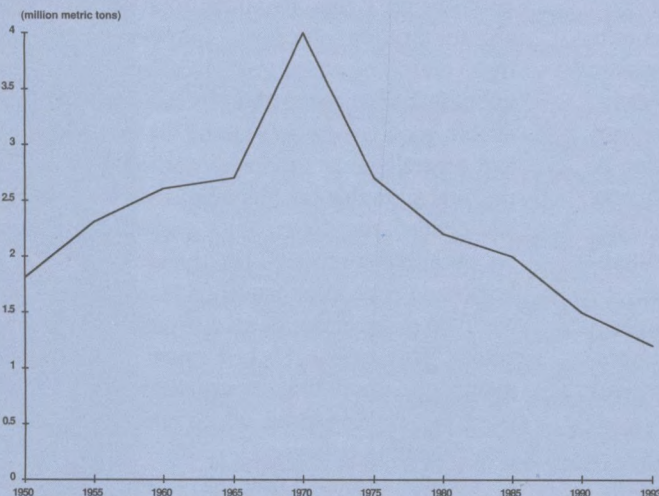
Although seemingly the simpler system, licensing limits require more prolonged government presence in management than quota systems. The Northern Australia prawn fishery has used license limits to good effect. Some government buy-backs of vessels along with other measures helped quickly trim the size of the fleet. Cooperative efforts, including research, between management and the fishermen succeeded in restraining the catch of smaller, lower-priced prawns, focusing instead on the larger ones. The result: enhancing the value of catches and allowing the biological renewal of the fishery.

Some Problems

Unfortunately, bycatch—the inadvertent capture of unsought species—is not necessarily reduced substantially by either approach, though quotas could be set for bycatch to encourage fishermen to work other areas of the fishery with less bycatch potential or (in some fisheries) to invest in equipment that would minimize bycatch. Also, the introduction of a property-rights regime does not immediately, or even necessarily, result in a leveling out of the rate of fishery stock depletion. And those fish that move between the biologically arbitrary 200-mile-wide territorial waters and the high seas present another challenge to property-rights regimes, much as they do to the present system.

Enforcement also remains a problem, with the intrusions of foreign boats and fleets especially vexing. Poaching may always be with us, and assigning surveillance and monitoring to property owners seems unlikely to change that. Even more damaging and difficult to resolve can be legal fishing at the very edges of the 200-mile limit. Small-scale fishermen looking ever-farther afield can so intrude, as can "pirate" trawlers using illegal equipment such as fine-meshed nets. Usually, however, the legal industrial fleets of huge trawlers present the greatest challenge. Designed to catch and process a ton or more per hour, these giants can effectively clean out much of any fishery. Negotiating and enforcing international agreements may prolong the full transition to a rights-based industry.

Effects of Overfishing: Changes in Catches of Atlantic Cod, 1950–1993



One result of over four decades of intensive fishing shows up clearly in the status of this single species. During this same period, global harvests increased nearly fivefold: by 1993, more than two-thirds of the total global fish stocks were being fished at or beyond their maximum productivity levels. In six of the eleven major Atlantic and Pacific regions, over 60 percent of all commercial stocks have been depleted or fished to their limits. In the northwestern Pacific, all of the assessed fish stocks are in that state.

Sources: World Resources Institute, Food and Agriculture Organization of the United Nations (FAO).

Perhaps of greatest concern, instituting exclusive user rights creates winners and losers. Especially vulnerable are those who run smaller, more traditional fishing operations. Locally controlled use rights, though, can provide an alternative for smaller operations. In Argentina, for instance, competition among the some 200 families engaged in fishing for the domestic market was leading to lower prices. So, the families negotiated among themselves—first prices, then limits on landings, then other controls to make their market more effective. Some smaller Japanese fisheries have improved their management in a similar manner. Conflicts with foreign fleets, however, especially those with large factory ships, unfortunately can overshadow such efforts.

Would a “millionaire’s club” of megafleets, foreign or otherwise, be likely to take over commercial fishing under a property-rights scheme? Thus far, this seems not to have occurred. When such concentrations appear likely, governments could make use of antitrust powers, impose taxes and user fees on windfall profits, and also decide who gets retired user rights. Government can employ some fairly simple measures to prevent concentration. For instance, a one percent limit on quota transfers, combined with other limitations, has kept the rights to the northern Pacific halibut fishery well-distributed.

Necessary Roles for Governments

While the role of governments would in time be substantially reduced in rights-based fisheries, the transition to a new system requires significant government involvement. Short-term actions will no doubt be needed to ease the disrupted lives of many through this transition even while encouraging the creation of property-rights systems for the long term. Reducing the size of management areas and bringing groups of fishermen into management decisions would be helpful. In particularly hard-hit fisheries, imposing moratoria on further investments and freezing fleets at existing capacity will be required to start the transition—as is being done for some of the devastated North Atlantic fisheries. Research into economic and biological alternatives for a fishery, as well as negotiating the redistribution of wealth and overlapping international interests, are other forms of government help.

Overcapacity: How Much and Why?

Overcapacity in the fishing industry can be translated as too many boats chasing too few fish. More precisely: in 1993, FAO determined the total costs of the world’s fishing fleets as being \$54 billion greater than all the 1989 revenues from marine resources. That global fishing fleet is now estimated to be at least 30 percent (and perhaps as much as 100 percent) larger, according to Francis Christy, than is required to fully and efficiently harvest available ocean fishery resources.

The large-scale industrial fleets have expanded in the past twenty years at twice the rate as the increase in total catch. Much of this increase occurred after the extension to 200 miles of territorial waters in the 1970s; many nations thereafter began subsidizing the construction of new vessels and processing facilities. Small-scale fleets and subsistence fishers (many in developing nations) who generally fish in coastal waters, however, make nearly half of the total catch, most of which is used as a local food source. In addition, population growth and declining economic conditions in these coastal areas can increase the number of boats in a declining fishery.

Sources: Food and Agricultural Organization of the United Nations (FAO), World Resources Institute

Government subsidies will be required, but for disinvestment this time, not for the shipbuilding booms that have contributed to fleet overcapacity. Buying back quotas and even vessels is one way to go, and can work quickly: Australia and New Zealand have had success doing so to help clear the field as a prelude to establishing rights-based systems.

Applying property rights to fisheries management involves making difficult decisions and changes. Devolving centralized power to a more local level seldom goes smoothly. Creating property rights where none existed before inevitably becomes an issue of redistributing wealth that in turn could result in monopolization, hardly a politically profitable outcome. The alternative, however, of continuing the traditional (however unintentional) destruction of fisheries resources is ultimately unacceptable. While many realize that the industry must change to save itself, rights-based proponents describe a way that those within the industry—and predominantly those who do the fishing—can effect the needed changes, and not have them imposed from without. ☞



Cleaning Up the Nuclear Weapons Complex: A Herculean Challenge

by Katherine N. Probst and Michael H. McGovern

For nearly five decades, the U.S. Department of Energy (DOE) and its predecessors engaged in a highly secretive, complex, and massive endeavor to fabricate nuclear weapons for national security purposes. Large-scale production of nuclear weapons was an unprecedented undertaking requiring thousands of facilities, dozens of large tracts of land, huge volumes of dangerous materials, and great quantities of water. With the Cold War's end and the emergence of new types of national security concerns, weapons production operations have, for the most part, ceased, and much of the secrecy under which they were shrouded has lifted.

The subsequent revelations have been shocking. In the rush to produce the materials, components, and devices necessary to produce thousands of nuclear weapons, DOE paid scant attention to the environmental consequences of its actions. At many sites, tremendous volumes of soil and groundwater are contaminated with both radioactive and hazardous materials. Wastes stored for years pose substantial dangers, and many aging facilities that harbor highly radioactive and sensitive materials are deteriorating.

In 1989, DOE established the Office of Environmental Management (EM) to address these problems and to clean up the

nuclear weapons sites. DOE has spent almost \$35 billion on the EM program over the past seven years, and expects to spend another \$6.5 billion on environmental management activities in fiscal year 1997. Some 70 percent of these expenditures address problems at six major sites: Hanford, Washington; Savannah River, Georgia; Rocky Flats, Colorado; Oak Ridge, Tennessee; Fernald, Ohio; and the Idaho National Engineering Lab. The Hanford cleanup alone has consumed \$8 billion since 1989.

More to "Cleanup" than Cleaning Up

Much more than cleanup goes on at the six major sites. In addition to addressing soil, groundwater, and surface water contamination, EM staff and contractors are responsible for safely managing millions of cubic meters of stored wastes, several metric tons of excess plutonium and highly enriched uranium, and thousands of aging and contaminated buildings. EM must also properly treat and dispose of newly generated wastes resulting from several remaining weapons production operations and from ongoing nuclear energy research.

The diverse challenges of environmental protection and nuclear safety can readily be illustrated at Hanford. Sixty million gallons of high-level waste are contained in 177 huge underground storage tanks at the site. Some of these tanks have been leaking waste into the soil for years, and some are in danger of exploding from the buildup within of hydrogen gas. In addition to safely managing the tanks, DOE must eventually extract all waste from them to treat and prepare for disposal in an off-site geologic repository. These operations are complicated because high-level waste is composed of both hazardous and highly radioactive constituents.

A Fragmented Regulatory Regime

For most of its existence, DOE followed

The Research Team

The RFF research team conducting research on DOE's EM program includes Senior Fellow Katherine Probst, CRM Director Terry Davies, Fellow Karen Dunn, Research Associate Michael McGovern, and Research Assistant Kieran McCarthy.

the practice of its predecessors—regulating all of its own activities to ensure the safety of its facilities, the protection of the environment, and the health and safety of workers. Total self-regulation of weapons production activities was deemed necessary because of the urgency and nature of the mission at hand.

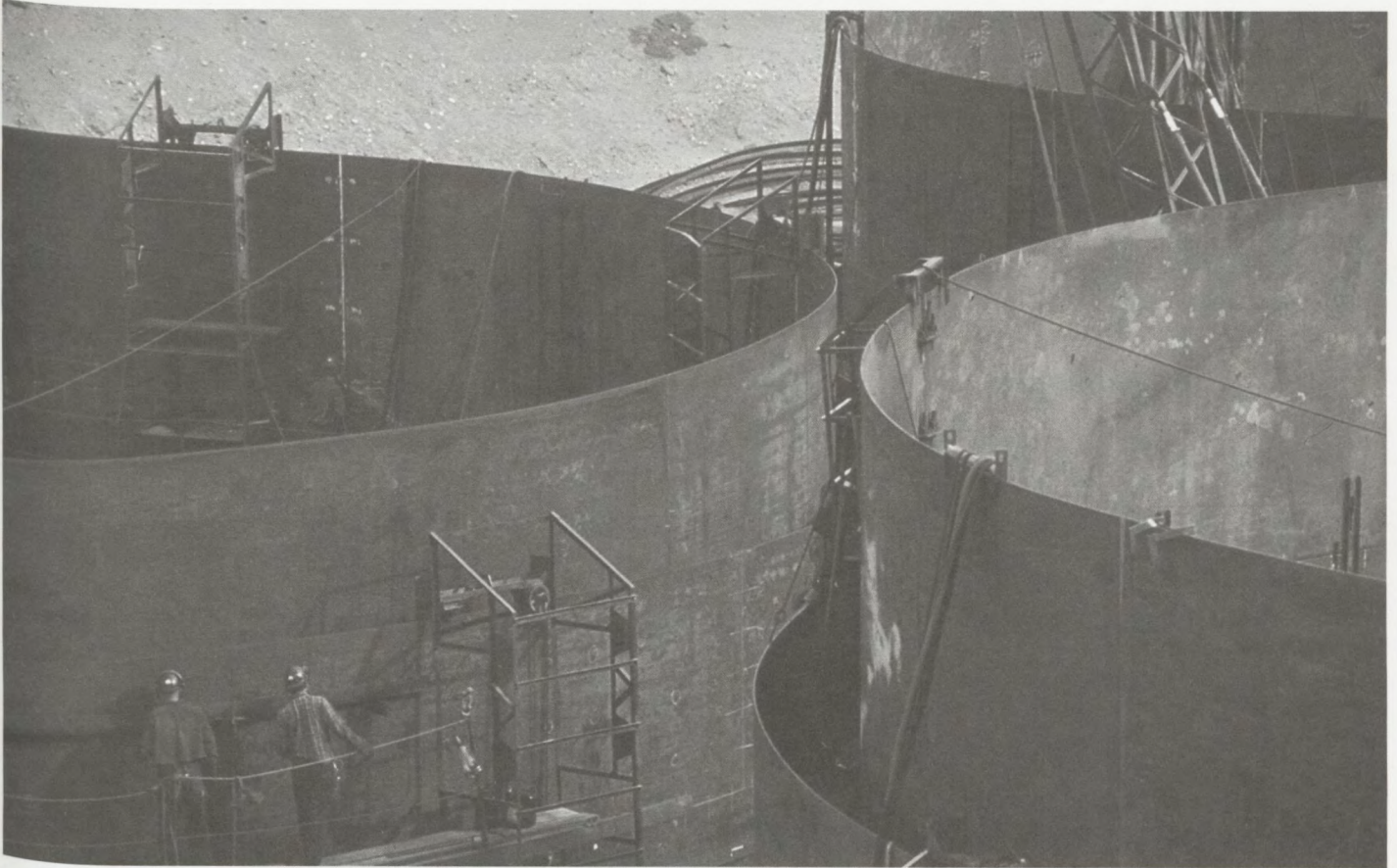
In the 1980s, however, DOE found itself increasingly hard-pressed to justify complete self-regulation, with environmental groups attacking that stance in court and in the media. As a result of several court rulings—notably *Leaf v. Hodel* in 1984—the U.S. Environmental Protection Agency (EPA) was granted authority to regulate DOE activities to ensure compliance with environmental laws. Many states now have similar authority as well.

Meanwhile, DOE still self-regulates to ensure nuclear safety under the authority of the Atomic Energy Act. This self-regulation is accomplished through the use of internal directives that govern the management of radioactive materials and the safety of nuclear facilities.

Thus DOE's environmental management activities are often subject to regulatory requirements under the purview of several different agencies. Moreover, cleanup activities are not uniformly regulated by either internal or external entities. This fragmented regulatory regime results in gaps and overlaps in regulatory requirements that make it extremely difficult to address diverse hazards in a holistic manner.

The RFF Project

RFF's Center for Risk Management (CRM) is exploring new approaches to cleaning up the nation's nuclear weapons complex under a cooperative agreement with the Department of Energy's Office of Environmental Management. In July, the CRM research team issued a discussion paper that considers whether a new "integrated" law is warranted to replace the often overlapping and conflicting requirements of the legal framework now governing environmental management activities within the weapons complex.



Constructing storage tanks at the Hanford site tank farm. When completed, each tank can store one million gallons of high-level, liquid radioactive waste seven to ten feet underground.

New Regulatory Regimes

In recent years, pressure has been mounting both within and without DOE to eliminate most remaining self-regulation. Responding in part to those demands, Secretary of Energy Hazel O'Leary established in January 1995 the Advisory Committee on External Regulation of Department of Energy Nuclear Safety.

That committee concluded in December 1995 that self-regulation of DOE activities should cease almost entirely and recommended that regulation of nuclear safety come under the authority of either the Nuclear Regulatory Commission (NRC) or Defense Nuclear Facilities Safety Board (DNFSB), an independent oversight


agency established by Congress in 1988. Adoption of the committee's recommendations—which are quite controversial—would require action by Congress.

The committee's recommendations to end self-regulation do not address the problems of multiple regulators and divided regulatory domains. An even more radical approach—"integrated legislation"—would address the full range of DOE's environmental management activities and the panoply of concerns that drive them. Specifically, a regulatory regime established by a single "integrated statute" could concurrently address nuclear safety and environmental protection, replacing the extant fragmented approach. Such a

law could be administered by either one of the existing regulatory agencies (EPA, NRC, a reconstituted DNFSB, state environmental agencies) or by a new agency.

An integrated law would provide an opportunity not only to eliminate gaps and overlaps in regulatory requirements, but also to ensure that resources would be focused on the worst risks first.

Over the next few months, the CRM team will continue its research to develop the outlines of what an "integrated statute" for DOE's EM program might look like.

 To obtain a copy of the team's discussion paper, entitled "Cleaning up the Nuclear Weapons Complex: Exploring New Approaches," (96-25), see page 22.



Cross-Media Pollution and the Chesapeake Bay

Nitrogen oxide (NO_x) emissions pollute the air. In turn, polluted air can contaminate the water. Airborne NO_x emissions, for example, are responsible for anywhere from 10 to 40 percent of the Chesapeake Bay's nitrogen buildup, which enriches nutrients that choke out aquatic life. Despite awareness of this cross-media effect, however, analysts have found it difficult to account correctly for the contributions NO_x emissions make to nutrients in the bay.

Pollution laws do not account for the cross-media effect, either, treating air and water in isolation from one another. Thus, if a stricter emission standard were placed on cars in the Northeast tomorrow, the benefit of making the bay a little cleaner at no additional cost would go unrecognized in the enactment.

Certainly the task of accounting for cross-media interactions is not easy. Many different sources of NO_x emissions exist whose impacts on Chesapeake Bay waters vary with time, location, and source. Likewise, the available response options vary, as do their political viability and cost-effectiveness.

Yet making an effort to recognize the cross-media effect is well worth the trouble, RFF researchers say. Neither cleanup of the Chesapeake nor cleanup of NO_x emissions will be cost-effective otherwise.

What is needed is a framework to determine how best to account for the

dual impact of NO_x emissions on air and water quality in devising pollution controls and to identify cost-effective policies when both media are affected. Until then, RFF researchers point out, the real costs of pollution control will continue to be distorted, since all costs are now attributed to a given medium in isolation.

To begin to build the needed framework, researchers Alan Krupnick and Virginia McConnell in RFF's Quality of the

helping to analyze the results of a model that Atkinson developed to simulate trading of NO_x emission allowances to reduce nutrient pollution in the bay.

Eventually, Krupnick and McConnell will help extend the Atkinson model to consider trading under a NO_x emissions cap designed to reduce air pollution after deducting water pollution benefits from abatement costs. They hope insights from the study will allow them to develop

policy options for trading programs and for other incentive-based NO_x emission reduction programs. In related work, Krupnick and McConnell will explore how the air and water impacts of NO_x emissions from electric utilities vary depending on facility location and what this suggests about how policies for reducing utility emissions should vary at the state or county level.

Knowing more about such air and water impacts for each facility will also help set the appropriate trading ratios among facilities for the marketable permit program.

Into their analysis of cost-effective abatement policies and cross-media trading programs, Krupnick and McConnell will also integrate the array of possible actions that might be taken to deal with cars and trucks—the so-called “mobile sources” that make a major contribution to NO_x emissions and nutrients in the bay.

COURTESY OF S. C. DELANEY/U.S. EPA



Emissions from cars and trucks make a major contribution to the Chesapeake Bay's nitrogen buildup, enriching nutrients that choke out aquatic life.

Environment Division are conducting a study funded by the Air Quality Coordination Group of the Chesapeake Bay Program and by the U.S. Environmental Protection Agency's Office of Policy Planning and Evaluation.

Working with Brian Morton of the Environmental Defense Fund and Scott Atkinson of the University of Georgia, Krupnick and McConnell are studying the use of marketable NO_x emission allowances to achieve both air quality and water quality goals. To that end, they are



INSIDE RFF

Third RFF fellow to serve on Council of Economic Advisers

Timothy J. Brennan, former Gilbert F. White Fellow and now a senior fellow in the Quality of the Environment Division, is the latest RFF researcher to be appointed as a senior economist on the staff of the President's Council of Economic Advisers. Established in 1946, the three-member council advises the President on a wide range of domestic and international issues and appraises public programs and policies from an economic standpoint.

Unlike his RFF colleagues Michael A. Toman and Alan J. Krupnick, who handled almost all of the environmental issues and most of the natural resource policy issues while serving on the CEA staff in recent years, Brennan will advise the council on matters relating to regulation, industrial organization, and antitrust. His responsibilities will reflect his expertise in telecommunications and electricity regulatory analysis, competition policy, intellectual property, and legal liability rules.

Brennan, along with Karen L. Palmer, is a lead author of the recent RFF book *A Shock to the System: Restructuring America's Electricity System*, a plain-English primer on understanding and evaluating the many proposals for expanding competition in the U.S. electricity industry in the near future.

In addition to working with RFF, Brennan is a professor of policy sciences and economics at the University of Maryland, Baltimore County. His appointment to the council staff runs from July 1996 through June 1997.

Grady is new member of RFF board

Robert E. Grady, managing director of the San Francisco investment banking firm Robertson, Stephens & Co., is the newest member of RFF's board of directors. During the Bush administration, Grady served as deputy assistant to



the President and as the number two official at the Office of Management and Budget. Prior to that appointment he was OMB's associate director for natural resources, energy, and science for three years.

In that latter capacity, Grady was instrumental in formulating the 1990 Clean Air Act Amendments, the 1992 Energy Security Act, and the Bush administration's science and technology policies and budgets for energy, environmental protection, and natural resources. He also served on

the U.S. delegation to the 1992 Rio Earth Summit and to four successive G-7 summits.

A trustee of the Environmental Defense Fund, Grady also lectures on public management at the Stanford University Graduate School of Business, where he received his MBA.

Stagliano hits use of petroleum stores

In testimony criticizing the 1996 sale of oil stored in the Strategic Petroleum Reserve, energy analyst Vito Stagliano advised Congress to rethink current policy—which he said is now “very confused and self-defeating”—regarding the reserve established over twenty years ago as an economic insurance policy.

Stagliano is the director of Energy Security Analysis, Inc. Formerly a deputy assistant secretary of energy for policy analysis during the Bush administration, he was a visiting scholar at RFF during 1995–96.

Stagliano warned members of the House Subcommittee on Energy and Power in May that using the SPR for short-term revenue raising and for quick fixes of oil prices trivializes the most important instrument the United States has to redress market imbalances during serious supply disruptions and to soften the economic effects of sharp rises in oil prices.

What Congress should do now, he said, is decide whether to eliminate the SPR entirely

because of the risk of its continued misuse, or recommit to holding the reserve in readiness for true emergencies.

Such a renewed commitment should be possible, Stagliano argued, since Democrats and Republicans have until very recently remained faithful to an SPR of last resort, even while disagreeing on most other aspects of energy policy. Established under the Energy Policy and Conservation Act in 1975, the reserve has only been tapped twice before, the first time during the Persian Gulf War.

The source of temptation in deviating from this long-time bipartisan commitment, Stagliano believes, is the elastic language of the 1992 amendments to the EPCA, which makes it possible to rationalize a drawdown just about anytime a politician wants to cheapen the price of gasoline. A case in point, Stagliano said, was President Clinton's decision to draw down the SPR in response to market conditions that were “temporary and self-correcting.”

If Congress recommits to an SPR of last resort, Stagliano urged repeal of the EPCA amendments. He further recommended that Congress fill the reserve to its authorized 750 million barrel level and then seek ways to reach the mark of one billion barrels originally agreed on, a level he said would be cost-effective.



Find the complete text of Stagliano's comments at <http://www.rff.org/testimony>.



ANNOUNCEMENTS

New RFF book views electricity restructuring

Technological, economic, and political developments are shaping an electricity system very different from the one we have known. *A Shock to the System: Restructuring America's Electricity System* introduces the concepts, crucial elements, and terminology used in discussions about electricity restructuring. Economic analysts at RFF provide the background necessary to understand the increasing role of competition in various electricity markets.

After presenting a brief history of America's electricity

industry and public policy toward it, the authors identify the significant issues in the competition debate. The book clearly explains the potential consequences that major proposals for introducing competition would have on utility regulation, industry structure, cost recovery, and the environment. Among the key topics discussed are the relative merits of vertical integration and the burgeoning controversy surrounding stranded costs.

Designed to be reader-friendly, *A Shock to the System* employs simple graphics to illustrate flows of resources and power and to delineate divisions of labor in the indus-

try. Easy-to-read tables and charts increase the reader's understanding of concepts and debates; special set-aside boxes provide further elucidation and valuable background information. All these features improve the reader's grasp on complicated issues in an area that touches the lives of all Americans.

A Shock to the System is intended as an instructive—and timely—guide to the decisions that electricity providers, their customers, and policymakers will face over the next decade, as well as to the forms the decisions may take and their possible long-term ramifications.



A Shock to the System: Restructuring America's Electricity Industry

Timothy J. Brennan, Karen L. Palmer, Raymond J. Kopp, Alan J. Krupnick, Vito Stagliano, and Dallas Burtraw

This new book provides the background necessary to understand and evaluate the many proposals for introducing competition to electricity markets. The authors introduce the concepts, crucial elements, and terminology used in discussions about restructuring. They identify the significant issues in the competition debate, explaining the consequences that the major proposals would have on efficiency, market structure, regulation, and the environment. *A Shock to the System* is an instructive guide to the next ten years—where changes will occur, what forms they are likely to take, and what their long-term ramifications may be.

"Well written, timely, and accessible. Its special contribution is to present the economic perspective on electricity-sector reforms in clear English. . . . The chapter on the pros and cons of vertical integration is a piece of textbook analysis that somehow has never appeared in the trade press; it should be required reading for everyone interested in energy policy." **Clinton J. Andrews**, *Princeton University*

"A useful introduction to issues that must be addressed...should be of value to decision makers, investors, and interested citizens." **Charles Stalton**, *former commissioner, Federal Energy Regulatory Commission*

"A superb analysis of the electricity industry and its coming transformation. *A Shock to the System* deserves wide readership." **James Carroll**, *Georgetown University and Florida International University*

July 1996 • 160 pages • \$18.95 • Paper

ORDERS NOW BEING TAKEN

Ordering Books and Reports

To purchase books and reports, add \$3.00 for postage and handling per order to the price of books and send a check payable to Resources for the Future to: Resources for the Future, Customer Services, P. O. Box 4852, Hampden Station, Baltimore, MD 21211-2190.

Books and reports may be ordered by telephoning 410-516-6955. MasterCard and VISA charges may be made on telephone orders.

Ordering Discussion Papers

Discussion papers may be ordered through RFF. The price per paper covers production and postage costs and is based on delivery preference: domestic, \$6 for book rate and \$10 for first class; international, US\$8 for surface and US\$15 for air mail. Canadian and overseas payments must be in U.S. dollars payable through a U.S. bank.

To order discussion papers, please send a written request and a check payable to Resources for the Future to: Discussion Papers, External Affairs, Resources for the Future, 1616 P Street, NW, Washington, DC 20036-1400.

Additional information about RFF books and discussion papers may be obtained on the World Wide Web (<http://www.rff.org>).



DEVELOPMENT

Planning opportunities with charitable trusts

The flexibility that charitable trusts can offer for financial and estate planning has been expanded in recent years through *charitable remainder trusts*. Such a trust, which may be created during one's life or by will, designates a charitable organization to be named as remainder beneficiary of the trust. An immediate income-tax charitable deduction is generated by a qualified charitable trust created as a lifetime trust, and highly appreciated property placed in a charitable remainder trust will completely escape tax on the capital gain.

Irrevocable trusts: two choices. To qualify for favorable tax treatment, the charitable remainder trust must be irrevocable, either in the form of an annuity trust or a unitrust.

The *annuity trust* pays a fixed amount annually, or at more frequent intervals, to a designated beneficiary or beneficiaries. The amount must equal at least 5 percent of the initial fair-market value of the trust. At the death of the last life-income beneficiary, the trust principal is distributed to a designated charitable organization.

The *unitrust* pays to a designated beneficiary or beneficiaries an amount—equal to at least 5 percent of the value of the trust as it is valued each year—to be paid annually or at more frequent intervals. At the death of the last income benefi-

ciary, the trust principal is distributed to a designated charitable organization.

The key difference between the two is that income payments from an annuity trust do not change, even though the value of the trust may change. Payments from a unitrust fluctuate according to changes in the value of the unitrust. An annuity trust might be appropriate when the security of a fixed income payment is suitable to the needs of the beneficiary. The unitrust, with its variable payments, may provide a hedge against inflation and may be more suitable when some investment flexibility is desirable.

Net-income unitrusts. This variant of a standard unitrust distributes to the beneficiary the lesser of either the net income of the trust or a fixed percentage rate. In addition, the net-income unitrust can include a "catch-up" provision that allows the trust to make up for reduced income that may have occurred in early years by distributing excess income in a later year when the trust income exceeds the stipulated percentage. As the following example illustrates, the net-income unitrust can be a potent financial-planning tool:

Assume that Mr. Smith owns growth stocks currently valued at \$120,000, which he purchased some time ago for \$50,000. The stocks yield an annual dividend of about \$1,200. Given his 31 percent tax bracket, his spendable

income from the dividend is minimal.

Mr. Smith also wants to make a financial commitment to RFF. One of his objectives is to generate substantial deductions to offset taxes in his peak earning years. Of equal importance to Mr. Smith is the potential growth value of the stocks because, upon retirement in about fifteen years, he plans to sell the stock and reinvest the proceeds in high-yield securities. Assuming the stocks continue to grow in value and are worth \$250,000 in fifteen years, their sale would result in a capital gain of \$200,000 and a potential capital gain tax of \$56,000 ($\$200,000 \times 28$ percent). This means Mr. Smith would realize only \$194,000 from the proceeds of the sale for reinvestment purposes.

Mr. Smith instead establishes a 6 percent net-income unitrust with a "catch-up" provision, funds it with the \$120,000 in stocks, and informs the trustee of his long-range objectives. The results: Mr. Smith, now fifty years old, realizes a charitable deduction of \$29,794, which in his 31 percent tax bracket means a tax savings of about \$9,236. The trust will continue to pay him the dividend income earned by the stocks. At the present rate, he would receive \$1,200 per year.

Assuming the unitrust grows to \$250,000 by Mr. Smith's retirement, the sale of the assets will not trigger a capital gain tax, and the full proceeds will be available for

reinvestment in high-yield securities. If the new securities yield a 9 percent return, the unitrust would generate an annual income of \$22,500. Even though this is in excess of the \$15,000—which is 6 percent of the then-value of the unitrust—the extra \$7,500 a year also goes to Mr. Smith, since distributions in the prior years were less than the maximum allowed. At his death, the principal of the trust passes to RFF to fulfill his commitment. Although included in his estate, a charitable deduction is allowed for the then-market value, which "washes out" the assets for estate-tax purposes.

For more information about charitable trusts as well as the RFF Gift Fund, 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, or check the appropriate box on the enclosed reply envelope for individual contributions.



Resources for the Future
1616 P Street, NW, Washington, DC 20036-1400
202-328-5000 • fax: 202-328-5001
Copyright 1996 by Resources for the Future
Updated: 1 March 1996

RFF discussion papers convey to interested members of the research and policy communities the preliminary findings of research projects for the purpose of critical comment and evaluation. Unedited and unreviewed, they may be ordered from RFF (see page 22).
The following papers have recently been released:

- "Cleaning Up the Nuclear Weapons Complex: Exploring New Approaches" by Katherine N. Probst, Carolyn A. Pilling, and Karen T. Dunn (96-25)
- "Revenue-raising vs. Other Approaches to Environmental Protection: The Critical Significance of Pre-existing Tax Distortions" by Lawrence H. Goulder, Ian W. H. Parry, and Dallas Burtraw (96-24)
- "Spatially and Intertemporally Efficient Waste Management: The Costs of Interstate Flow Control" by Eduardo Ley, Molly Macauley, and Stephen W. Salant (96-23)
- "Cross-Border Environmental Management and the Informal Sector: The Ciudad Juarez Brickmakers' Project" by Allen Blackman and Geoffrey J. Bannister (96-22)
- "Thresholds for Carcinogens: A Review of the Relevant Science and Its Implications for Regulatory Policy" by James D. Wilson (96-21)
- "Was the NOAA Panel Correct about Contingent Valuation?" by Richard T. Carson, W. Michael Hanemann, Raymond J. Kopp, Jon A. Krösnick, Robert C. Mitchell, Stanley Presser, Paul A. Ruud, and V. Kerry Smith with Michael Conaway and Kerry Martin (96-20)
- "Electricity Restructuring and Regional Air Pollution" by Karen Palmer and Dallas Burtraw (96-17 rev)
- "Does the Provision of Free Technical Information Really Influence Firm Behavior?" by Richard D. Morgenstern (96-16)
- "Timber Supply Model 96: A Global Timber Supply Model with a Pulpwood Component" by Roger A. Sedjo and Kenneth S. Lyon (96-15)
- "Investments in Biodiversity Prospecting and Incentives for Conservation" by R. David Simpson and Roger A. Sedjo (96-14)
- "Six Steps to a Healthier Ambient Ozone Policy" by Alan J. Krupnick and Deirdre Farrell (96-13)

Find the complete text of discussion papers as close as your computer. Search the RFF home page for books and book reviews, seminar information, testimony, and more.



RESOURCES FOR THE FUTURE
1616 P Street, NW
Washington, DC 20036-1400

ADDRESS CORRECTION REQUESTED

Nonprofit Org.
US Postage
PAID
Washington, DC
Permit No. 5005