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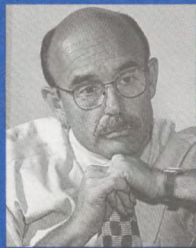
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Communicating as Well as We Think



Paul R. Portney

Participating in a focus group a year ago, a reader of *Resources* commented that "RFF doesn't communicate as well as it thinks." When asked to clarify, he explained that, to him, the quality of our research and policy analysis had always seemed better than our communications efforts.

I agree. That's one reason why this issue of *Resources* looks different—and, I hope, more interesting. Responding to many requests, we have redesigned and reorganized *Resources* to make its content more topical and relevant to the work and world of its readers. You should find that content more accessible, partly through layout and partly as a result of the organization and writing style of the articles. Many familiar items remain—namely, articles featuring research by RFF scholars and affiliates, and news on the people here and what they're about. But we're striving to better emphasize, in nontechnical language, the context, findings, and implications of our work. We hope you will find the results to be clear, useful, and engaging—and that you'll tell us how well we're succeeding.

Our commitment to better addressing the needs of RFF's audiences is reflected, too, in the forthcoming monograph, *A Shock to the System*, a chapter of which is the source of the article beginning on page 6. The coming restructuring of the U.S. electricity system is a fabulously confusing subject, and our new "primer" will serve as a useful tool for policymakers, administrators, and analysts to introduce key concepts, elements, and terminology along with discussion of the major issues and likely consequences to their own avidly interested but nonspecialist audiences.

Through *Resources*, we mean to speak with all of RFF's diverse audiences four times each year. To complement this effort, we are developing new communications items to speak more directly with specific segments of those interested in what we're doing. A series of one-page "briefs" about RFF's research and congressional testimony is now being produced to make it easier for policymakers and the media to track our activities. More new items will follow. We are meanwhile putting the full texts of discussion papers and testimony on our web page for those who want to get into the fine detail of our work.

All our efforts at improved communication are important to me, and I intend to give them very careful attention. Because we are all aware of organizations that are long on style and short on substance, however, these improvements will not come at the expense of our research program. The rigor and objectivity of RFF's work will always be its bedrock. Though we are working very hard to improve our communications, we'll never communicate better than we think!



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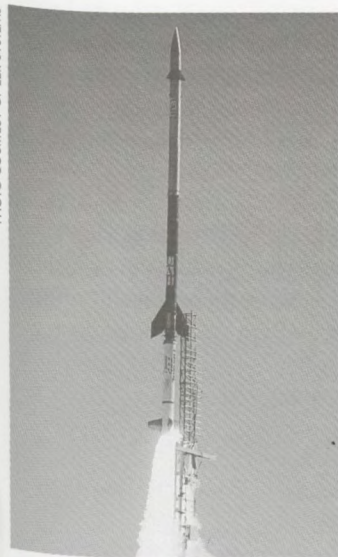


GOINGS ON

RFF research results in innovative space policy

Based on recommendations that RFF Senior Fellow Molly K. Macauley made more than seven years ago, the National Aeronautics and Space Administration's "Launch Voucher Demonstration Program" made its debut in the flight of "Conquest 1" on April 3.

PHOTO COURTESY OF EER SYSTEMS



"Conquest 1" liftoff launches RFF-recommended voucher program

The program gives researchers government-backed vouchers redeemable for accommodations on launch vehicles in order to further commercial research efforts that require outer space experimentation.

According to Macauley, vouchers for space transportation should work much like vouchers for education or federal housing programs. By giving researchers more choice in the modes of transportation they may use to conduct their space experiments,

the program should encourage more variation in launch design, more flight opportunities, and a reduction in mission delays, she said.

The University of Alabama in Huntsville's Consortium for Materials Development in Space (UAH CMDS) managed the first mission, which carried eight materials and biotechnology experiments to study the effects of microgravity on various materials, processes, and biological specimens at an altitude of nearly 200 miles in space.

Among the participants were researchers from the University of Southern Mississippi, who wanted to see if the absence of gravity would improve polymer development, and researchers from Space Hardware Optimization Technology Inc., who tested the effectiveness of their advanced separations hardware and a new electromagnetic mixing concept in microgravity. The entire mission from launch to touchdown lasted about fifteen minutes.

NASA provided UAH CMDS with \$2 million to integrate the launch with the "payload"—the 1,000 pounds of equipment and instruments needed to carry out the eight experiments—and contracted with EER Systems in Seabrook, Maryland, for the rocket, launch, and recovery services. As part of the demonstration, UAH CMDS will provide NASA with an assessment of how well the program worked in its first implementation.

Congress first approved the use of vouchers to purchase

launch services in a 1993 NASA authorization bill. As with the results of other pioneering RFF research, Macauley's work on the costs and benefits of space vouchers has taken time to implement, but she is pleased that a demonstration voucher program is finally underway.

"It's gratifying to see our work finally being used," she said, "and I hope this initial test will help illustrate how the program can be improved in the future." ☰

Tax breaks may not foster commerce in outer space

In addition to seeing her ideas put into action on the launch, Macauley also weighed in recently on two proposed pieces of legislation to spur business in outer space. At the joint invitation of the National Space Society and the Chair of the Science Committee of the U.S. House of Representatives, Macauley advised against a proposal under the Space Business Incentives Act (H.R. 1953) to use tax-exempt bonds and exclude taxation of capital gains on some investments to foster space industry growth. In fact, using the federal tax code as an inducement at all may have unintended, undesirable consequences, she told other participants in the congressional roundtable discussion.

Macauley expressed concern that the distortions such subsidies would create could be large. And experience with

smaller tax breaks in other industries strongly suggests that those who would benefit from the proposed statute might not be the intended beneficiaries. Tax accountants and attorneys—not the space industry—would benefit when disputes arose over the meaning of "commercial space centers" and "space manufacturing" vis-à-vis the tax code, she said.

In short, the proposed tax breaks might well retard space business, just as the Energy Policy Act of 1992 set back commercial use of solar, geothermal, and other renewable energy technologies at least a decade.

As for the Omnibus Space Commercialization Act, the other proposed piece of legislation under discussion,



Molly K. Macauley

Macauley said it offered many good alternatives to tax preferences. The act could be improved, however, by permitting the space station program to charge users for on-board resources like utilities, and by allowing individual science teams to use vouchers to purchase space science data them-



GOINGS ON

selves, rather than having to resort to agency-wide block purchases. The act could be strengthened further by encouraging the private sector to supply earth remote-sensing data and by ensuring that all parties that want subsidized access to space receive consideration through careful benefit-cost analysis.

According to Macauley, the challenge to legislators lies not simply in facilitating the demands of commercial space enthusiasts and developers but also in identifying the most useful things to do in space and determining which of these activities might be in the taxpayers' interest to subsidize. Responding to that challenge may be the next best step in formulating commercial space policy.

 The complete text of Macauley's comments can be found at <http://rff.org/testimony>

OMB cites RFF publications

Historically, the Office of Management and Budget (OMB) has played a key role in reviewing selected major regulations aimed at protecting the environment, health, and safety. In guidelines the Clinton administration recently issued for federal agencies to use in conducting "state-of-the-art" economic analyses of federal regulations, OMB recommends further reading. Three of the ten books cited are RFF publications and one was edited by an RFF university fellow. (See OMB's

"Document on 'Best Practices' for Preparing Economic Analysis of Regulatory Action under Executive Order 12866," January 15, 1996.) They are:

- *The Measurement of Environmental and Resource Values: Theory and Methods*, by A. Myrick Freeman III. "A comprehensive high-level treatment of environmental valuation issues."
- *Discounting for Time and Risk in Energy Policy*, by Robert C. Lind and others. "An advanced treatment of issues related to public and private sector discounting."
- *Using Surveys to Value Public Goods: The Contingent Valuation Method*, by Robert Cameron Mitchell and Richard C. Carson. "Provides a valuable discussion on the potential strengths and pitfalls of contingent-valuation methods."
- *Advances in Applied Microeconomics: Risk, Uncertainty, and the Valuation of Benefits and Costs*, (JAI Press) edited by RFF University Fellow V. Kerry Smith.

 To order RFF publications, see page 22.

Biodiversity: the ecological and economic viewpoints

Biological diversity contributes to the sustainability and productivity of ecosystems, and these ecosystems provide important services to meet human needs, according to G. David Tilman, professor of ecology at the University of Minnesota. Michael A. Toman,

senior fellow at Resources for the Future, agrees that biodiversity is undeniably an important resource, but notes the practical difficulties in determining how much biodiversity preservation is enough



G. David Tilman

and in designing effective policies for biodiversity protection. Toman and Tilman offered these views at the April session of the year-long "Ecology and Economics" seminar series sponsored jointly by Resources for the Future and the Smithsonian Institution.

Tilman's research confirms that the ecological productivity of an ecosystem rises with its diversity, as does its resistance to disturbances like drought or disease. Because some plants are more resistant to drought than others, for example, they will thrive during an extended dry spell while other plants decline, subsequently face less competition for nutrients, and as a result increase their productivity. In addition, noted Tilman, the probability of having a greater

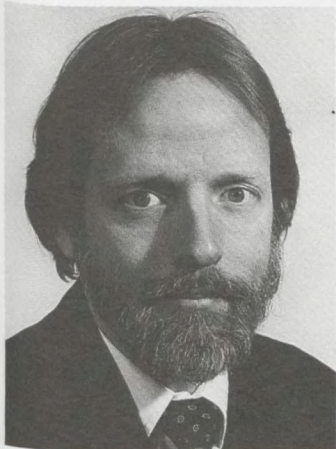
number of drought-resistant plants is higher in an area of greater biological diversity, increasing the overall sustainability of the ecosystem. However, Tilman's work also underscores the point that greater diversity may impose more stresses on specific species.

Tilman noted that diverse ecosystems are better equipped to continue to provide a large range of "services" (including food and clothing, air and water purification, genetic resources, and climate stabilization) on which the human population has come to depend. Failing to protect the biodiversity found in large ecosystems will have strongly adverse implications for future generations, Tilman predicted, as people spend the "ecological capital" of generations to come.

While agreeing that biodiversity is an important resource and that large-scale habitat destruction is disturbing, Toman noted that humans benefit both from biodiversity preservation and, occasionally, from its reduction. For example, the economic productivity of agriculture is increased by having single-crop fields rather than mixing species, though it is necessary also to preserve enough genetic diversity to provide insurance against diseases and other natural threats. Thus, a balance must in practice be struck, taking into account both the needs of the present and provision for future generations. In principle, said Toman, economic methods can be used for this

purpose, but in practice neither the economic nor the ecological information needed to do so is yet available. Nevertheless, biodiversity protection policies should recognize costs as well as benefits.

Toman said that policymakers should make an aggressive commitment to designing cost-effective protection policies and encouraging flexible compliance strategies, while relying on sound science. Also badly needed are corrections of broader policy failures in developed and developing countries that have large adverse effects on biodiversity, such as land tenure and macro-economic policies that encourage excessive land conversion




Michael A. Toman

and do not reward habitat preservation. Finally, Toman and Tilman strongly agreed that education about the value of biodiversity and the threats to it is one of the best tools available to help make headway on this issue.

The monthly RFF-Smithsonian seminar series,

which is open to the public, promotes a dialogue between ecologists and economists on emerging environmental issues.

 Information about upcoming seminars can be obtained by contacting Stacey Wilson at RFF (202-328-5154; swilson@rff.org).

Economists vet benefit-cost analysis

It was to clarify what benefit-cost analysis can and cannot do that Resources for the Future, the American Enterprise Institute, and the Annapolis Center convened a meeting of eleven leading economists in Washington last fall. Following a day of spirited discussion about the strengths and weaknesses of benefit-cost analysis (and several subsequent iterations by phone and mail), the participants arrived at a set of principles for using that technique, now available in published form from the AEI Press.

"Benefit-Cost Analysis in Environmental, Health, and Safety Regulation: A Statement of Principles" offers general guidance to decisionmakers on using economic analysis to evaluate laws and regulations, including specific suggestions for improving the quality of such analysis in regulatory decisionmaking.

Among the points that the group of economists agreed on was that Congress should remove prohibitions against benefit-cost balancing such as exist in some parts of the Clean Air Act and other regulatory laws. These prohibitions

reflect the controversy that surrounds the use of the tool despite the mounting pressure to contain the direct costs of environment, health, and safety regulations, which are probably on the order of \$200 billion annually.

In response to that pressure, both Congress and the President have been turning more to economic analysis for help in assessing the true value of both new regulatory proposals and rules already on the books. Yet far from clarifying what the proper role of benefit-cost analysis might be, much of the debate surrounding use of the tool has merely led to its caricature to make political points, RFF President Paul R. Portney has observed. Such distortions often are echoed in the media because their simplicity and color make for lively copy. (See Portney's article, "Cartoon Caricatures of Regulatory Reform," *Resources*, Fall 1995, No. 121.)


In moving beyond cartoons, the economists who developed the consensus set of principles addressed the concern that a benefit-cost analysis means that dollars and cents will dominate other considerations under laws and regulations affecting health and safety. Underscoring the argument that quantitative and qualitative analyses are not mutually exclusive and that not every benefit or cost has to be expressed in dollar terms, the economists agreed that no agency should be bound strictly by the results of a benefit-cost test. Care should be taken to ensure that quantitative factors


do not dominate important qualitative ones.

Still, the principles state, a benefit-cost analysis should be required in considering any regulation whose annual cost is expected to be more than \$100 million. And, if the costs of such a proposed regulation are expected to far exceed the benefits, an agency should have to explain why issuance is warranted.

To better define what a benefit-cost analysis entails, the economists also note that a good one begins with a clearly defined baseline to identify sources of positive change besides the regulation itself; recognizes costs and benefits as they play out incrementally; identifies the distributional consequences of a policy (say, job losses in a local economy); and provides decisionmakers with "best estimates" and clearly described ranges of possible values and benefits (rather than single numbers).

In addition to Portney and Robert W. Hahn of the American Enterprise Institute, who co-chaired the event, the economists that participated in developing the set of principles were Kenneth J. Arrow, Maureen L. Cropper, George C. Eads, Lester B. Lave, Roger G. Noll, Milton Russell, Richard Schmalensee, V. Kerry Smith, and Robert N. Stavins.

 For a copy of the booklet, 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.



Air Quality and Electricity

What Competition May Mean

by Dallas Burtraw, Alan J. Krupnick, and Karen L. Palmer

Although the likely breakup of the U.S. electricity industry is heralded as an economic boon to business and consumers alike, the downside to more competition is debatable, especially since the uncertainties involved are many. Whether the air we breathe improves or worsens will depend on choices consumers, producers, and policymakers have yet to make. Economic analysis of alternative regulatory options offers insights into what could happen.

For a number of reasons, including advances in technology favoring smaller-sized power plants, the natural monopoly status of electricity generation is coming to an end in the United States. In the next ten years, most analysts anticipate, the generation component of the industry will open up to competition. As a result, different approaches to regulation of transmission and distribution will also have to be found.

The move away from tightly regulated electricity generation promises efficiencies that will benefit consumers, whose energy prices should be lower and whose array of options should expand to include, for example, time-of-day pricing and interruptible service.

Yet other considerations besides efficiency enter into the thinking of policymakers when deciding what form a restructured and more competitive industry should take. One of these considerations is the need for environmental protection. From the standpoint of society as a whole, the benefits of increased market competition could be a bad bargain unless air quality is maintained at current or improved levels.

The electricity industry is and will continue to be subject to numerous federal and state laws, regulations, and initiatives to reduce air pollution and its consequences. What isn't clear yet is whether current environmental policies are likely to be more or less

effective when the generation segment of the industry is opened to competition. Nor is it clear how many existing laws and policy initiatives will have to be revamped or replaced. The environmental effects of restructuring ultimately will depend on choices that producers, customers, and especially policymakers have yet to make. As they weigh options, an economic analysis of alternative regulatory approaches—and the likely effects on consumption and investment—offers some insights into what could happen.

Cleaner Air vs. Dirtier

Power plants now produce more than a third of the country's annual nitrogen dioxide (NO₂) and greenhouse gas emissions and about three-quarters of its sulfur dioxide (SO₂) emissions. These emissions also include the soot, dust, and aerosols that, together with secondary forms of NO₂ and SO₂ emissions, make up particulate matter.

Some analysts have suggested that restructuring the industry could possibly reduce air pollutants and their effects by hastening new investments and growth in construction and use of new plants that run on cleaner fuel (natural gas). However, if, as expected, restructuring reduces the price of electricity, an upswing in use is likely. Whether an upswing in use is

accompanied by an upswing in emissions depends on the vintage of plants and type of fuel used to meet the increased demand.

Because new, cleaner plants are not expected to dominate the industry for some time, there is concern about increased use of existing facilities. Such concern is raised most often by states in the Northeast, who fear that more open access to electricity transmission will increase coal-fired generation in the Midwest. These downwind states fear the added use of coal will cause them to experience higher concentrations of ozone and particulate matter (and more acidic deposition), making it more difficult for them to maintain current ambient air quality levels.

However, the Federal Energy Regulatory Commission takes a different view. FERC's recent analysis of its own open transmission access regulation predicts only trivial increases in NO₂ emissions, implying small changes in ozone concentrations and particulates in the northeastern states. Several limitations of this analysis argue for caution in its interpretation, however. For instance, FERC's analysis does not account for changes in prices once access to transmission is more open, nor the effects changes in prices will have on consumer demand, operation of the electricity system, or new investment in generation and transmission.

Impact on Current Environmental Policies

Whether or not competition in electricity generation markets increases or reduces air pollution, it certainly will affect the many policies that regulators have devised to deal with power plant emissions thus far. Since the passage of the Clean Air Act in 1970, a wide range of federal regulations has been implemented, with a growing reliance on incentive-based methods to force accountability for environmental damage. Competition could give some of these programs the boost they need to succeed in even more significant ways. One example is EPA's SO₂ Emission Allowance Trading Program, under which coal-fired electric power plants receive annual allowances for SO₂ emissions, which they can transfer to other plants within their own systems, sell to other utilities, or save for later use to meet the annual emissions cap.

Current incentives to trade allowances are not as strong as they could be, since the states often create disincentives for using utility compliance plans that

rely on trading. For instance, in every important coal-producing state, regulators reward the use of in-state coal over other "strategies" that may cost less. The incentive to use trading should become stronger in a deregulated market where generators are penalized by the market for incurring unnecessary costs.

On the other hand, industry restructuring will likely weaken policies that state regulators have adopted to factor environmental damage into the cost of doing business, encourage consumers to conserve energy, and promote renewable energy sources. What is broadly described as "social costing" could become one of the casualties.

Social costing. In use by seven states and under consideration by several others, this type of policy requires utilities to estimate the environmental damage that could result from alternative generating technologies and, for each option evaluated, to incorporate the results into the estimated private cost of producing electricity. The power plants that the utilities invest in (or contract with) must be chosen based in part on the results of this exercise.

Broader access to electricity transmission could undermine state efforts to encourage generators to reflect social costs in investment or operating decisions. And if competition were to extend to the consumer level, social costing as it is now practiced would become virtually unworkable. Electricity suppliers would be able to bypass social costing regulations by operating as independent generators and by marketing power directly to large customers or to power aggregators, who would then contract directly with electricity consumers.

In the short run, the demise of social costing would be of little consequence. The emission rates of new facilities are relatively low, so social costing programs have had minor impact on investment decisions for new plants. Over time, however, social costing programs could take into account a broader range of factors in estimating the environmental damage of producing electricity. Many analysts, including researchers at RFF,

A New RFF Book

This article is adapted from a chapter in RFF's new book *A Shock to the System: Restructuring America's Electricity System*. By providing in plain English the background necessary to understand the many proposals for introducing competition to electricity markets, the new "primer" will be an invaluable guide to likely changes in the industry over the next decade. For further description and ordering information, see page 22.

envison extending social costing beyond investment considerations to encompass the operation of existing facilities, which often have emission rates several times higher than new plants do.

What analysts hope is that, if social costing were to become more comprehensive, utilities could make business decisions that would lead to dramatic environmental gains at relatively low costs. For instance, suppliers could switch from one generating technology to another, depending on the effect of prevailing atmospheric conditions. (They could use older, dirtier plants when breezy conditions would disperse emissions, and clean but expensive new plants when temperature inversions would create stagnant air.) Regulators will have opportunities to incorporate a broadened application of social costing into the workings of the new institutions arising to regulate transmission and distribution.

Alternatively, imposing a tax on emissions throughout the economy could make the cost of environmental damage part of the cost of doing business. Some experts consider this approach superior because no distortions would arise between the prices of electricity and other forms of energy.

Conservation programs. Despite skepticism about the overall effectiveness of so-called "demand side management" (DSM) programs for consumers (such as free energy audits and subsidies to purchase energy-efficient heating and air conditioning systems), many states insist they be maintained as restructuring moves forward.

Yet how such conservation programs can be funded in a restructured industry is open to question. States may find it unfair to continue to impose the costs of such programs on incumbent utilities in a competitive environment. To do so may make such utilities less competitive because of the offsetting prices they have to charge for transmission or distribution.

One way around this difficulty might be to enhance the ability of electricity suppliers to base their prices on time-of-demand and power load conditions, thus limiting the need for conservation programs. Another way is for states to charge a fee for DSM programs, which all generators (or their customers) that connect to the transmission or local distribution grids have to pay. Such a fee would prevent customers from taking their business elsewhere solely to avoid paying for such programs.

Renewables. Little doubt exists that renewable energy sources like hydroelectric power, wind, and solar, geothermal, and combustible resources will suffer in an

environment where the cost of generating electricity is expected to fall. If it does fall, firms that use renewables to produce power may not be able to cover their (generally higher) costs. Moreover, the costs and operating characteristics of renewables often do not compare favorably with those of fossil-fired facilities.

Nevertheless, through proper pricing of electricity transmission, the advantages of using renewables may still be recognized in a restructured industry. For example, industrial and commercial users could take advantage of wind and solar generation, which often are available at times that coincide with periods of peak electricity demand.


Whether concern about pollutants from fossil fuels will stimulate policies to increase the use of renewables is likely to depend on concern about global warming (renewables emit few, if any, greenhouse gases). Since any related national policies will take time to shape, expanding and increasing the renewable electricity production investment tax credits authorized in the 1992 Energy Policy Act may be an appropriate interim way to sustain development of renewable technologies.

Putting Change in Perspective

Within the larger context of the country's regulatory structure, changes in the electricity industry may have more limited implications for the environment than might be inferred from this article, which merely throws the possible consequences into rough relief. Cities will still have to meet air quality standards, power plants will still be subject to an SO₂ emissions cap, and other policy initiatives for preserving or improving air quality in national parks and rural areas will continue.

As with many issues associated with restructuring, whether society will be the worse off if demand side management programs and social costing activities diminish or take on new forms remains a subject for further study. In any case, current state efforts to tilt electric utility investment decisions in favor of the environment have not been widespread or particularly forceful. If law and public policy do have to be reconfigured, the quality of the environment may actually benefit as a result of the industry's new structure.

Alan J. Krupnick is a senior fellow and Dallas Burtraw and Karen L. Palmer are fellows in RFF's Quality of the Environment Division.



Water as a Source of International Conflict

by *Kenneth D. Frederick*

Efficient use of shared water resources has long been challenged by the reluctance of some neighboring nations to share "their" water, with conflict the most likely result. Rising water costs alone necessitate greater efficiencies: integrated management practices and some market-based means offer avenues for both reducing conflict and curbing costs.

From Canada to Mexico, from Africa to the Middle East, from Asia to Europe, conflicts and the potential for conflicts are growing over the availability of water. While sharing water resources has long been divisive, today's rising environmental, social, and financial costs of managing Earth's most abundant and renewable natural resource exacerbate these perennial tensions. Easing such tensions becomes imperative at a time when demands for water are rising. The greater efficiencies achievable by integrated resource management, developing water markets, and price incentives may prove the best ways to achieve this end.

The Roots of Conflict

Several factors underlie virtually all international conflicts over water and pose problems for managing and allocating it efficiently and equitably. These include the variability and uncertainty of supplies, the interdependencies among users, and the increasing scarcity and rising costs of freshwater. Because water is a "fugitive" resource—naturally flowing from one location and one state (liquid, gas, or solid) to another—individuals and countries have incentives to capture and use the resource before it moves beyond their control but little, if any, incentive to conserve and protect supplies for downstream users.

Also at the root of conflict, however, are other human elements: the vulnerability of water quality and aquatic ecosystems to human activities, the failure to treat water as an economic resource, the desire for food security and self-sufficiency in arid and semiarid regions of the world, and the importance of water to public health and economic development.

These human factors are making conflicts over water resources within countries increasingly common. When water is shared by two or more countries, the obstacles to achieving efficient, equitable, and conflict-free management are even greater. Such are the situations—described later in this article—between India and its neighbors Pakistan and Bangladesh and among most of the nations of the Middle East

Efficiency vs. Equity

From the standpoint of integrated resource management, these human factors contribute to the inefficient division of an otherwise natural hydrological unit. Efficient management techniques require treating all the water in a given river basin, aquifer, or watershed as a unitary resource: overcoming the tendency among neighbors to exploit water unilaterally would provide a cost-effective way to increase freshwater supplies. The institutional obstacles to achieving this, though, can be considerable.

Even within the United States, multistate water laws, independent water management systems, and institutional inertia impede the introduction of more efficient management systems. Greater obstacles to integrated regional water management are likely when different countries and cultures, and even historical animosities, are involved. Consequently, achieving a sense of equity, perhaps through formalizations of historic patterns of use, among all parties may be a more realistic short-term goal than efficiency in settling international disputes.

Ultimate Market Efficiency

Water will surely become increasingly scarce, however, (see the sidebar on this page), and questions of efficiency ultimately should grow to assume greater significance in resolving conflicts. Developing markets and market-based prices allows the peaceful transfer of most resources among countries.

Under some very restrictive conditions, markets lead to an efficient distribution and use of a resource: under a wide range of conditions, the market process contributes to a more efficient allocation and management of these resources. Markets can provide individual people as well as countries with increased opportunities and incentives to develop, transfer, and use a resource in ways that would benefit all parties.

Two conditions must be satisfied for the development of efficient markets. There must be well-defined and transferable property rights in the resource being

transferred, and the buyers and sellers must bear the full benefits and costs of the transfer. Both conditions are now commonly violated for water resources. The fugitive nature of the resource makes it difficult to establish clear property rights, and the interdependencies among users might cause externalities or third-party impacts when the use or location of the water is changed.

Regions of potential conflicts

Rivers and lakes that border multiple countries, rivers that flow from one country to another, and aquifers that underlie more than one country are international resources: the use of the resource by one country affects the quantity or quality of the resource available to another country. Such situations are numerous: about 200 river basins are shared by two or more countries. Thirteen are shared by five or more countries, and four basins—the Congo, Danube, Nile, and Niger—are shared by nine or more countries. Shared watersheds comprise about 47 percent of the global land area and more than 60 percent of the area on the continents of Africa, Asia, and South America. (Groundwater resources are also frequently shared by two or more countries.) The table on page 11 further illustrates some of these interdependencies.

The Middle East. The competition for water in the Middle East is so intense that lasting peace in the region is unlikely in the absence of an agreement over shared water use. Indeed, negotiations over water have a separate role in the ongoing peace talks between Israel and its neighbors. Outstanding issues and potential sources of conflict include the allocation and control of the Jordan River, the use of the aquifers underlying the West Bank, and Jordanian objections to the construction and operation of Syrian dams on the Yarmuk, the major tributary of the Jordan River. Water has already been the source of armed conflict in the region between Syria and Israel, once in the 1950s and again in the 1960s.

Several times over the past thirty years, disputes among Turkey, Syria, and Iraq over the development and use of the Euphrates River have nearly ended in armed conflict. Disputes arose in the 1960s when Turkey, where 90 percent of the water originates, and Syria started to plan large-scale withdrawals for irrigation. The conflicts heated up in 1974 when Iraq threatened to bomb the dam at Tabqa, Syria, and massed troops along the border because of the reduced flows they were receiving in the Euphrates.

Once and Future Water Shortages

Are water supplies, whether considered globally or regionally, sufficient to our needs? Shifts in population (including increased urbanization) and in industrial and economic growth and development can increase both demands on, as well as contamination of, water supplies. In the developing nations, these factors are especially acute and are exacerbated by projected population growth: by 2000, nearly 900 million people (by U.N. figures) will likely be in regions where adequate basic drinking water and sanitation services are already strained, insufficient, or altogether lacking.

In most developed nations, there is a sound basis for the belief that supplies can meet demands. Demands, however, for water for environmental uses—wildlife, fisheries, and recreation—are increasing, and agricultural uses (irrigation demands are particularly heavy in the United States) and contamination continue to be problems.

The unknown factor of possible climate changes may be waiting in the wings for all nations. Water supplies may theoretically increase or decrease across regions under global warming, and present-day uncertainty over where and when these changes might occur makes calculating for climate change a task for the future.

The threats were renewed in the spring of 1975. With the completion of the Ataturk Dam in January 1990, Turkey is in a pivotal position to influence the downstream flow of the river. Potentially, the dam could benefit all countries within the basin by reducing the variability of the river's natural flows. But the dam gives Turkey a potential water weapon that could be used against the downstream countries. The Ataturk Dam and related water projects could reduce flows as much as 40 percent to Syria and 80 percent to Iraq. The threat of reduced water flows has been used in an attempt to force Syria to withdraw support of the Kurdish rebels operating in southern Turkey. Border security and water sharing have been linked in recent negotiations between the two countries.

The Indian subcontinent. When the Indian subcontinent was partitioned between India and Pakistan in 1947, longstanding conflicts over the Indus River became overnight an international issue between two hostile countries. The partitioning divided the basin physically and split an established irrigation system between the two countries without specifying how the waters were to be divided. India was left with control of the waters supplying Pakistan's irrigation canals, and in 1948 India diverted those waters away from Pakistan. Although the canals were later reopened, the dispute threatened to lead to war. With help from the World Bank, negotiations over water issues between the two countries began in 1952. Concerns over sovereignty stymied the bank's attempts to develop and manage the basin as a unitary system for the mutual advantage of both countries. The Indus was divided between the two countries, with India receiving the three eastern and Pakistan the three western tributaries. This division deprived Pakistan of the original source of water for its irrigation system. In compensation, India paid for new canals to bring water from the rivers allocated to Pakistan and a consortium of countries financed the construction of storage dams to ensure Pakistan a reliable supply. At a price, the treaty defused a major source of potential conflict and allowed each country to develop its share of the basin's waters.

Bangladesh, which gained its independence from Pakistan twenty-five years ago with the aid of India's army, is now threatening to cancel its Treaty of Friendship with its former liberator because of conflicts over water. Most of Bangladesh's rivers flow from India, which has shown little concern about the impacts of its

Dependence on Imported Surface Water

Countries and Their Percent of Total Flow Originating Outside of Their Borders

Egypt	97	Romania	82	Iraq	66	Austria	38
Hungary	95	Luxembourg	80	Albania	53	Pakistan	36
Mauritania	95	Syria	79	Uruguay	52	Jordan	36
Botswana	94	Congo	77	Germany	51	Venezuela	35
Bulgaria	91	Sudan	77	Portugal	48	Senegal	34
Netherlands	89	Paraguay	70	Yugoslavia	43	Belgium	33
Gambia	86	Czechoslovakia	69	Bangladesh	42	Israel*	21
Cambodia	82	Niger	68	Thailand	39		

* Although only 21 percent of Israel's water comes from outside current borders, much of its fresh water supply comes from disputed lands.

Source: Peter Gleick, *Water and Crisis: A Guide to the World's Fresh Water Resources*, Oxford University Press, 1993.

water developments on its downstream neighbor. A major diversion from the Ganges River just a few miles from the Bangladesh border has increased salinity levels and reduced water supplies in the Padma River (as the Ganges is known in Bangladesh), threatening the livelihood of millions of Bangladeshis.

The former Soviet Union. The breakup of the Soviet Union has also converted some formerly domestic water issues into potential international conflicts. Water scarcity and conflicts are particularly acute in the five former central Asian republics of the Soviet Union that share the flows of the Amu Dar'ya and Syr Dar'ya rivers. These two rivers originate in the high mountains to the southeast and flow through deserts to the Aral Sea. As recently as 1960 the Aral Sea was the world's fourth largest lake in area. Since then, water diverted primarily for cotton production has altered the water balance of the Aral; between 1960 and 1989 the sea declined precipitously in level, area, and volume. Mismanagement of the region's water and land resources has produced an ecological and human disaster with few parallels: the once productive fishing industry has disappeared; rising soil salinity has depressed agricultural yields; pesticides applied to the cotton have contaminated drinking water supplies in the lower reaches of the river basins, with tragic impacts on human health. Reversing decades of mismanagement and abuse of the region's water supplies may be more difficult now that it requires the cooperation of five struggling newly formed countries.

Potential Benefits of Integrated Management

The lack of clear property rights to international water resources is an obstacle to more efficient resource management and to the resolution of water conflicts. Two extreme and opposing doctrines have been proposed for establishing property rights over international waters. The doctrine of unlimited territorial sovereignty states that a country has exclusive rights to the use of waters within its territory. This doctrine, which allows a country to deplete and pollute with no obligation to compensate adversely affected parties, was asserted by the U.S. Attorney General in 1895 in rejecting Mexico's claims to waters originating in the United States. Although the United States subsequently modified its stance on shared waters, this view characterizes India's approach for development of the Ganges River.

The contrasting doctrine of *unlimited territorial integrity* states that one country cannot alter the quantity and quality of water available to another. This doctrine, which greatly constrains how the upstream country can use the resource, is reflected in Egypt's threats against countries proposing water development projects that would reduce the waters of the Nile reaching Egypt.

In the absence of bargaining, both of these doctrines are likely to lead to inefficient outcomes. Under the first doctrine India has no incentive to mitigate the impacts on Bangladesh regardless of the relative magnitude of the damages imposed and the costs of abatement. On the other hand, under the second doctrine upstream countries on the Nile risk the wrath of a more powerful downstream neighbor unless they forego potentially profitable development projects regardless of how high the costs of mitigation and how small the impacts.

In practice, international water disputes generally have moved away from the extreme positions implied by these two doctrines and toward a doctrine of *equitable and reasonable use*. Although this narrows the likely range of disagreement, it does not provide clear property rights. In the absence of enforceable property rights, the strongest, most clever, and most advantageously positioned countries can claim and use the resource with little concern for the impacts on others. Opportunities for coordinated management may be lost in the acrimony over rights to the resource and obligations to mitigate any adverse impacts imposed on others.

Inefficient management of and conflicts over international water resources reflect problems in the management and allocation of water resources within individual countries. Individual water rights might be limited or poorly defined, constraining the ability to transfer water among competing users and uses in response to changing conditions. Water prices commonly reflect only a small fraction of the social costs associated with use, reducing incentives to conserve and protect the resource. The institutions controlling water use are often rooted in a "pre-scarcity" era when transfers were viewed as unnecessary or unimportant. Similarly, cultural and religious considerations may result in water being viewed as too important or too sacred to have its use determined by the impersonal outcome of markets.

Equity considerations and historical use have been more important than efficiency in the management of both domestic and internationally shared water resources. Relatively few precedents demonstrate the potential advantages of efficient integrated management of an entire hydrologic unit. Yet, as water becomes increasingly scarce, the potential benefits of integrated management—and of institutions that enable scarce resources to be transferred among competing uses in response to changing conditions—will grow. Institutions that perpetuate inefficient water use will become increasingly costly and unstable. Inflexible and inefficient international agreements, which must be self-enforcing, may not be sustainable.

Conclusion

Much of the world's most accessible freshwater supplies are located within basins and aquifers that cross international borders. Inflexible, inefficient, and often inequitable agreements for managing international waters contribute to rising water costs, growing concerns over the adequacy of supplies, and potential conflicts. More flexible allocation mechanisms and efficient management practices are critical for avoiding future conflicts over international supplies and curbing the rise in water costs. Introducing markets and market-based prices, which provide peaceful transfer of other resources among countries, might help promote a more efficient and flexible allocation of water resources located in international basins.

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Chongqing: A Case Study

Environmental Management during a Period of Rapid Industrial Development

by *Walter O. Spofford Jr.*

An RFF assessment of Chongqing's environmental regulatory framework identified the two national programs most effective in controlling the municipality's air and water pollution—and the flaws that mar them. Although the RFF team identified ways to improve implementation of the two programs in urban and industrial regions, China may be unable to take corrective action immediately, given current economic realities. Breaking the cycle in which environmental degradation follows on industrial development will require foreign investments and loans from multinational development banks.

China began to develop its regulatory framework for environmental management and pollution control just after the first United Nations Conference on Environment in Stockholm in 1972. Today, China's framework is comprehensive and well developed, comprising a vast set of environmental laws, programs, and standards promulgated by the state, provincial, and local governments, all underpinned by the "Environmental Protection Law of the People's Republic of China" (1989), first adopted on a trial basis in 1979.

Despite the framework's comprehensiveness, analyses of environmental programs at the local level reveal several weaknesses, which China's National Environmental Protection Agency in Beijing is beginning to address. These include gaps in program coverage and conflicts between programs, as well as the fact that no current laws control air pollution from domes-

tic sources or water pollution from municipal sewage. A lack of systematic integration of economic development and environmental protection goals is another problem, subtle and pervasive.

Members of an RFF research team found sufficient evidence of these general weaknesses to explain why Chongqing's own environmental regulatory framework is not working as intended. Trends in ambient levels of air and water quality and the city's high levels of air and water pollution make the point as well.

Environmental Management in Chongqing

In conducting their case study, the RFF team discovered that two of the eight programs established by the state for urban and industrial pollution control were far more effective than the others in controlling air and water pollution in Chongqing. These are environmental management for construction projects—or *Three*



Chongqing's pollution levy system is inadequate to control industrial discharges.

Synchronizations, as it is called in China—and the pollution levy system. In addition to singling them out for deserved recognition, the team also discovered weaknesses that prevent even these programs from living up to their promise.

Three Synchronizations. Introduced in Chongqing in 1977, this program's purpose is to ensure that new construction projects include pollution abatement facilities to meet state emission and effluent standards. Under the program, a new industrial enterprise or one that wishes to expand or change its production process must register its plans with the local environmental protection bureau and design (first synchronization), construct (second synchronization), and

begin to operate (third synchronization) pollution control facilities simultaneously with the principal part of the enterprise's production activities.

The program has had a significant impact on controlling pollution from new sources in Chongqing. According to the Chongqing Environmental Protection Bureau, 70 percent of all investments in pollution control systems and equipment made by firms in the municipality are the direct result of Three Synchronizations regulations.

Despite these encouraging results, however, Chongqing Municipality has tended recently to let economic development take precedence over environmental protection, eager as the municipality is to catch up to the per capita incomes of coastal cities in China that have experienced dramatic economic growth. Waning enforcement of Three Synchronizations regulations is reflected in the program's low fines for noncompliance. From 1990 to 1993, the amounts charged for violating the third synchronization requirements at seventy-three industrial enterprises in Chongqing averaged less than the annual salary of a typical worker.

Also problematic is the rapid rise in the number of township and village industrial enterprises (TVIEs) in Chongqing, most of which are engaged in highly polluting activities. TVIEs tend to be small, and because there are so many of them—90,000 in the rural area—it is impossible for Chongqing's environmental protection bureaus to ensure universal monitoring and inspection.

Indeed, a different approach to enforcement is needed. Monitoring and enforcement procedures to control pollution at industrial enterprises in Chongqing's urban area cannot be practically applied to control pollution from TVIEs dispersed over thousands of square kilometers of rural countryside. The compliance rate of these enterprises with Three Synchronizations regulations is no more than 22 percent, and perhaps much lower.

Pollution levy system. Second only to Three Synchronizations in catalyzing investments in industrial pollution controls in Chongqing, this system is nevertheless afflicted with problems, too. Introduced in 1980, it consists of a combination of fees levied on industrial enterprises whose pollutants exceed state emission and effluent standards and a series of fines and other charges levied on those who violate system regulations.

The RFF China Program

The China Program began in 1989 with a project to translate into Chinese fifteen books written by RFF researchers. Since then, RFF has been working with China's universities, research institutes, and national and local governments to balance the country's sometimes conflicting goals of rapid economic development and protection of human health and the environment (See *Resources*, Spring 1995, No. 119). The accompanying article highlights findings of an assessment of the environmental regulatory framework of Chongqing Municipality in Sichuan Province, based on a report that RFF recently completed for the World Bank. In conducting the assessment, RFF teamed with researchers from the Beijing Environment and Development Institute and the Chongqing Environmental Protection Bureau.

In effect, the system offers a carrot and wields a stick to control emissions and effluents. The carrot consists of grants and low-interest loans that industrial enterprises may receive for the construction of industrial pollution control facilities. The stick consists of fees levied for exceeding state emission and effluent standards.

Thus far, the combination of carrot and stick has not been sufficient to induce a high level of compliance with the standards. As under Three Synchronizations, the penalties for noncompliance levied by the system are too low. Set by the central government, the amounts of such fees are far below the marginal costs of operating and maintaining waste treatment facilities and cannot be raised or lowered by local governments.

Soft budget constraints have also had their impact. State-owned industrial enterprises in poor economic health are often allowed to pass pollution levy fees on to the state as deficits to be covered by government subsidies or to escape from payment altogether.

The pollution levy system's carrot has encouraged initiative on the part of industrial enterprises in Chongqing that are not in compliance with emission and effluent standards to the extent that, in order to qualify for a grant or loan from the pollution levy fund, they themselves must finance at least 50 percent of the cost of controlling the pollutants they emit.

The success of the system has its limits, however. The grants and loans available through the fund do not necessarily go to those projects that promise the most cost-effective regional pollution control. This is because the grants and loans are earmarked for industrial enterprises that have paid pollution levy fees, and because the amount of a grant or loan to a particular enterprise cannot exceed 80 percent of the total fees the company has paid. Moreover, the pollution levy system funds cannot be used for investments in sewerage systems to collect and treat industrial wastewater, even though such systems are often more cost-effective than "end-of-pipe" treatment.

Intended to give industrial enterprises an economic incentive to comply with emission and effluent standards, China's pollution levy system was designed for a second purpose as well—to raise revenues for the use of the environmental protection bureaus. In Chongqing, this includes the city's own environmental protection bureau as well as some twenty-one other bureaus operating at the municipality's district and county levels.

Chongqing Profile

Chongqing is a severely polluted city of 15 million people located in China's most populous province—Sichuan Province in Southwest China. The central government moved dirty heavy industries there in the 1960s to prepare for an anticipated Soviet invasion.

As China's fifth largest city in terms of industrial output, Chongqing has heavy industry that accounts for 60 percent of the value added in the industrial sector; high-sulfur coal is the principal source of energy. The municipality has approximately 8,000 industrial enterprises in the urban area of which about 1,000 are state-owned and 7,000 are owned collectively.

Based on 1988 data, Chongqing ranked first among twenty-three large cities in China for levels of sulfur dioxide and eighth for levels of total suspended particulate matter. Acid rain, with a pH ranging between 3.5 and 4.5, also is a serious problem. For the past ten to fifteen years, the municipality's growth in real terms has averaged just under 10 percent annually. In terms of income per capita, however, Chongqing lags far behind other major Chinese cities, with less than 30 percent the per capita income of Shanghai and less than 40 percent that of Beijing.

As required by State Council regulations, Chongqing must set aside 80 percent of the pollution levy fees collected to pay for industrial pollution control systems and equipment. The local environmental protection bureaus may use the remaining 20 percent and all of the fines and charges for regulatory violations to cover the costs of their equipment, supplies, staff training, and public education programs.

Increasingly, however, local environmental protection bureaus have come to rely on these fees to cover far more—up to 90 percent in some cases—of their operating budgets. This distortion of the system reflects the inadequate means of public finance for environmental regulatory agencies in Chongqing, which goes far beyond the environmental regulatory framework per se. Responsibility for raising income for operating budgets has placed fundraising objectives far higher on the priority list of the environmental protection bureaus than their main regulatory responsibility, which is to enforce environmental laws, regulations, and standards.

As it stands, the need to raise revenues for operating budgets has virtually institutionalized the pollution levy system in China—not because the system is efficient or even effective in controlling emissions and effluents, but because it is a principal source of financial support for local environmental protection bureaus.

Study Findings

As the findings of the study suggest, Chongqing might explore ways to make its environmental protection bureaus less dependent on pollution levy fees as their principal source of financial support. The municipal government could provide additional public finance, or the environmental protection bureaus could charge a service fee for monitoring industrial emissions and effluents. Currently, the bureaus perform this service at no charge. Because there will be a shortage of capital for pollution control in Chongqing for several years to come, the Chongqing Environmental Protection Bureau, together with the Chongqing Planning Commission, should address the most critical environmental problems first.

Delegating more power to local governments also would help Chongqing integrate decisions on environment and development. For example, the central government might consider giving local governments the authority to increase pollution levy fees, as well as the authority to decide the most effective way to use the pollution levy fund, given local conditions.

In addition, the Chongqing Environmental Protection Bureau might consider indirect regulatory approaches for controlling emissions and effluents at

township and village industrial enterprises, such as taxes on the sulfur and ash contents of fuels, as substitutes for pollution levy fees on emissions of sulfur dioxide and particulate matter. Finally, the Chongqing Municipal Government could increase the size of the staffs of the county environmental protection bureaus to better enforce Three Synchronizations regulations and emission and effluent standards with regard to TVIEs.

The Future

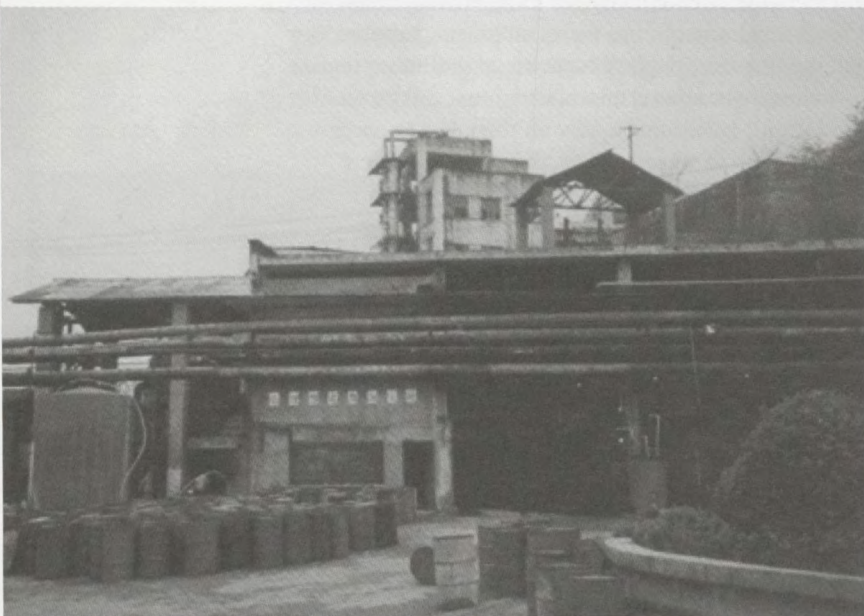
Given current economic and institutional realities, China may be unable to act on all of the findings of the study in the near term. However, as the economy of the region grows, the capital necessary to address some of Chongqing's knottier problems will accumulate and improvements in environmental programs could be implemented in pace with economic and other institutional reforms.

As is the case throughout China, economic development is a precondition for long-term environmental protection in Chongqing. Without the creation of wealth, it will be impossible to restructure and modernize the industrial sector, develop cleaner sources of energy, build needed urban and environmental infrastructure, and clean up existing contaminated sites within the city.

At least in the short run, then, meaningful environmental progress will require a willingness on the part of the international community to support and encourage China's investments in clean technologies and environmental infrastructure before the proceeds of economic development arrive. Such a response could make a decided difference, however. For despite the dire nature of some of China's environmental problems, they are not that much worse overall than what the United States, Europe, and Japan experienced only a few years ago.

Walter O. Spofford Jr., leader of the RFF study team, is a senior fellow in RFF's Quality of the Environment Division and director of its Environment and Development Program. Other members of the RFF research team included staff members of the Beijing Environment and Development Institute, and Kathlin Smith, who is associate director of the Committee on Scholarly Communication with China.

In addition to Spofford and Smith, co-authors of the final report included BED staff members Ma Xiaoying, currently a doctoral candidate in engineering at Stanford University, and Zou Ji, currently a visiting research associate at the London School of Economics and Political Science.



Rusting waste containers in Chongqing, one of the most heavily polluted areas in the world.



What Drives Productivity in Natural Resource Industries?

Resources for the Future has embarked on a two-year project to study the sources of productivity change in energy, forests, and minerals—natural resource sectors that continue to be major contributors to the U.S. economy. With the support of a \$350,000 grant from the Alfred P. Sloan Foundation, RFF is amassing the latest information and analysis available on productivity growth in the extractive phases of industries in each of the three sectors to assess the future supply of oil and gas, coal, timber, and copper at stable prices here and abroad.

Why a Study Is Needed

Although many forces of change in productivity are readily apparent, they do not themselves reveal how productivity gains take place, and little research has focused on individual innovations. This is clearly the case with technology, long viewed as the chief engine of productivity growth. Most of the available data predate important innovations that appear to have driven recent changes in productivity.

The Research Team

The team of RFF researchers conducting the study includes Douglas Bohi and Joel Darmstadter (energy), Roger Sedjo (forestry), John Tilton and Hans Landsberg (minerals), and Ian Parry (statistical analysis).

Three-dimensional seismic survey methods have, for example, transformed oil and gas exploration in the last decade into a reasonably predictable process. And breakthroughs like cell cloning in seedling nurseries are creating a new element in pricing “industrial wood” used for building materials and paper.

Adding to the need for the study is the fact that no authoritative source routinely publishes total-factor productivity data for extractive industries, although the Bureau

of Labor Statistics is expanding the scope of its multifactor productivity measures to include such industries. Data that *are* getting reported can be misleading. By ignoring capital and other inputs, for example, statistics on labor productivity can create an inaccurate picture of productivity change. Another reason for the study is to better understand the role that environmental regulation has in effecting changes in productivity.

Methodology

RFF is combining a “top-down” statistical analysis of industry-level data on productivity and a “bottom-up” case-study analysis of specific technologies that have affected productivity.

Top-down analysis. This evaluation is being performed to document productivity changes that have actually occurred in the selected industries and to gauge the extent to which they can be “explained” by variations in the factors that contributed to them, such as spending on research and development and the educational level of the labor force. The “unexplained” portion of productivity change is the focus of the bottom-up analysis.

Bottom-up analysis. The bulk of this analysis concerns the contribution of specific innovations to productivity changes over the last ten to fifteen years. The study ranges across innovations in technology, market structure, organization of production, and the use of nonmarketed resources—whichever are the most important sources of productivity change in each industry. Whenever possible, data are being collected on the costs and implications of the innovations. The researchers also are seeking insights from experts in each of the industries and from academics in related fields, many of whom RFF staff members have worked with on resource studies over the years.


In studying new technologies, the RFF researchers are measuring the effect of a

given innovation on the costs of production (primarily in the United States) and then determining its effect on sustainability of supply. Among the questions they are asking themselves are whether a particular innovation is resource-augmenting or resource-depleting, and if an apparent gain in productivity resulted from greater use of contributing factors than was measured.

In conducting the case studies, the research team is asking the experts for anecdotal and historical evidence to help determine the process involved in creating a given innovation. The team is looking to see if a complementary development made the innovation possible, and whether it was the product of directed research aimed at reducing production costs or was purely serendipitous. They are also trying to determine how many years of trial, testing, and development were necessary before the given innovation could be implemented satisfactorily.

Once the creation process of an innovation is understood, RFF wants to identify the process of its diffusion: was the innovation quickly adopted by competitors or was an extended period required to prove its worth? The team is also assessing the effect of each innovation studied on the international competitiveness of U.S. industries. Eventually, the findings from the bottom-up and top-down analyses of each industry will be brought together for cross-comparison of similarities and differences with regard to sources of productivity change.

Outputs

Near the end of the first year of research, RFF will convene a meeting of experts to evaluate the team’s findings and advise on future work. Once draft reports are completed, a broader audience will be invited to a second informational event. RFF also plans to publish a book on the findings of this research program, and will seek other forums for dissemination and discussion as well. 



Grading "Sustainable America"

The Report of the President's Council on Sustainable Development

by Michael A. Toman and Joel Darmstadter

With a backdrop of increased public anxieties arising from the rapid pace of global economic change, social dislocations, and degradation of the natural environment, the 1987 "Brundtland Commission" report called for "sustainable development"—development that meets the needs of the present without imperiling the ability of future generations to meet their needs.

"Sustainable America: A New Consensus for Prosperity, Opportunity, and a Healthy Environment for the Future," the February 1996 report of the President's Council on Sustainable Development, is an ambitious, high-profile attempt to reach this goal. Appointed by President Clinton in 1993, the council was charged with conducting an open, collaborative dialogue on ways to meet the Brundtland Commission challenge. Co-chaired by a vice president of Dow Chemical and the president of the World Resources Institute, the twenty-three members of the council included representatives from business and environmental organizations, several cabinet-level officers, and members of labor, minorities, and other groups. It was supported in its activities by numerous task forces and working groups. While the council's report reflects the views only of its members and expressly states that it does not represent Clinton administration policy, the participation of several cabinet-level officers and Vice President Al Gore indicates the administration's strong interest in the issues addressed by the council.

Core Beliefs and Policy Goals

Because the council's report addresses an enormous range of topics—among them, pollution management, resource stewardship, income distribution, community planning, education, and population control—any effort to summarize its ideas will do some injustice. The report starts with sixteen core beliefs about the need for

environmental, economic, and social progress and ways to achieve them. Among these beliefs are that: the United States needs integrated approaches to avoid the unintended consequences of more piecemeal policymaking; economic, environmental, and social goals are not only important but very often complementary; regulation, while important, needs to become more performance-based, and should be supplemented by greater assumption by all parties of stewardship responsibilities for the future; the United States also needs a new, more inclusive, collaborative, and "place-based" decision-making process that reflects local as well as national interests; cooperative efforts to improve communities through education, incentives, investments, and changes in development patterns are critical to a more place-based approach; and education and easier access to information are crucial to achieving policy goals and enhancing public participation.

About the Authors

Michael A. Toman and Joel Darmstadter are senior fellows in RFF's Energy and Natural Resources Division. They are editors of *Assessing Surprises and Nonlinearities in Greenhouse Warming* (RFF 1993), and contributors to *Global Development and the Environment: Perspectives on Sustainability* (RFF 1992). A searchable catalog of RFF publications can be found on RFF's World Wide Web home page (<http://www.rff.org>); information about ordering RFF publications appears on the home page as well as on page 22.

Based on these beliefs, the council report advances ten basic policy goals and a very large number of proposed actions

that address both substantive policy options and ways to reform the policy process. The council recommends changes in economic incentives, including altering subsidy and tax policies to discourage pollution, encourage natural resource protection, and promote community redevelopment. It also endorses voluntary measures for resource preservation and waste management in order to pursue these same goals. Increased flexibility in regulatory compliance is supported, provided it is accompanied by requirements for increased environmental protection. Considerable emphasis is placed on improvements in technology, business management, and worker training that would prevent pollution problems, enhance economic productivity, and expand employment possibilities.

To implement a more place-based policy approach, the council supports increased community involvement through local and regional dialogues and negotiations in which diverse stakeholder interests would be represented and accommodated. In the environmental sphere, however, these processes would be undergirded by national standards. To enhance the scientific soundness of policy actions and to encourage public participation, the council advocates the creation and promulgation of a variety of economic, social, and environmental quality indicators and educational programs. The development of these indicators remains a key element of the council's continuing activities.

Strong Points and Shortcomings

A reader will inevitably find something specific with which to disagree in a report addressing such a wide range of topics and requiring consensus among diverse points of view. Such reports also characteristically make points that are not perfectly articulated, or that sound vague but dutiful, in response to the need to contain common-ground statements.

An important consideration is whether the report as a whole brings a useful new perspective to designing effective public policies—policies for meeting a range of human needs and aspirations—with a package of recommendations that provides a useful point of departure for policy reform.

Strengths. The report underscores the need for recognizing interactions among environmental, social, and economic goals—in particular, the importance of a healthy environment to economic progress—and the importance of considering more systematically the consequences of current actions for future generations. It also provides welcome support for more aggressive use of performance-based standards and economic incentives to reduce the cost of environmental improvement and resource protection, including controversial measures such as the reduction of existing environmentally damaging subsidies. An additional strength is the report's emphasis on improved scientific knowledge and public understanding, as well as on investments in technical advance and human skills. The report further draws attention to the need for balancing local and national goals and enhancing cooperative decisionmaking.

Weaknesses. In its emphasis on strengthening environmental standards, the report advances the notion that doing so can be accomplished cheaply or can even generate economic benefits. This tends somewhat to obscure an awkward but important part of the environmental policy debate by deemphasizing situations in which greater benefits would flow from directing resources to other priorities. While it is certainly true that reduction of economic and environmental inefficiencies will in some instances generate both economic and environmental benefits, there are surely limits on the extent to which further improvements in environmental quality can be purchased without any increase in real cost. Such increased costs

may well be justified by the resultant benefits in some cases, but in others—for example, large expenditures to reduce small but politically salient risks—such a conclusion is more questionable.

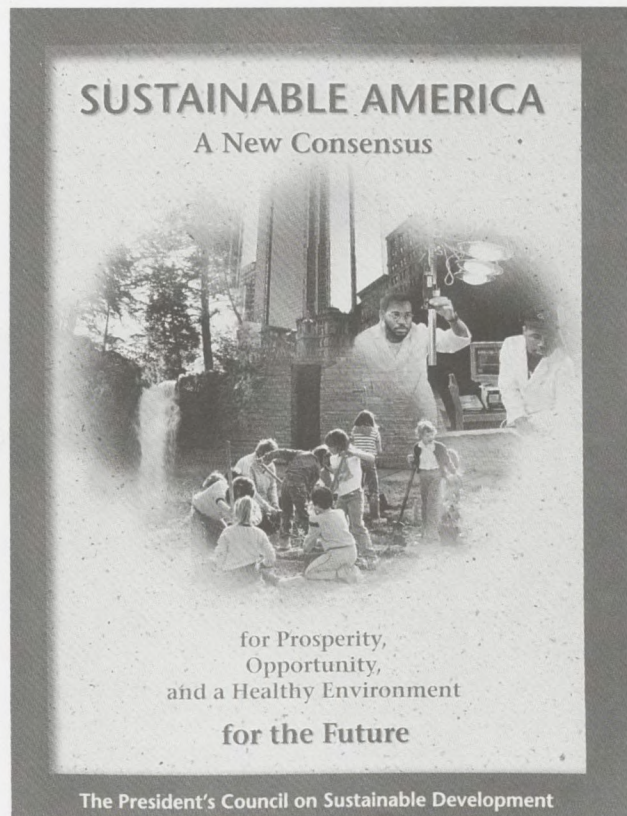
Further, while emphasizing how changes in the use of technology may advance environmental and economic goals, the report devotes insufficient attention to the need for continued government support of basic science and R&D that help make new technologies available. In addition, the report espouses a number of voluntary measures based on shifts in social values, although experience suggests that such measures frequently are less effective than claimed.

Some Policy Challenges

Other concerns emerge as one considers the operation of a place-based policy approach. To succeed, policies need to reflect the interests of all affected parties, not just the various activists on different sides of the debate. Achieving this participation is a significant challenge. Successful policies must address issues that cut across multiple administrative and geographical scales, and the longstanding question of how to weigh expert and lay judgments of risks and priorities in social decisionmaking must be resolved. The council's recommendations for building sustainable communities, for example, emphasize large doses of collaborative planning and potential changes in fiscal mechanisms to counter sprawl and other perceived disamenities. But achieving broad consensus

on community development will also have to address the fact that many Americans really seem to prefer lower-density suburban living.

Notwithstanding the council's consensus, the questions of how serious the problem of sustainable development actually is and what to do about it remain hotly contested. The President's Council on Sustainable Development has made a useful contribution by bringing these issues to the fore and suggesting some solutions. The council will provide a further social benefit if its members can help generate support for a limited but tractable set of policy changes that can advance economic, environmental, and social aims. ☐



Sustainable America: A New Consensus for Prosperity, Opportunity, and a Healthy Environment for the Future (Washington: Government Printing Office, Feb. 1996), 186 pages, \$15.



INSIDE RFF

Science outstrips understanding of how to lessen climate change

Rapid change is taking place in climate science, visiting scholar John Firor told his audience at one of RFF's Wednesday noon-time seminars recently. And yet the pace of change in the way anyone can describe the total impact of climate change remains slow.

Firor, who until recently headed the Advanced Study Program at the National Center for Atmospheric Research in Boulder, Colorado, explained that scientific understanding of possible human-induced changes in climate is decidedly more definite than it was at the time of the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992. The increase in scientific confidence, he believes, arises from a fairly simple change in the perceived pattern of "anthropogenic forcing," or human influence, on the climate.

Among the international bodies considering the scientific data, there is less "fence sitting" than there used to be, Firor said, and more international agreement that human influence is indeed a factor.

Despite the acknowledged need for some actions to slow human-induced emissions, Firor noted that many uncertainties remain. "Prominent among them are the costs and benefits of preventive measures," he said. "We are a long way from knowing all of the features of effective policymaking because we have no big picture of the totality of human impact on the environment."

Firor, who spent some time at RFF as a visiting scholar in 1981, has returned to share some of the scientific findings of his long-time study of global climate and climate change in exchange for some economic insights into how to respond to the phenomenon. During his three-month stay, he has been working with senior fellows in the Energy and Natural Resources Division on climate change issues, including an assessment of the report that the United Nations Intergovernmental Panel on Climate Change issued in Rome at the end of 1995, which recommended immediate action in response to its findings, including turning away from fossil fuels as primary sources of energy.

Instead of making policy recommendations to his seminar audience, Firor offered some basic insights into the

nature of research itself. Economists as well as scientists need to tackle the important problems even if they are the most difficult ones, he said. Global change modelers, for example, need to consider the variability associated with climate change, rather than strive only to obtain global temperature averages. They ought not to wait until their models are perfect before taking up the task. And economists need to settle on a better index of national well-being than gross domestic product, he feels, before trying to estimate the costs of slowing climate change.

Rather than writing up their findings immediately, researchers should spend the year following the completion of their studies to test the sensitivity of their models to the basic assumptions they made, whether those assumptions were the customary ones of their disciplines or were constrained by the need to simplify the model conditions being simulated. To make progress in responding to climate change, Firor concluded, researchers also ought to strive for transparency so that everyone else can clearly see exactly what they are doing.

Firor's writings on global climate change include his 1990 book, *The Changing Atmosphere: A Global Challenge* (Yale University Press). He has also written on cosmic rays, radio astronomy, the sun's atmosphere, solar flares, the atmosphere as a natural

resource, sustainable development, and political and legislative controls on air pollution.

Firor holds a Ph.D. in physics from the University of Chicago and began his career on the staff of the Carnegie Institution of Washington, where he studied radio waves from the sun. In 1961, he joined the then new NCAR and served as its second director. Firor is also a founding trustee of the World Resources Institute, which he now serves as vice chair. He will remain at RFF through May. ☞

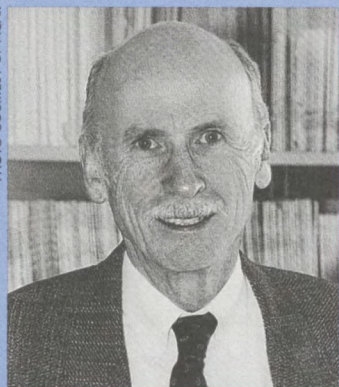
RFF Council meets on environmental regulatory reform

The RFF Council took up the national debate on federal environmental regulation—how it should and should not be reformed—at its sixth annual meeting in Florida in April. EPA Deputy Administrator Fred Hansen spoke to the gathering, which included the major corporate, foundation, and individual supporters who make up the council as well as RFF's board of directors and a number of invited guests.

The problems that Hansen touched on and the potential solutions he posed received in-depth consideration over the course of the one-day meeting, where participants with differing views had an opportunity to exchange ideas and information.

Entitled "Whither Regulatory Reform?" this year's agenda included four sessions

PHOTO COURTESY OF NCAR



John Firor



EPA Deputy Administrator
Fred Hansen addresses RFF
Council meeting.

in which a range of speakers from industry, environmental organizations, government, and RFF identified what they see as the principal problems affecting the environmental regulatory system. They also considered what's been tried so far with what success, whether risk assessment and benefit-cost analysis can be used more effectively in improving environmental regulation, and what might be done in the future. Major problems were discussed in all of their aspects, including the statutory, administrative, scientific, and political obstacles to sound regulation.

In addition to the day's discussion of regulatory reform, the annual meeting provided an opportunity for council members and other participants to talk with RFF division directors and the research staff about the full range of projects underway at RFF, including work on Superfund reauthorization, the

restructuring of the electric utility industry, the upcoming revisions of the national ambient air quality standards for ozone and particulate matter, the sources of productivity growth in the energy industries, and the management of public lands. ☞

Robert Fri to head Museum of Natural History

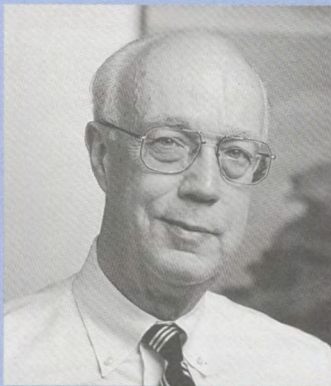
Former RFF president Robert W. Fri has assumed new duties as director of the Smithsonian Institution's National Museum of Natural History. In announcing the appointment, which took effect May 1, Smithsonian Secretary J. Michael Heyman described Fri as "precisely the right person" to offer "thoughtful leadership" and to successfully manage an organization that has a staff of 650 and an annual budget of about \$44 million.

A storehouse and showcase for more than 120 million specimens, the Museum of Natural History is a world leader in research in the fields of anthropology, biodiversity, earth sciences, marine sciences, paleobiology, and systematic and evolutionary biology. It is also one of the oldest institutions within the Smithsonian's complex of sixteen museums and galleries and drew more than 5.4 million visitors last year.

At RFF, Fri served as president from 1986 to 1995 and then as a senior fellow until his appointment as the museum's director. Reflecting on his near-

ly ten-year tenure, Fri said he was proud to have served an organization whose research is meant to help people make better decisions about the conservation and use of their natural resources and the environment. In making the transition, Fri said he feels like he is "crossing a bridge," from one first-rate institution to the other, devoted as each of them is to research and public education.

Before becoming RFF's president, Fri was a principal of McKinsey and Company, Inc., management consultants. Earlier in his career, he was the first deputy administrator of both the U.S. Environmental Protection Agency (1971-73) and the Energy Research and Development Administration,



Robert W. Fri

precursor to the Department of Energy (1975-77). He also served as acting head of both agencies.

Among his many professional activities are Fri's membership on the University of Chicago board of governors for the Argonne National

Laboratory and his role as a trustee of Science Service Inc., which publishes *Science News* and organizes the Westinghouse Science Talent Search. He serves in an advisory capacity to the Gas Research Institute and the Aspen Institute, is a member of the National Petroleum Council, and chairs the Energy Modeling Forum project on electric industry deregulation.

An honors graduate in physics from Rice University, Fri received a master's degree with distinction from Harvard Business School, where he was a Baker Scholar.

In announcing Fri's departure, current RFF president, Paul R. Portney, said Fri will be "sorely missed, but—happily—close by." ☞

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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>).

RFF names academic award winners

Robin R. Jenkins and Hilary A. Sigman are the winners of RFF's 1996 Gilbert F. White Postdoctoral Fellowships. Awarded annually since 1980 in honor of the retired chairman of the RFF board, the fellowships support postdoctoral research in the social or policy sciences in areas related to natural resources, energy, or the environment.

Jenkins is an assistant professor in the Department of Economics at St. Mary's College of Maryland. Her research will focus on the role "host fees" play in addressing

the pollution and other unintended consequences of operating a municipal solid waste landfill as well as the role these fees play in a community's obtaining "environmental justice" for siting such a landfill. Sigman is an assistant professor in the Department of Economics at the University of California-Los Angeles, and will study liability-based funding and Superfund cleanup. Jenkins and Sigman will be in residence at RFF during the 1996-97 academic year.

In honor of the late Joseph L. Fisher, RFF president from 1959 to 1974, RFF annually awards fellowships to graduate students in economics and

other policy sciences to support that final year of dissertation research. Of the fifty-five applications submitted, RFF has selected the following students for the 1996 Joseph L. Fisher Dissertation Awards:

- Carolyn Fischer, Department of Economics, University of Michigan
- Michael Greenstone, Department of Economics, Princeton University
- Debra Israel, Department of Economics, University of Wisconsin at Madison
- Richard G. Newell, JFK School, Harvard University
- Christopher D. Timmins, Department of Economics, Stanford University



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



DEVELOPMENT

The benefits of giving real estate

If you have owned your home or other real estate for a long time, it has likely increased in value appreciably. Perhaps you are now ready to move into a smaller house, a condominium, or a retirement home. Maybe you have a vacation getaway you no longer use. Possibly you would like to give up farm life for a place in town.

What happens if you sell your property? In many circumstances, if you do not meet the requirements for available tax breaks—such as the two-year, tax-free rollover for residences—you must pay capital gains tax on the property's appreciation. Plus, marketing and selling real estate takes time and effort, even if you use professional assistance.

Your property can instead open the door to a unique giving opportunity.

Rather than sell the property, you can transfer it to RFF as a gift and reap some attractive tax benefits not available if you sell, such as a charitable deduction. Here are some of the available options.


Outright gift. If you bestow a piece of real estate to RFF as a gift and have owned the property for more than a year, you will receive a tax deduction for the full current market value (rather than your lower cost basis) and avoid capital gains tax on the appreciation. Your gift will be deductible up to 30 percent of your adjusted gross income, with a five-year carry-over allowed for any excess.

Conditional gift. When you deed property to RFF, you are free to place conditions on the gift regarding occupancy. For example, you can maintain domicile of the property for your lifetime (with life use for your surviving spouse, too). That way, you can continue to receive a sizable, current income tax deduction, based on the value of the property and your (and your spouse's) age.

Charitable remainder trust.

Another alternative is to transfer your unmortgaged home or other unmortgaged real estate to a charitable remainder trust. Once the property is transferred, the trustee can sell it and invest the proceeds in income-producing securities, which become the source of payments to you and any other recipient you name. This gift can secure a life income for you and a survivor (such as your spouse), while providing RFF with much-needed financial assistance when the remainder comes to us at the termination of the trust.

The fact that a gift of real estate is not limited to a person's primary residence can be helpful in making financial decisions. For example, if you are at least age 55 and meet certain ownership and residency requirements, you can escape tax entirely on up to \$125,000 of the gain from the sale of a residence. However, this one-time exclusion is for your principal residence only; it is not available for a second home, a vacation home, or a gift of a remainder interest.

Thus, the option of giving may be especially attractive when you are interested in disposing of a secondary property. 



RESOURCES FOR THE FUTURE

is an independent nonprofit organization engaged in research and public education on natural resources and environmental issues. Its mission is to create and disseminate knowledge that helps people make better decisions about the conservation and use of their natural resources and the environment. Established in 1952, RFF is a publicly funded organization under Section 501(c)(3) of the Internal Revenue Code, and all contributions to its work are tax deductible.

For more information about 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.



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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:

- "A Comparison of Timber Models for Use in Public Policy Analysis" by Brent L. Sohngen and Roger A. Sedjo (96-12)
- "Distributional Impacts of an Environmental Tax Shift: The Case of Motor Vehicle Emissions Taxes" by Margaret Walls and Jean Hanson (96-11)
- "Environmental Policy and the Tax System" by Ian W. H. Parry (96-10)
- "Pluralism and Regulatory Failure: When Should Takings Trigger Compensation?" by James Boyd and Timothy J. Brennan (96-9)
- "Analyzing the Economic Impact of Climate Change on Global Timber Markets" by Brent L. Sohngen, Roger A. Sedjo, Robert Mendelsohn, and Ken Lyon (96-8)
- "Marine Debris, Beach Quality, and Non-Market Values" by V. Kerry Smith, Xiaolong Zhang, and Raymond B. Palmquist (96-7)
- "Weak Complementarity and Quasi-Rents" by Ju-Chin Huang and V. Kerry Smith (96-6)
- "Referendum Design and Contingent Valuation: The NOAA Panel's No-vote Recommendation" by Richard T. Carson, W. Michael Hanemann, Raymond J. Kopp, Jon A. Krosnick, Robert C. Mitchell, Stanley Presser, Paul A. Ruud, and V. Kerry Smith with Michael Conaway and Kerry Martin (96-5)
- "Second-Best' Adjustments to Externality Estimates in Electricity Planning with Competition" by Dallas Burtraw, Karen Palmer, and Alan J. Krupnick (96-4)
- "Environmental Taxes: Dead or Alive?" by Richard D. Morgenstern (96-3)
- "Retroactive Liability and Future Risk: The Optimal Regulation of Underground Storage Tanks" by James Boyd and Howard Kunreuther (96-2)

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