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No Simple Solutions

In this issue of *Resources*, RFF senior fellow Alan J. Krupnick comments on his year on the staff of the President's Council of Economic Advisers. He remarks that one of the challenges of the job was convincing the "can-do" types at the White House to submit new ideas to objective analysis before (as he puts it) "running with them."

Reflecting on his comment, I realized how neatly it sums up RFF's characteristic role in a process that is often anything but neat. Apart from the evident pride we feel in seeing one (two, actually—see p. 11) of our researchers advising the President on economic policy, we can take satisfaction in what—and how—RFF contributes in general to debates about environmental policy. When highly topical or emotionally charged issues emerge, RFF researchers are able to examine them through a dispassionate lens. Closer scrutiny may well reveal that what is *really* taking place differs from what people *assume* is happening—and that solutions likewise differ from what is popularly assumed.

Three articles published here show RFF scholars working thoughtfully on high-visibility issues where urgent calls for action abound. Theodore Glickman weighs in on the debates about environmental justice. He is combining exposure assessment techniques with geographical information software in order to identify the distribution of certain environmental hazards in Allegheny County, Pennsylvania. Preliminary inquiry shows that environmental equity issues are not as cut and dried as some would like us to believe.

Programs that encourage businesses to reduce pollution voluntarily are attractive because they appear to be cost-effective.

But do they really work? Seema Arora and Timothy Cason studied the factors that led businesses to participate in the EPA's 33/50 Program. They find that while companies have quite disparate reasons for participating in the program, the overall pollution reductions that could result may be substantial. (See "Inside RFF" for an item on RFF's own participation in another EPA voluntary program.)

Michael A. Toman and R. David Simpson also question popular wisdom in their article on the prospects for environmental improvement in the former Soviet Union. They recognize the enthusiasm there for receiving environmental aid, but they point out that, without reforms to the region's basic social and economic systems, the aid may not have the desired impact.

Lest anyone think this sort of independent thinking is new at RFF, Douglas Bohi and Joel Darmstadter have been applying it to energy policy since before the so-called energy "crisis" twenty years ago. As they observe in their retrospective, government policy interventions seriously worsened the problems then, and they fear we have not learned that lesson sufficiently well.

Those who define and execute policy understandably yearn for streamlined analysis that enhances quick action. RFF has a different role to play. We think that anything that advances our understanding of the true nature of environmental and resource problems and the true potential of solutions is important, even if it makes those problems and solutions uncomfortably complex. We continue to be grateful to those who support our search for such solutions.

Robert W. Fri, President

Measuring Environmental Equity with Geographical Information Systems

Theodore S. Glickman

Concern that racial minorities and the poor are shouldering a disproportionate share of the burden of environmental hazards has prompted interest in ways to redress existing environmental inequities. Many efforts have been made to identify these inequities, but not in terms of the actual risks associated with environmental hazards. Researchers at Resources for the Future are now combining risk assessment techniques with geographical information systems (GIS) software to do just that. They are analyzing environmental equity with respect to the risks from industrial hazards in Allegheny County, Pennsylvania. This test case of the use of GIS to analyze environmental equity has suggested that those most exposed to environmental risks are not always nonwhites and the poor.

Environmental justice, or the equitable distribution of environmental hazards, is currently attracting more attention than perhaps any other environmental issue. Last year, the White House issued an executive order that requires federal agencies to consider the impacts of their decisions on environmental equity, and the U.S. Environmental Protection Agency has created a special office to facilitate such analyses. Both actions were motivated by concern that racial minorities and the poor may be shouldering a disproportionate share of the impacts of environmental hazards.

Indeed, racial minorities and the poor, who in many cases are one and

the same people, typically *do* have greater exposure to environmental hazards than those who are more economically advantaged. The poor often live in areas that are likely to have more environmentally undesirable facilities—for example, factories, power plants, waste incinerators, and so on—than the areas where other groups live. And, unfortunately, these subpopulations may include a disproportionate number of young children or elderly people, two groups that are generally believed to be especially susceptible to the health effects of pollution.

Before cases of existing environmental inequity can be remedied, they must first be identified. Fortunately, a new information technology has emerged that can be used to provide real data about environmental equity impacts in any selected location. This technology—known as geographical information systems, or GIS—is a type of software that was originally developed for combining different types of spatial data, such as information about a region's topographical features and its distribution of natural resources. Using GIS requires appropriate data and expertise, but most of the data are already available, and some systems are friendly enough to be learned easily.

GIS is becoming an increasingly important technology for analyzing environmental equity. The information provided injects an essential degree of objectivity into environmental justice deliberations. In turn, this objectivity helps decision makers to establish priorities based on information about which hazards create the greatest disparities in impacts and which groups of people are most affected.

In the Center for Risk Management at Resources for the Future, we are conducting a study that demonstrates the potential of GIS to shed light on the distribution of environmental burdens. An important part of the study is a comparison of proximity-based measurements and risk-based measurements of environmental equity. Below we describe how we have used GIS to generate both kinds of measurements in an analysis of environmental equity with respect to industrial hazards in Pittsburgh and surrounding Allegheny County, Pennsylvania, circa 1990.

This analysis differs in three important respects from related analyses of environmental equity that have been done elsewhere. First, it considers not only *chronic* hazards in the form of air pollution from industrial facilities but also *acute* hazards in the form of potential exposure to accidents involving the airborne release of toxic chemicals from facilities where the chemicals are stored. Second—and more important—our analysis of equity is based not only on *proximity* to hazards but also on the actual health and safety *risks* associated with each kind of hazard, separated and combined. These dimensions of equity are absent in most related studies, which measure equity based only on people's proximity to hazardous facilities. Third, for selected facilities, our analysis will trace changes in the distribution of environmental hazards using historical data on hazards, land use, property values, demographics, and other agents or indicators of change, whether legal, political, or economic.

Our study using GIS reveals the need to look beyond aggregate results when analyzing equity and to be cautious when using worst-case assumptions. Also, somewhat surprisingly, it shows that, in the face of hazards that have the potential to affect large areas (such as major accidental chemical releases), most of those who would be exposed do not belong to the most disadvantaged groups of people—that is, racial minorities and the poor.

When our study is completed this fall, we expect it to benefit a wide audience, ranging from community groups to professional peers, by demonstrating how to assemble data germane to environmental equity, how to analyze the data using moderately priced GIS software, and how to interpret the results. We believe our approach will be particularly useful in showing how to measure "outcome inequity," that is, in determining whether one socioeconomic group bears more of the burden of a particular environmental hazard than another. In addition, the part of our study that deals with the use of historical data to examine the evolution of environmental inequities should prove useful in showing how the distribution of burdens changes with time and—perhaps—in helping understand why.

Proximity-based measurements

One way to measure environmental equity is based on people's proximity to facilities that pose environmental hazards. In our analysis of environmental equity with respect to industrial hazards in Allegheny County in 1990, we used a GIS to avoid some of the pitfalls that attend more simplistic approaches to proximity-based equity measurements.

Previous approaches hinged on a comparison of the percentage of minorities or poor people in the census areas that contain environmentally hazardous facilities with the percentage of minorities or poor people in nearby census areas that do not contain such facilities. This kind of approach is problematic for several reasons. First, it draws no distinction between areas that are home to only one facility and those that host two or more facilities. Second, it does not account for the possibility that the hazardous facility or facilities may be so close to the edge of the host area that a neighboring area is affected as much, if not more. Third, and perhaps most important, this approach does not consider that census tracts and counties do

not generally represent either the affected neighborhood or the range of the hazard associated with a facility. A more sensible way to represent both is to construct an imaginary circle centered at each facility, although the question of how large the radius of the circle should be is open to question. In the case of facilities in urban areas, a radius of one or two miles seems reasonable, since neighborhoods do not usually extend any further than that.

Our environmental equity analysis accounts for all three of the above shortcomings. In this analysis, we divided Allegheny County's industrial facilities into two types: those that may pose chronic hazards and those that may pose acute hazards. We refer to the former facilities as TRI facilities after the Toxic Release Inventory (a national database of reports of industrial air pollution), from which we obtained the location of these facilities and information about emissions from each. We refer to the latter facilities as EHS facilities because they store "extremely hazardous substances"; the risks associated with these facilities arise in the event of an accidental chemical release rather than from continual, routine chemical releases. We were able to identify these facilities using the federally required reports that indicate where EHSs are stored in quantities above a certain threshold.

Next, we constructed circles with radii of one-half mile, one mile, and two miles around each TRI and EHS facility. Then, for each radius, we divided Allegheny County into two parts, one being the area formed by the circles and their overlapping portions, and the other being the rest of the county (the areas outside of all the circles). We made this division for the EHS facilities and then, separately, for the TRI facilities. In each case, the combined area within the circles, which may not all be contiguous, is what we call the "close-proximity region"—the region where people live in close proximity to the facilities. We assumed that, for a given choice of radius, the close-proximity region is homoge-

neous with regard to proximity effects—that is, the hazard burden is the same no matter which facility you are close to or how close you are to it, as long as you live within the region.

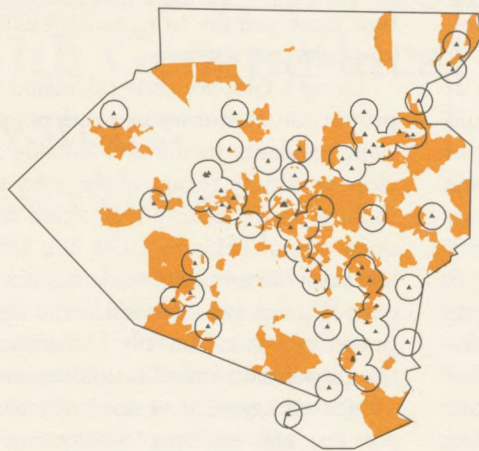
Using a GIS, we then calculated the proportion of nonwhite residents and poor residents inside and outside the close-proximity region of the sixty-two facilities in the county that stored large quantities of EHSs in 1990. We found that *nonwhite* residents made up 16 percent of the population inside the close-proximity region but only 11 percent of the population outside this region in 1990 (see figure, p. 4, top). Similarly, *poor* residents made up 16 percent of the population inside the close-proximity region but only 10 percent of the population outside that region in 1990 (see figure, p. 4, center). Thus the percentage of nonwhites and the percentage of the poor among people who live close to the EHS facilities are slightly higher than those elsewhere in the county.

When we calculated the percentage of nonwhite residents and poor residents inside and outside the close-proximity regions of the county's TRI facilities, we obtained similar results: the percentages of nonwhites and the poor living inside the close-proximity regions were greater than the percentages of these people living outside those regions.

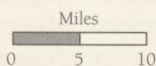
Risk-based measurements

Risk-based equity measurements are superior to proximity-based equity measurements because they take into account other major factors on which risk depends—factors that can actually change the picture of environmental equity given by proximity-based measurements. These other factors include the probability of an accidental release of chemicals; the size of the area affected by such a release (which depends, in turn, on the substance released, the quantity released, the nature of the release, the release rate, and the weather at the time of the release); and the wind direction

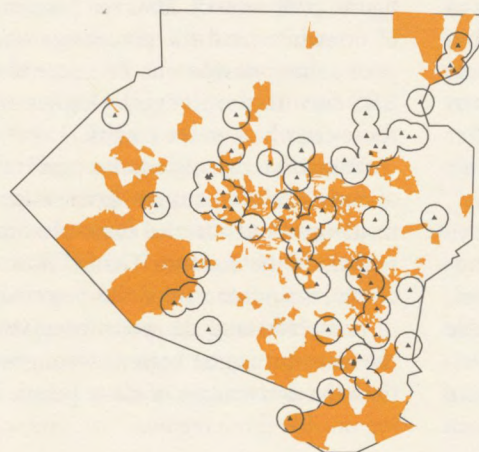
EHS facilities and areas with large nonwhite populations



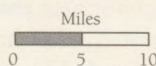
Note: The triangles indicate the locations of the sixty-two facilities in Allegheny County that stored more than a minimal quantity of EHSs in 1990. Circles indicate areas within a one-mile radius of the facilities. The yellow shading indicates the areas formed by the 25 percent of census block groups that had the highest number of nonwhite residents in 1990.



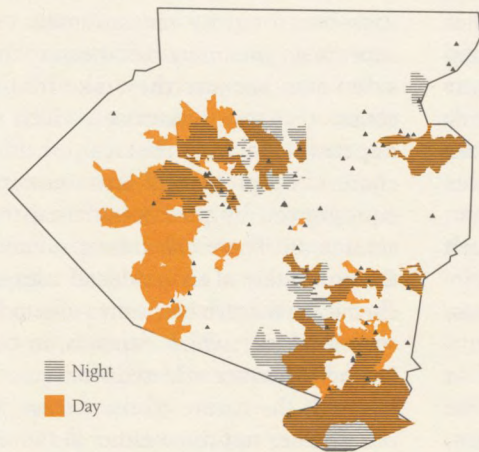
EHS facilities and areas with large poor populations



Note: The triangles indicate the locations of the sixty-two facilities in Allegheny County that stored more than a minimal quantity of EHSs in 1990. Circles indicate areas within a one-mile radius of the facilities. The yellow shading indicates the areas formed by the 25 percent of census block groups that had the highest number of residents living below the poverty line in 1990.

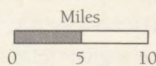


Highest risk areas by night and day



Note: Crosshatching indicates the distribution of nighttime and daytime risks posed by accidental chemical releases in Allegheny County in 1990. These shaded areas represent the 5 percent of census block groups that had the highest risks in each of the two time periods during that year. The shaded areas appear to represent more than 5 percent of the county because census block groups in rural parts of the county usually are larger in area than those in more densely settled areas.

▨ Night
 ■ Day



at the time of release. Risk also depends on the toxicity of the chemical released and on the level of exposure of the population of concern.

As yet, the results of our risk-based environmental equity analysis for Allegheny County are confined to acute hazards associated with EHS facilities in 1990. We defined the risk posed by these hazards as the expected annual number of persons exposed to accidental chemical releases, and we developed an exposure assessment procedure that takes all the above-noted factors into account. We did so using a formula that multiplies the probability of an accidental chemical release by the size of the impact area and the population density in that area. This procedure allows for the possibility that any person might be exposed to several such accidents in any given year, thereby contributing several "person-exposures" to the annual total.

Because population exposure varies by time of day, so does risk. Analysts commonly calculate only nighttime risks, because doing so requires only residential census data. However, because nighttime and daytime risks can differ significantly, it is important to account for each separately. Therefore we used residential census statistics and "journey-to-work" data, which reflect the weekday comings and goings of commuters, to calculate both the nighttime and the daytime risks that each EHS facility poses for nonwhites and for the poor (see figure at left, bottom). Then we calculated the total risk to nonwhites and to the poor for each facility alone and for all EHS facilities taken together.

We defined the average risk that EHS facilities pose as the weighted combination of the nighttime risks, which only take the residents of each impact area into account, and the daytime risks, which take into account the working population and the nonworking residential population in each impact area. We counted twice any risk in the overlap between two impact areas, which is appropriate since the total risk to any person is essentially the sum of the two risks. Based on these

measurements, equity for nonwhites (or the poor) is said to exist if their percentage of the total risk is the same as that of nonwhites (or the poor) among the entire county population.

According to our calculations, which are based on the most hazardous chemical stored at each facility, the percentages of nonwhites and poor people at risk from accidental chemical releases are 9 percent and 8 percent, respectively. The percentages of nonwhites and poor people in the county are 13 percent and 12 percent, respectively. In other words, nonwhites and poor people actually bear proportionately slightly less of the risk than they would if equity existed.

At first, this finding comes as a surprise because environmental inequities are generally expected to work in favor of the white, more affluent majority, as demonstrated by the above-noted proximity-based equity measurements. Upon reflection, however, the reasons for the outcome of our exposure risk-based equity measurements are clear.

First of all, this outcome is an aggregate result obtained by combining the results for all the facilities where EHSs are stored. On a facility-by-facility basis, the direction of the inequity varies, sometimes working in favor of whites who are not poor and sometimes against them. The aggregate result shows that, on balance, it worked against them more than it worked for them.

Second, nonpoor whites are often at greater risk from hazards that affect a large area, such as major accidental chemical releases, than from hazards that affect only a small area. This becomes apparent when we consider that the radius of the area affected by a major chemical release accident often exceeds one mile and that nonwhites and poor people tend to live closer to EHS facilities than whites and nonpoor people. Thus, nonpoor whites will be affected at larger radii.

This phenomenon calls for caution in risk assessment. Although it is commonly suggested that worst-case assumptions

be used in assessing risks, doing so introduces a bias when disadvantaged people live closer to hazardous facilities than other people. Why? Because the impact of hazards on nonpoor white individuals increases as the hazard area increases. As a result, risk assessments that use worst-case scenarios may show disproportionate risks in nonpoor, white communities because these communities' share of the hazard burden is larger than it would be under average-case assumptions—for instance, if the "plume" of a toxic vapor cloud were assumed to dissipate quickly, rather than more slowly and over a larger area.

We are still in the process of generating risk-based measurements of equity for the chronic hazards associated with air pollution from the TRI facilities in Allegheny County. This is a more time-consuming process, because it requires that concentration contours representing countywide pollution patterns first be modeled for common pollutants such as particulates, as well as for less ubiquitous air toxics. When these concentration contours are grafted into the GIS as a "data layer," they will be combined with the aforementioned estimates of population exposures in order to assess the associated risks to nonwhites and the poor. We will use the resulting risk estimates, which will be expressed not just as person-exposures but as predicted cases of cancer or disease, to assess distributional equity. We will also analyze equity on the basis of the *combined* risks of accidental chemical releases and air pollution, which means that the acute impacts of accidental injury or fatality and the chronic health effects of pollution exposure will have to be measured on a common scale, such as the total expected reduction in life expectancy.

Future developments

While the use of GIS to measure environmental equity is still in its infancy, we feel safe in making certain observations about this practice. Given the wide-

spread availability of census and TRI data, as well as the increasing availability of user-friendly GIS packages, the capability to produce proximity-based estimates of industrial air pollution hazards is within the reach of many interested parties. Naturally, such estimates should not be considered the "last word" on environmental equity, since TRI data and EHS storage data are self-reported, TRI facilities are but one source of air pollution, and proximity is not a surrogate for risk. Other pollution sources and any environmental hazards that are of a nonpolluting nature or that are unrelated to health effects also can be readily subjected to a proximity-based analysis, provided that the data are available, complete, and "clean." GIS may be a new technology, but the oldest maxim in computing—"garbage in, garbage out"—still applies.

Risk-based analysis of environmental equity is another matter entirely. Such analysis is still the province of specialists, requires much more data than proximity-based equity analysis, and yields results that are more difficult to interpret. However, these obstacles will become less formidable as more research of the kind we are conducting is done, as better risk assessment software becomes available, and as risk education and communication improve in general. In the meantime, much more research is needed on how to combine risks, especially those that are difficult to measure in common units, such as carcinogenic and noncarcinogenic risks (or even health and ecological risks), and those that do not merely sum when accumulated, namely health risks that are exacerbated in the presence of certain other health risks.

In the near future, two principal benefits are likely to emerge from the use of GIS to measure environmental equity. One is the capability of concerned parties, such as public interest groups or government agencies, to use GIS as a screening tool to evaluate a region and determine which facility or facilities are contributing to the inequitable distribu-

tion of risks in the region. The other benefit is the contribution that GIS can make to the process of facility siting. Ideally, all the stakeholders in this process—whether they be industries, government agencies, or community groups—would participate in the process of identifying and evaluating the candidate locations for an undesirable facility, with the assistance of a GIS.

If, at some point in the future, an inventory of risk estimates could be developed for each region—whether it be a city or county—the facilities considered in the screening or siting process

could be evaluated not only in terms of the absolute risk they pose to each population group of concern but also according to their relative contributions to the overall risk burden of each group.

One overarching policy issue should be confronted in the not-too-distant future: Is it ultimately better for all parties concerned to spread out a region's environmental hazards in order to achieve short-term equity? This would be the outcome of making immediate, piecemeal improvements in the status quo. Or is it better to concentrate these hazards in one or more "hazard zones" and effect long-

term equity by reducing the associated risks and putting programs in place to enable affected residents to relocate over time? This issue goes well beyond the use of GIS to measure environmental equity, although GIS could help in such a policy analysis.

Theodore S. Glickman is a senior fellow in the Center for Risk Management at Resources for the Future. The findings of this study will be described in an RFF discussion paper, "Environmental Equity Measurements Based on Industrial Risks," which will be available in October.

A Voluntary Approach to Environmental Regulation: The 33/50 Program

Seema Arora and Timothy N. Cason

Voluntary pollution reduction gives companies an opportunity to take least-cost actions to reduce pollution and at the same time gain positive public recognition. Given these potential advantages, will voluntary pollution reduction programs attract large numbers of participants and result in large pollution reductions? An analysis of the U.S. Environmental Protection Agency's 33/50 Program suggests that willingness to participate in that program varies greatly among industries and among firms; indeed, only a small percentage of any industry's firms are participating in the program. However, the companies that are participating are responsible for a large percentage of toxic emissions. Thus pollution reductions due to the program could be substantial.

Pollution reduction programs that encourage voluntary participation by companies are gaining currency as a viable approach to environmental improvement. But can voluntary programs be effective in reducing pollu-

tion? What kind of company would decide to participate? And what kinds of pollution reductions would be made?

To answer these questions, we conducted a study of the 33/50 Program, a voluntary pollution prevention initiative designed by the U.S. Environmental Protection Agency (EPA) to reduce toxic releases. This program stresses cooperation between regulators and industry and provides positive feedback and awards to participating firms. We evaluated factors that lead to participation in this program by industries and by individual firms. We also compared the 33/50 Program with other voluntary pollution control programs. Before we summarize our findings, however, we present some background on voluntary compliance and the 33/50 Program itself.

The movement toward voluntary compliance

In 1984, a poisonous gas leak from a Union Carbide pesticide plant in Bhopal, India, killed more than 2,500 people and

permanently disabled some 50,000 more. Since then, the potential for accidental chemical releases has worried residents of communities near industrial plants, who have wanted to know what chemicals these plants are emitting in order to prepare for such releases. U.S. residents began advocating local community right-to-know laws, augmenting a movement for worker right-to-know laws that had begun in the late 1970s.

The chemical disaster in Bhopal also catalyzed the movement for a federal community right-to-know law. In 1986, Congress passed the Emergency Planning and Community Right-to-Know Act, which embodies the principle of public disclosure. The act requires all manufacturing facilities to report annually on releases and transfers of more than 320 toxic chemicals. This reporting has resulted in the creation of a national database called the Toxics Release Inventory (TRI).

One of the results of mandated public disclosure has been public pressure for accountability. Such pressure may be exerted by consumer groups, citizen

action groups, or the media. Even the mere anticipation of public pressure can lead companies to alter their behavior, as it did in the case of Monsanto.

When the TRI was first publicly reported in 1987, Monsanto discovered that it was one of the largest polluters. This discovery led the company to pledge to reduce its toxic air releases by 90 percent by the end of 1992. Several features of this pledge are striking. First, the pledge was voluntary, as the company was not violating any environmental standards. Second, it came from the highest echelon of the corporation—in fact, from Richard Mahoney, Monsanto's chief executive officer. Third, it set a trend for other polluting firms to follow.

While public disclosure prompted Monsanto to act before consumers, citizen action groups, and the media had time to react to the TRI information, other companies needed more urging. Soon after the first TRI was reported, the *New York Times* published a full-page advertisement, which was sponsored by citizen action groups, highlighting the top ten corporate land polluters, water polluters, and air polluters. Firms that figured prominently in the ad immediately approached EPA and pledged to improve their environmental performance.

By the late 1980s, many companies that had not been at the forefront of environmental stewardship began to adopt a much more proactive environmental stance. Among the results of the companies' inclination toward voluntary action was the 33/50 Program.

The 33/50 Program

The 33/50 Program gets its name from its two-step reduction goals: a 33 percent reduction of chemical releases and transfers from 1988 levels by 1992 and a 50 percent reduction by 1995. The program encourages firms to develop less-toxic substitutes for highly toxic chemicals, reformulate products, and redesign production processes in order to reduce pollution at its source. It focuses on seven-

teen of the 320 TRI chemicals that are highly toxic, are produced by industry in large volumes, and present pollution prevention opportunities. The 33/50 Program stresses flexibility, allowing participants to reduce releases of any of these chemicals into any environmental media (air, land, or water). Since about 70 percent of these releases are into the air, however, the 33/50 Program is primarily an air toxics reduction program.

Participation in the program is voluntary and does not change a firm's responsibilities for complying with environmental laws. Indeed, EPA claims that it will not give preferential treatment—such as relaxed regulatory oversight or enforcement of EPA regulations—to program participants. Because participation is voluntary, commitments to achieve pollution reductions are not legally enforceable—in fact, firms are free to renege. Nevertheless, many companies that have decided to participate in the 33/50 Program have submitted detailed timetables and pollution reduction targets.

Incentives for participation in the 33/50 Program include public recognition by EPA, special awards for outstanding achievements in pollution prevention, and, significantly, the opportunity to take least-cost actions to mitigate pollution. Unlike mandatory programs, this voluntary program allows firms the flexibility to make the emissions reductions that are most cost-effective for them. Moreover, EPA provides assistance to the companies making these reductions by conducting regional pollution prevention workshops and by providing access to the agency's Pollution Prevention Information Exchange System.

Voluntary pollution reduction programs such as the 33/50 Program appeal to regulators because the programs require EPA to engage in no costly rule-makings. Furthermore, they save regulators the substantial costs of monitoring and enforcing compliance.

EPA initiated the 33/50 Program in February 1991, when it invited 555 companies with substantial chemical releases to participate. It later extended

this invitation to all other firms that release chemicals targeted by the 33/50 Program. As of March 1994, the agency had invited more than 8,000 companies to participate in the program. To date, nearly 1,200 of these firms have done so.

The 33/50 Program has been hailed as a success. It exceeded its 1992 interim goal (a 33 percent reduction in emissions) by more than 100 million pounds—a reduction of more than 40 percent from 1988 emissions levels. According to the projections of participating firms, the 1995 target is also likely to be achieved.

Participation by industry and EPA region

Since participation is critical to the success of voluntary pollution reduction programs, we examined the factors that may have led 1,100 of the more than 7,000 firms in our study sample to take part in the 33/50 Program. Our analysis revealed substantial variation in the willingness to participate among different industries and EPA regions. Among industries, this variation may be explained by levels of advertising as well as research and development (R&D) expenditures; the strength and environmental commitment of trade and manufacturer associations; and each industry's market structure. Among EPA regions, the variation may be due to differences in the regions' environmental regulations. We look at each of these factors in turn.

The amount of money an industry spends on advertising and on R&D helps to explain which industries participate in the 33/50 Program. Industries with high advertising expenditures tend to have high levels of contact with consumers. If consumers are environmentally conscious, we would expect that participation in the 33/50 Program would be higher among industries that produce final products, and hence have a lot of consumer contact, than among industries that produce inputs to final products. When we tested this hypothesis using advertising expenditures as a proxy

for consumer contact, we found that the greater an industry's advertising expenditures, the greater the likelihood that it participates in the 33/50 Program. Industries with high R&D expenditures are also likely to participate in the program, perhaps because a commitment to developing new products is consistent with the program's goals.

The comparative strength and environmental commitment of trade and manufacturer associations is another factor in industry participation: industries with associations that exert a strong measure of influence on members' actions and that stress environmental stewardship are likely participants. The high participation rate within the chemical industry may be owing in part to the fact that all members of the Chemical Manufacturers Association must join Responsible Care, an initiative with goals similar to those of the 33/50 Program.

The market structure of each industry may also help explain which industries participate in the program. Recent trends in "green" marketing and in consumer awareness of environmental issues, as well as theoretical work on firms' environmental performance, provide a basis for the expectation that firms compete on environmental variables, particularly when they are part of an industry in which competition is great and individual market shares are small. We confirmed this intuition in a study of a small sample of firms for which we were able to combine financial (or economic) information with toxic release data. The study indicates that unconcentrated industries, in which firms have many competitors (and hence small market shares), are more likely to participate in the 33/50 Program than concentrated industries.

Within EPA's ten regions, the variation in willingness to participate may be a result of differences among the regions' environmental regulations. In some regions, EPA may mandate pollution prevention laws or toxics reduction laws that complement 33/50 Program goals. In regions where this is the case, willingness to participate may be relatively high.

Moreover, regional variation may reflect the varying stringency of environmental regulations in individual regions. It may also be a measure of the effectiveness of EPA's regional coordinators in recruiting firms to join the 33/50 Program.

Participation by individual firms

Our research revealed many determinants of the willingness of individual firms to participate in the 33/50 Program. Overall, we found that only a small percentage of the invited firms in any one industry chose to participate (see figure, p. 9). However, the firms that did participate were responsible for a large percentage of their industry's toxic emissions (see figure, p. 10). Specific determinants, such as the volume and number of 33/50 chemicals and other TRI chemicals that a firm emits, a firm's size and financial health, and the intensity with which EPA tries to recruit it, are considered next.

Firms that use high volumes of the seventeen chemicals targeted by the 33/50 Program (as well as of other TRI chemicals) obviously have the potential for making the largest aggregate reduction in releases of these chemicals and are more likely to participate in the 33/50 Program. By voluntarily reducing these releases, these firms may benefit from consumer goodwill.

In certain circumstances, however, the larger a firm's release intensity (as measured by the volume of chemicals emitted per volume of sales), the more unlikely it is to participate in the 33/50 Program. Firms with high release intensities will incur high costs per volume of sales if they switch to alternative chemicals and production processes.

The number of chemicals a firm releases is also a significant determinant of its willingness to participate in the 33/50 Program. Firms that emit a large number of chemicals are more likely to participate, perhaps because these firms possess greater opportunity and flexibility to develop less toxic chemicals.

Holding other factors constant, large firms, as measured by number of employees, are also likely to join the program. These firms may enjoy greater benefits from participation than small firms because they typically serve a larger market demand and because improved environmental performance may generate employee goodwill. Compared with small firms, large firms may also feel more pressure to participate in the 33/50 Program. Large firms have more shareholders, and shareholder pressure for environmental consciousness could spur program participation.

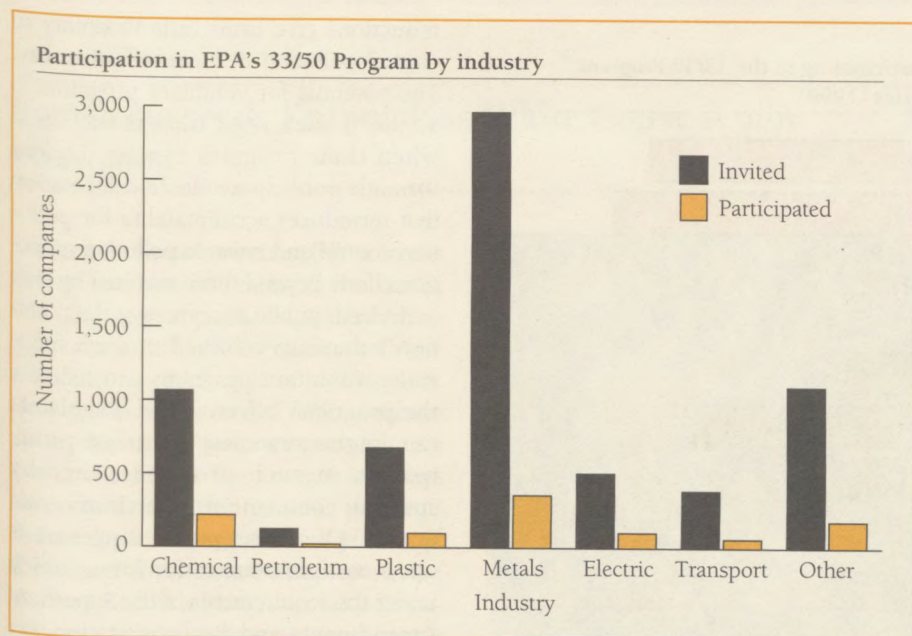
While large size increases the likelihood that a firm will join the 33/50 Program, the fact that a firm has a large number of facilities does not. This finding is contrary to our expectation, since firms could theoretically benefit from public recognition, even if just one of their facilities participated in the program.

Financial health and profitability is another determinant of participation. Increased earnings provide opportunities for firms to invest in pollution prevention. While profitability increases the likelihood of participation, our analysis showed that its effect on the firms in our study sample was not significant.

A significant determinant of a firm's willingness to join the 33/50 Program is the intensity of EPA contact. EPA consulted extensively with the 555 companies it initially invited to join the program. At one point, participation among these companies was as high as 60 percent. By contrast, the participation rate among the approximately 6,000 companies EPA later invited to join the program has been less than 15 percent. With these companies the agency had comparatively little contact.

Distinguishing between TRI and 33/50 Program emissions reductions

Once we knew something about the industries and firms that participated in the 33/50 Program, we wanted to know



whether emissions reductions made by program participants were attributable to the 33/50 Program or to the disclosure requirements of the Toxics Release Inventory.

Our research indicates that program participants are not free-riding on the reductions that they made in response to TRI disclosure requirements, which went into effect in 1988. Instead, the 33/50 Program has induced firms to modify their toxic emissions, as is clear from the changing pattern of toxic releases since the program began.

Our analysis suggests that, between 1988 and 1990, releases and transfers of the seventeen chemicals targeted by the 33/50 Program fell by 16 percent, while releases and transfers of other TRI chemicals fell by 24 percent. This pattern changed dramatically after the 33/50 Program was initiated. Between 1990 and 1991, releases and transfers of 33/50 Program chemicals fell by 21 percent, while releases and transfers of nonprogram chemicals fell by only 8 percent. The 1992 data reveal that reduction rates for the program chemicals are four times those reported for other TRI chemicals. A breakdown of these data by program participants and nonparticipants reveals that both groups have increased their

reductions of chemicals targeted by the 33/50 Program. This suggests spillover effects from the program. The availability of more environmentally friendly products and chemical substitutes has made it easier for even nonparticipants to achieve emissions reductions.

But could reductions in chemicals targeted by the 33/50 Program be "crowding out" potential reductions or even increasing emissions of other chemicals? The answer is probably "no." We found that releases and transfers of nonprogram chemicals by program participants have fallen more than 12 percent. This finding suggests that the 33/50 Program has been successful in setting priorities with respect to the chemicals targeted by firms in their pollution control efforts. In addition to encouraging reductions in emissions of some of the most toxic chemicals, the program may also bring about reductions in emissions of other toxic chemicals.

33/50 Program and other voluntary pollution control programs

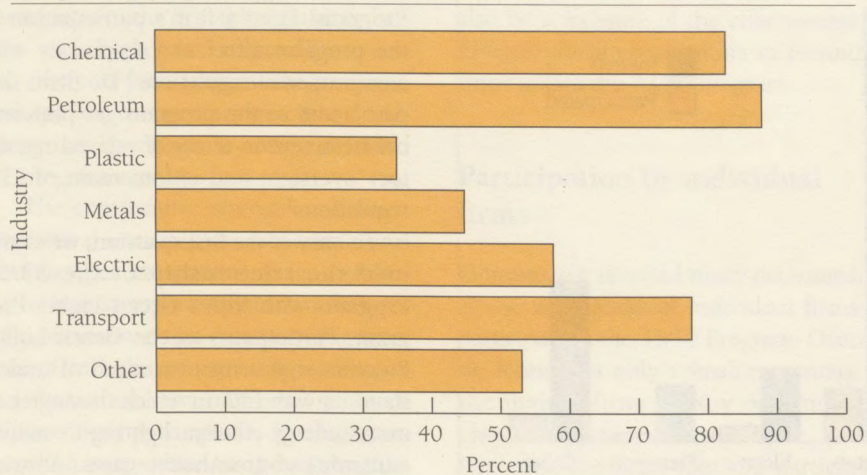
Our evaluation of the 33/50 Program raised three additional questions: Does a

firm's participation in another voluntary pollution reduction program affect its likelihood of participating in the 33/50 Program? Does a firm's participation in the program affect its compliance with environmental regulations? Do firms that participate in the program get preferential treatment in terms of relaxed regulatory oversight and enforcement of EPA regulations?

To answer the first question, we examined the relationship of the 33/50 Program with EPA's Green Lights Program. Participants in the Green Lights Program sign a memorandum of understanding with EPA in which they agree to install energy-efficient lighting to reduce emissions of greenhouse gases. As with the 33/50 Program, the major incentive for participating in the Green Lights Program is positive public recognition. Of the more than 1,000 participants in this program, ninety are corporations that release chemicals targeted by the 33/50 Program. Our analysis reveals that participation in the Green Lights Program significantly increases the likelihood that a firm will participate in the 33/50 Program. This observation suggests that "environmentally conscious" firms seek to improve their reputation by participating in several voluntary pollution reduction programs at the same time.

Our second question was prompted by fears that firms can use participation in the 33/50 Program to circumvent some environmental regulations under the Clean Air Act. Skeptics of the program argue that this participation may be a way to obtain an extension for complying with certain of the act's requirements. While such an extension may be obtained through participation in the 33/50 Program, it is more appropriately obtained by participation in the Early Reductions Program. Any reductions in hazardous air pollutants documented under the Early Reductions Program may be credited under the 33/50 Program and vice versa. Unlike the 33/50 Program, however, the Early Reductions Program is more stringent and is, in fact, enforceable.

Releases of toxic emissions by companies participating in the 33/50 Program as a percentage of emissions for their industries (1990)



If firms could obtain extensions for compliance with regulations under the Clean Air Act through participation in the 33/50 Program, the success of the program as an alternative policy tool would be diminished. The ability to obtain such extensions would suggest that firms' participation in the program was not really motivated by the desire to gain positive public recognition. However, there is no evidence to support this theory.

Our third question was prompted by the concern that firms participating in the 33/50 Program might get preferential treatment from EPA, despite the agency's claim that it would not relax regulatory oversight or enforcement for program participants. Our examination of enforcement decisions made and penalties proposed in 1993 under the Toxic Substances Control Act (TSCA) provides some evidence that supports EPA's claim. Of the twenty-three companies that were fined under TSCA during that year, eight were participants in the 33/50 Program. These eight companies also received the highest fines. Even within the toxics unit of EPA's enforcement program, participation in the 33/50 Program does not seem to reduce substantially inspections or penalty settlements.

In the enforcement of other environmental laws and programs, EPA intervention on behalf of participants in the 33/50 Program is probably even less likely. Since the 33/50 Program is federal and since most of EPA's enforcement takes place at the state level, widespread intervention in state enforcement programs on behalf of program participants is unlikely. However, participants might believe that they can get preferential treatment, even though EPA's enforcement behavior does not appear to corroborate this belief.

Implications of the 33/50 Program

Our research reveals that the companies with the largest amounts of toxic releases are most likely to take part in the 33/50 Program. This suggests that this voluntary program may achieve substantial pollution reductions because it targets firms with the greatest pollution reduction potential.

Our research also indicates that a voluntary approach to pollution reduction could augment existing command-and-control regulation, under which mandated pollution reductions and prescribed technologies for achieving those

reductions give firms little flexibility to control pollution in a cost-effective way. The potential for voluntary programs to augment such regulation is increased when their progress can be tracked through publicly available information that introduces accountability for pollution control and rewards pollution reduction efforts beyond those required by law.

Indeed, public awareness of the pollution reductions achieved through innovative voluntary programs can increase the programs' effectiveness. Regulators can use this awareness to increase participation in such programs, thereby spurring competition in environmental quality. Of course, public disclosure is not a costless exercise for firms, which under the requirements of the Superfund Amendments and Reauthorization Act must report their releases and transfers of chemicals. Estimates of doing so have ranged from EPA's conservative estimate of \$4,000 per TRI chemical to the Chemical Manufacturers Association's estimate of \$7,000.

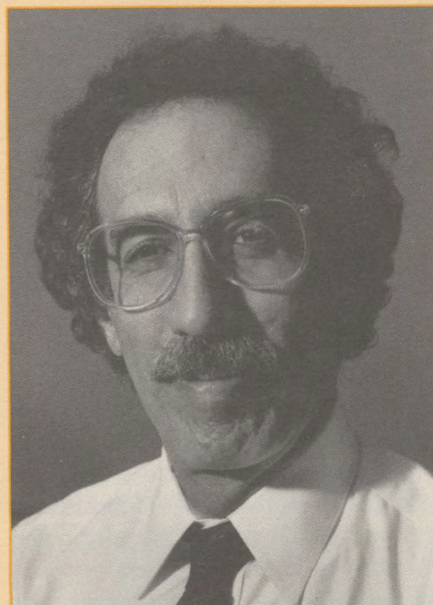
The benefits, in terms of consumer goodwill, might outweigh the costs of such disclosure when a firm can document substantial pollution reductions through participation in voluntary pollution control programs. To help ensure these benefits, EPA should provide substantial public recognition and awards to firms achieving such reductions. Greater public awareness of firms' participation in voluntary pollution control programs is key to achieving the program's goals.

Seema Arora, assistant professor of economics at the Owen Graduate School of Management at Vanderbilt University, is a Gilbert White Fellow at Resources for the Future. Timothy N. Cason is an assistant professor of economics at the University of Southern California. Research on which this article is based can be found in RFF discussion paper 94-10, "An Experiment in Voluntary Regulation: Participation in EPA's 33/50 Program," by Arora and Cason, and discussion paper 94-11, "Toward a Theoretical Model of Voluntary Overcompliance," by Arora and Shubhashis Gangopadhyay.

Toman succeeds Krupnick as White House senior economist

Michael A. Toman, a senior fellow in the Energy and Natural Resources Division at RFF, has been appointed a senior economist on the staff of the President's Council of Economic Advisers for 1994-95. Toman will be the second RFF scholar to serve the three-member council as a senior economist. The council acquaints the president with economic developments, appraises programs and policies of the federal government, and prepares the Annual Report of the Council of Economic Advisers. Toman's one-year leave of absence from RFF begins in September, when he replaces senior economist Alan J. Krupnick, a senior fellow in RFF's Quality of the Environment Division.

Since joining the council in September 1993, Krupnick has been working on environmental and natural resource policy. According to Krupnick, the fundamental challenge of the council is one that all economists face—communicating economic concepts, methods, and analysis to noneconomists. "It's a particu-



Alan J. Krupnick

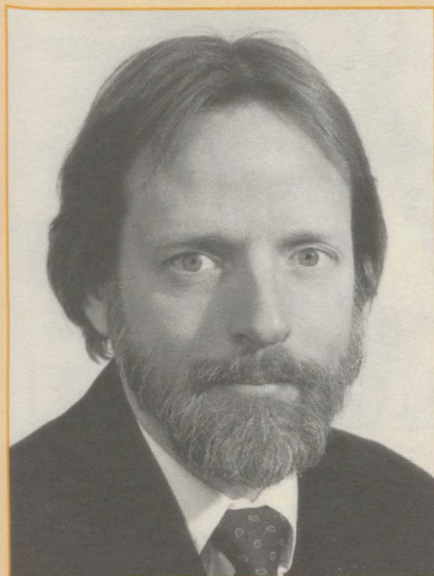
lar challenge in my job because I deal with people who are committed to cleaning up the environment but who do not look at that job from an economic perspective. They do not always or fully consider the trade-offs between environmental improvement and the costs of that improvement to the economy."

Krupnick noted that the council is one of the few places where academics

rotate in and out of the government and that the scarcity of academics can be a challenge in itself. "I have been criticized sometimes for being negative about new ideas for the administration's initiatives and for not being a team player," said Krupnick, "until I explain that, as an academic, I look upon all ideas skeptically—including my own."

Many people around the White House are what Krupnick calls "can-do" people. "They have an idea, and they want to run with it. What the council does is to subject ideas to scrutiny from the point of view of economics, be it the micro or macro paradigm. That does not always win friends," reflected Krupnick, "but hopefully it does win us respect."

The challenge of dealing with noneconomists aside, Krupnick has found work on the council to be exhilarating. "It's an exciting, dynamic place to work, with wonderful and committed people who love to mix it up on policy issues and who are very smart and very quick to get to the heart of the matter," Krupnick said. "Also, it's a real privilege to work with Joe Stiglitz, the council member responsible for covering environmental policies and other microeconomic issues. All in all, I'd say that my year on the council has been a delightful learning experience. I may even have helped nudge the Clinton administration's environmental policies in directions that better address efficiency concerns."



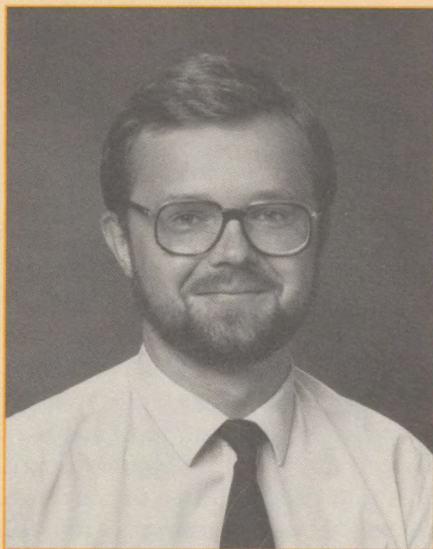
Michael A. Toman

From Russia with a mission

In keeping with a commitment to work on international, as well as domestic, environmental, and resource questions, RFF often hosts scholars from other countries while they pursue research related to these questions. Among RFF's recent visiting scholars has been Vladimir L. Likhachev, deputy director of the Energy Research Institute at the Russian Academy of Sciences. During his just-ended five-

month residence at RFF, Likhachev met with people in government and academia, read up on energy economics, and completed a dozen lectures on U.S. and European energy policy for presentation to graduate and postgraduate students in the Center for Energy, Environment, and Disarmament at the Moscow Physical Technical Institute.

continued on page 12



Vladimir L. Likhachev

continued from page 11

Because the Energy Research Institute provides the scientific basis for Russia's national energy strategy, Likhachev is a key player in helping his country move toward more efficient and environmentally sound energy markets. "By learning about energy policy here in the United States and in other western countries," said Likhachev, "I can envision what the energy policy of Russia and the other republics of the former Soviet Union could be and how this policy could be implemented."

Likhachev noted that he benefited from the opportunity to use RFF scholars as a sounding board for his ideas. "I particularly enjoyed working with Doug Bohi [director of RFF's Energy and Natural Resources Division] because he has expertise in the creation of new market mechanisms in the electricity sector. This kind of knowledge is going to be helpful in formulating special rules of the game during the restructuring of Russia's electricity sector. This restructuring is aimed at creating greater competition and, from an environmental perspective, sustainability."

Likhachev and Bohi are planning to work together on research concerning the institutional framework, regulation, taxation, and pricing policy of an electric industry in the newly independent

states of the former Soviet Union. "This research will have implications for my institute's work with a federal electricity utility back in Russia," said Likhachev. "We are trying to help the utility solve its problems with management and investment policy."

Likhachev believes the knowledge he acquired while at RFF also will be useful to his participation in a cooperative Russian-Ukrainian-Japanese-U.S. project to foster sound energy policies in Russia and Ukraine. Likhachev serves as a rapporteur to the project, in which RFF President Robert W. Fri is also participating as a member of a U.S. advisory group.

When Likhachev returns to Russia, he will be taking part in a project to improve cooperation between Russia and the United States in efforts to deal with the environmental problems associated with Russia's energy production and use. Likhachev reported that U.S. assistance in these efforts is poorly coordinated because different U.S. agencies are working with different Russian institutes. He noted that effective ways to implement this assistance are urgently needed.

Gilbert F. White fellows selected

Resources for the Future has awarded Gilbert F. White postdoctoral fellowships for the 1994-95 academic year to Timothy J. Brennan, Richard Hall, and Jerrell Richer. Brennan, a professor of policy sciences and economics at the University of Maryland, will be conducting research on the justifications for utility subsidies for demand-side management and on impediments to incentive-based regulation in emerging democracies. Hall, an associate professor in the Department of Political Science at the University of Michigan, will study the influence of both public and private interest groups on energy and environmental policymaking. Richer, an assistant professor in the Department of Economics at California State University-San Bernardino, will conduct research on private donations to environmental groups as a means of valuing environmental protection programs.

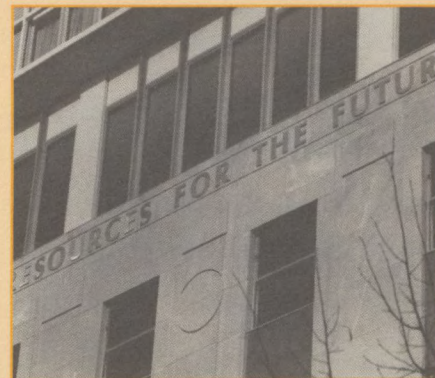


Members of the advisory committee of RFF's Forest Economics and Policy Program gathered at RFF on May 19 to review the progress of the program's activities during the past year. Attending a luncheon at the conclusion of the meeting were U.S. Forest Service Chief Jack Ward Thomas (left) and Adela Backiel (center), deputy assistant secretary for natural resources and the environment at the U.S. Department of Agriculture. Perry R. Hagenstein (right) is the current chairman of the advisory committee.

RFF participates in EPA Energy Star Buildings Program

In June, Resources for the Future volunteered to join approximately twenty other organizations nationwide that are participating in the Energy Star Buildings Program, a program sponsored by the U.S. Environmental Protection Agency (EPA), to increase the energy efficiency of their workplaces. According to Mary Nichols, EPA's assistant

administrator for air and radiation, each participant in the program could obtain energy savings of 40 percent or more through investments in better lights, fans, insulation, and air-conditioning systems. The buildings of organizations taking part in the initial phase of the program will be used to showcase the program.



Winners announced for Joseph L. Fisher Dissertation Awards

RFF recently announced the winners of the Joseph L. Fisher Dissertation Awards, which are given to students in economics and social science disciplines to support their final year of graduate study. To be eligible for the awards, students must be writing dissertations on natural resource or environmental issues. Each of the following individuals received a \$12,000 fellowship in support of the completion of the dissertations indicated.

- Priscilla Cooke, Department of Economics, University of Washington: "Household Heterogeneity and Fuelwood Use by Rural Households."
- Cheryl Danley, Department of Agricultural Economics, Michigan State University: "The Effects of Institutions on Common Pool Resources and Conservation Investments in the Semi-Arid Regions of Zimbabwe."
- Yin Runsheng, School of Forest Resources, University of Georgia: "An Empirical Analysis of Rural Forestry Reforms in China."
- Stuart Siegel, Department of Engineering and Public Policy, Carnegie Mellon University: "A Decision Support System for Electric Utility System Optimization under Uncertainty."
- David Widawsky, Food Research Institute, Stanford University: "Natural Resistance and Pesticides in Chinese Rice Production."

New book

Mining and the Environment: International Perspectives on Public Policy

Edited by Roderick G. Eggert

For centuries, denuded landscapes, dirty air, and fouled streams were accepted by society as part of the price that had to be paid for mineral production. Even initial environmental legislation devised by industrialized countries in the 1960s and 1970s was largely designed without mining in mind, and developing countries had little in the way of environmental policy.

With the advent of sustainability in the 1990s, times have changed. Today's economic development, many now feel, must not come at the expense of an environmentally degraded future. Current policies toward mining are under rigorous review, and mineral-rich developing countries are designing environmental policies where none existed before. The mining industry is more concerned than it was even five or ten years ago about the possible effects of environmental policy on its activities.

In *Mining and the Environment: International Perspectives on Public Policy*, noted analysts offer viewpoints from Australia, Chile, the United Kingdom, the United States, and the European Community on issues and challenges this new concern has raised for metal mining. Their appraisals, prepared originally for the

John M. Olin Distinguished Lectureship Series in Mineral Economics at the Colorado School of Mines, are accessible to readers with no more than general familiarity with economics, environmental policy, and the mineral industries.

Topics examined in the lectures include the appropriateness of using a benefit-cost framework for comparing alternative uses of land, the appropriateness of the notion that those who pollute the environment and benefit economically should pay for cleaning up mine wastes, the challenges involved in formulating national environmental policies in the developing world, the European effort to elaborate supranational policies toward the environment, and the potential of technological innovation to offer an escape from the presumed trade-off between economic growth and environmental quality.

The lectures presented in *Mining and the Environment* will be of interest not only to environmental economists, mineral economists, public policy analysts, and mining industry executives, but also to students and others wanting an introduction to many of the important policy issues in the area of mining and the environment. Roderick G. Eggert is associate professor at the Colorado School of Mines and author of *Metallic Mineral Exploration: An Economic Analysis* (RFF, 1987).

June 1994. 172 pages.

\$25.00 paper. ISBN 0-915707-72-1

Discussion papers

RFF discussion papers convey the preliminary findings of research projects for the purpose of critical comment and evaluation. Unedited and unreviewed, they are available at a cost of \$3.00 each to interested members of the research and policy communities. Price includes postage and handling. Prepayment is required.

The following papers have recently been released.

- "Using Random Utility Models to Estimate the Recreational Value of Estuarine Resources," by Yoshiaki Kaoru, V. Kerry Smith, and Jin Long Lieu. (94-04)
- "Cost-Effective Water Quality Management Strategies in Central and Eastern Europe," by László Somlyódy and Charles M. Paulsen. (94-05)
- "Optimal Pollution Taxation in a Cournot Duopoly," by R. David Simpson. (94-06)

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- "Prices, Regulation, and Energy Conservation," by Adam B. Jaffe and Robert N. Stavins. (94-07)
- "Environmental Regulation and International Competitiveness: What Does the Evidence Tell Us?" by Adam B. Jaffe, Steven R. Peterson, Paul R. Portney, and Robert N. Stavins. (94-08)
- "Estimating an Emissions Supply Function from Accelerated Vehicle Retirement Programs," by Anna Alberini, Winston Harrington, and Virginia McConnell. (94-09)
- "An Experiment in Voluntary Environmental Regulation: Participation in EPA's 33/50 Program," by Seema Arora and Timothy N. Cason. (94-10)
- "Toward a Theoretical Model of Voluntary Overcompliance," by Seema Arora and Shubhashis Gangopadhyay. (94-11)
- "Patent Citations and Appropriability," by David H. Austin. (94-12)
- "Global Forest Products Trade: The Consequences of Domestic Forest Land-Use Policy," by Roger A. Sedjo, Clark Wiseman, David Brooks, and Kenneth S. Lyon. (94-13)
- "Long-Term Water Costs," by Kenneth D. Frederick. (94-14)
- "Cost-Benefit Analysis and International Environmental Policy Decision Making: Problems of Income Disparity," by Dallas Burtraw and Raymond J. Kopp. (94-15)
- "Efficiency v. Bias of Willingness-To-Pay Estimates: Bivariate and Interval Data Models," by Anna Alberini. (94-16)
- "The Impact of a Proposed EPA Rule Mandating Renewable Oxygenates for Reformulated Gasoline: Questionable Energy Security, Environmental, and Economic Benefits," by Vito Stagliano. (94-17)
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- "Valuing Biodiversity: An Application to Genetic Prospecting," by R. David Simpson, Roger A. Sedjo, and John W. Reid. (94-20)
- "Calibrated Nonmarket Valuation," by Young Sook Eom and V. Kerry Smith. (94-21)
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- "Changing Timber Supply and the Japanese Market," by Roger A. Sedjo, A. Clark Wiseman, David J. Brooks, and Kenneth S. Lyon. (94-25)
- "Shifting Gears: New Directions for Cars and Clean Air," by Winston Harrington, Margaret A. Walls, and Virginia McConnell. (94-26)
- "Reducing Emissions from Old Cars: The Economics of the Delaware Program," by Anna Alberini, David Edelstein, Winston Harrington, and Virginia McConnell. (94-27)

About contributions to RFF

Resources for the Future sustains its programs through its endowment and through income from individuals, government agencies, corporations, and foundations. RFF accepts grants on the condition that it is solely responsible for the conduct of its research and the dissemination of its work to the public. RFF does not perform proprietary research.

All contributions to RFF, a publicly funded organization under Section 501(c)(3) of the Internal Revenue Code, are tax deductible. If you would like more information about contributions to RFF, please contact Debra Montanino, Director of External Affairs, Resources for the Future, 1616 P Street NW, Washington, DC 20036-1400. Telephone: 202-328-5016. Fax: 202-939-3460.

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Gift annuities are especially popular now because of the low earnings potential of conservative investments, such as bonds and certificates of deposit. A gift annuity is a combination of a gift to charity and an annuity. Since a portion of the annuity payment is tax-free return of principal, the gift annuity may provide donors with a very substantial income.

A gift annuity can be created with a simple, one-page agreement and may be funded with as little as \$10,000. By setting up a gift annuity, you can make a tax-deductible gift to RFF, which in turn provides a lifetime income at a predetermined rate.

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For more information about gift annuities, gifts of appreciated securities, bequests, or 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.

Recent contributions from individuals

The following individuals made gifts of \$100 or more between March 25 and June 9, 1994, in support of research and education programs at Resources for the Future:

Anonymous (3)	Holland Hunter	Lauren K. Soth
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Joseph M. Dukert	F. Glennon Loyd	William J. Vaughan (<i>in memory of Betty Cawthorne</i>)
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Robert Horst	Cliff and Susan Russell (<i>in memory of Betty Cawthorne</i>)	
Mr. and Mrs. Charles Howe	Milton Russell	

The following individuals made gifts between March 25 and June 9, 1994, in memory of former RFF President Joseph L. Fisher, in whose name RFF has established dissertation awards to support graduate students in the final year of their dissertation research on environmental and natural resource issues.

Jack Alterman	Robert W. Kates	Norman Y. Mineta
Warren and Ann Fisher	Hans H. Landsberg	Howard W. Ottoson
John D. Herbert	Mr. Ralph A. Luken	Dr. James G. Yoho
	Matthew F. McHugh	

Recent contributions from corporations and foundations

The following corporations and foundations made contributions to RFF between March 25 and June 9, 1994:

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	Washington Gas

Twenty Years after the Energy Crisis: What Lessons Were Learned?

Douglas R. Bohi and Joel Darmstadter

Last winter was the twentieth anniversary of the first of two oil price shocks, which had many Americans worrying about whether they could afford to fill up their cars and many analysts fearing severe consequences for the economy. At the time, the so-called energy "crisis" was blamed on the actions of the Organization of Petroleum Exporting Countries, and many experts believed that oil import independence was a crucial U.S. goal. It turns out that U.S. government policies facilitated and aggravated the crisis and that the independence goal is, for many reasons, unrealistic. These are but a few of the lessons that make up the legacy of the energy crisis for today's policymakers.

Twenty years ago, some motorists acquired the foresight to bring along reading matter while sweating out the inconvenience of long gasoline lines. Those Americans would have gotten the impression from their morning papers that they were the victims of a successful effort by the Organization of Petroleum Exporting Countries (OPEC) to dictate the price and supply of world oil. During the winter of 1973-74, a quadrupling of the world oil price encouraged the belief that a new OPEC-dominated era had dawned, with profound implications for oil, energy, and economic well-being. A renewed escalation of oil prices in the wake of the 1979 Iranian revolution reinforced that belief.

Although oil-related economic and geopolitical concerns can never be totally dismissed, a closer look at what

occurred in the 1970s and at what has happened since serves to correct common misimpressions about the causes and consequences of the "energy crisis." As we mark the twentieth anniversary of the gasoline lines that symbolized that crisis, the world oil market seems calm. World oil prices, adjusted for overall inflation, are today but a fraction of what they were expected to be. Still, energy experts note that the proportion of imports in U.S. oil consumption is near its historic 50 percent share. Policy analysts are again asking how important it is for the United States to limit its dependence on oil imports, whether we can do more to use energy more efficiently, and how difficult it will be to manage environmental concerns associated with energy use.

To probe just how much has been learned from the energy crisis, a symposium at the University of Tennessee in April of this year considered the subject, "Twenty Years after the Energy Shock—How Far Have We Come? Where Are We Headed?" At the symposium, we presented a paper that addressed the topic, "The Energy Upheavals of the 1970s: Socioeconomic Watershed or Aberration?" Here we present our findings organized around five broad questions.

What did the energy crisis teach us about the strengths and weaknesses of government intervention in energy markets?

The short answer: U.S. government policies facilitated and aggravated the ener-

gy upheavals of the 1970s. The effects of these policies were far greater than those of the Arab oil producers' limited 1973-74 production cutbacks and of their embargo. Among the government's counterproductive policies, three are especially worth recalling. First, price controls, which lessened incentives to find and produce natural gas, impeded a shift away from oil—this at a time when oil demand had been rising rapidly. Second, oil price and allocation controls, introduced by the Nixon administration in the early 1970s as part of a broader anti-inflation program of price and wage controls, had the effect of channeling U.S. oil demand into greater imports, rather than advancing the goal of reducing imports. This policy contributed, in due course, to abandonment of the mandatory oil import quota program, begun in 1959.

Probably the most misguided intervention during the oil price shock, however, was the entitlements program, under which refiners with access to cheap, price-controlled domestic oil in effect subsidized refiners dependent on costly imported oil. The resulting averaging of imported-oil and domestic-oil prices could not, of course, contain overall price increases as the oil import share rose, but it kept those prices below their unregulated level. The perverse result: Domestic consumption was encouraged, production discouraged. In the course of one year, the United States switched from officially restricting to effectively subsidizing oil imports—an ironic twist to the then-popular view that we were in the grip of a cartel with a demonstrated capacity and will to wreak havoc on the international economy.

Although less directly interventionist, a whole series of government programs came into being. Some—notably an attempt to establish a synthetic fuels industry—were destined to collapse quickly, though not without some hefty bail-out from taxpayers. Other efforts continue to this day.

We note here only a few of those programmatic initiatives. In 1975, Congress

enacted legislation mandating automotive CAFE (corporate average fuel efficiency) standards, continued oil price controls, and created the Strategic Petroleum Reserve. In 1978, it enacted the Public Utility Regulatory Policies Act (PURPA)—which sought to promote innovative resource and technology applications in electricity generation, as governed by avoided-cost criteria—and the Energy Conservation Policy Act (ECPA), which required utilities to provide conservation services and introduced mandatory equipment efficiency standards. The Natural Gas Policy Act of 1978 provided for phased decontrol of wellhead gas prices. Separate legislation committed the nation to decontrol of oil prices. In 1980, the Energy Security Act created the short-lived Synthetic Fuels Corporation (SFC). And so on . . .

With benefit of hindsight, it's easy to critique some of these efforts (like the hopelessly unrealistic synfuel production targets and poor management of the SFC). But other programs deserve a more tempered judgment. To this day, for example, there are respectable arguments over the respective influence of obligatory CAFE standards versus market forces in bringing about the impressive automotive fuel economy gains of the last twenty years. PURPA's directional nudge to much more competitive electricity generation was surely beneficial, notwithstanding some economic distortions occurring in the start-up years. And, of course, oil and gas price decontrol proved critically important.

Before long, the oil price shocks of the 1970s began to produce fundamentally changed views regarding the consequences of an interventionist government and, conversely, the value of unimpeded energy markets—a point reverted to below. While the initial response to the oil crisis, following a well-established tradition, was more government intrusion, within several years it became clear that government regulation would not only fail to extricate us from our problems; it was

responsible for actually worsening the crisis. And so, by the late 1970s, even an interventionist-prone Congress began to realize that existing trends had to be reversed and that only by moving toward less regulated markets could the prevailing encouragement of economic inefficiency be reduced. That process continues to this day, notably in the case of electric and gas utilities.

What insights did the energy crisis provide about the world oil market and, by extension, other resource markets?

Early in 1994, oil was trading at around \$15 per barrel. In real price terms, then, oil is back to where it was prior to the first oil shock. At the same time, OPEC's share of world oil production is markedly down from its mid-1970s high, and energy sources other than oil make up a significantly increased proportion of the global energy mix. In the United States, per capita energy consumption is below its 1973 level. These facts reflect the substantial flexibility with which both supply and demand forces can adapt to changing market conditions.

Yet recall that, amid the concern sparked by the Arab oil embargo and quadrupling of oil prices in the winter of 1973–74, smart people saw OPEC as the likely harbinger of a string of successful commodity cartels around the world. In testimony before Congress in early 1974, Fred Bergsten, then at the Brookings Institution, said, "There can now be no doubt that a large number of primary producing countries will be making steady, determined, and often concerted efforts to raise substantially their returns from a wide range of commodities which they produce. . . through the formation of new OPECs. . . [and] many of them are in an excellent position to do so." And in what seemed to signal a reversal of this country's general aversion to international commodity price

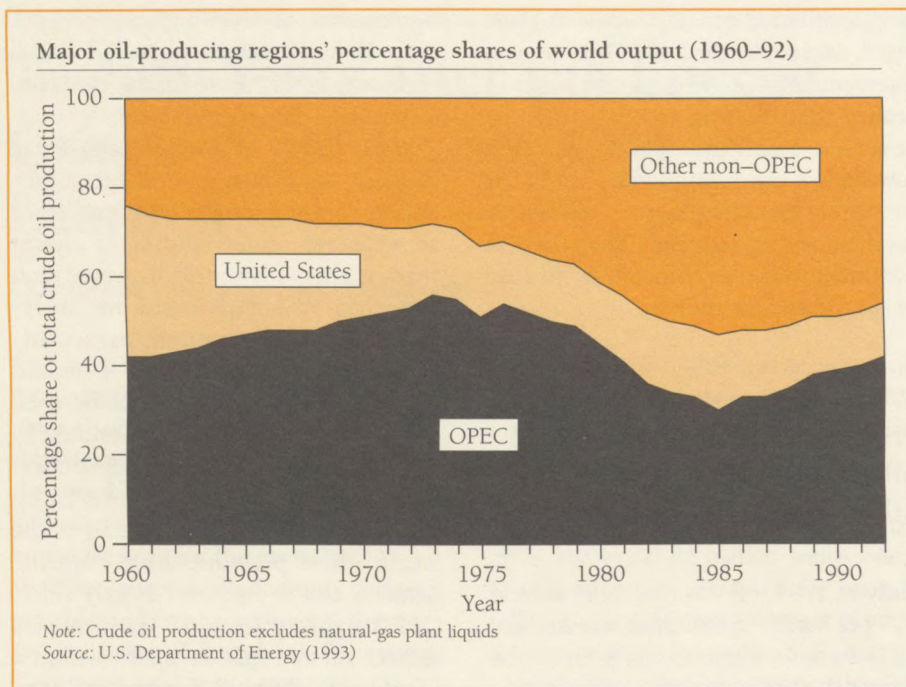
agreements, in 1975 U.S. Secretary of State Henry Kissinger indicated a willingness to contemplate such agreements, at least on a case-by-case basis.

As it turned out, over the last two decades, adjustments in oil specifically and in energy generally have conformed to what our understanding of energy markets should have told us would have happened. As already noted, the energy mix shifted away from oil, particularly outside the United States. Demand slowed, and energy began to be used more economically. Incentives created by the new price realities favored exploration in and new supplies from non-OPEC oil sources (see figure, p. 18). And, in the face of these pressures from both the demand and competitive supply sides, OPEC's ability to make its members respect allotted market shares within a shrinking pie began to weaken and then falter.

Amid all this, the introduction of market instruments long utilized in other commodity markets (for example, futures and spot markets) and new business strategies (for example, dual-fuel capability by utilities) would contribute to both forestalling disruptions and cushioning the effect of those that occurred.

On a somewhat more subtle level, the past twenty years have also made clear the futility of our trying to insulate the United States from the instability of the world oil market. Back in 1974, President Nixon's Project Independence envisaged complete self-sufficiency as a viable American objective. We have since learned that the domestic economy cannot be shielded from events in the world oil market, regardless of how much oil we import. Domestic oil prices are determined by world oil prices.

We have also learned that the United States cannot influence the world oil market without taking into account the actions of the rest of the world. An increase in oil demand or oil supply, whether it originates in the United States or elsewhere, has the same effect on that market. This interdependent feature of the world oil market also means that



policies implemented by the United States alone will have limited effects on the world oil market and could be offset by the actions of other countries. What has long been true for other commodities is now recognized as true for oil.

How worried should we be about oil import dependence?

With falling world oil prices since the mid-1980s raising the imported share of U.S. oil consumption, energy dependence—and the bearing which such dependence may have on energy insecurity and economic vulnerability—remains, for many policymakers and special interests, a charged issue. (Note the successful recent petition to the U.S. Department of Commerce by the Independent Petroleum Association of America for an examination of the security implications of oil import dependence. A finding that a threat to national security exists could be used to invoke protectionist measures.)

At issue are, first, the likelihood of major oil price shocks to oil-importing countries—whether purposefully or acci-

dentally triggered—and, second, the economic consequences of such disruptions. In the spirit of camaraderie that prevailed among oil-importing countries for a few years (partly through the existence of the International Energy Agency, which was created in 1974 to coordinate the energy policies of Western countries), there was hope of being able to stave off such impacts through the use of strategic stockpiles and coordinated demand restraint measures. In fact, that joint strategy never blossomed—in part because the OPEC threat is seen as having receded. Among the initiatives of individual countries, the most visible defensive measure continues to be the U.S. Strategic Petroleum Reserve (SPR), now amounting to nearly 600 million barrels. The evolution of the SPR as an important, but limited, thrust of U.S. energy policy was the early recognition that only at an intolerably high cost could the self-sufficiency preached by Nixon be approached, much less achieved.

Regarding the economic consequences of major oil price shocks, it is worth underscoring two points elaborated by Douglas Bohi in *Energy Price Shocks and Macroeconomic Performance*

(RFF, 1989). First, empirically, the economic damage through lost national output and inflation accompanying the second oil price shock in 1979–80 was uncorrelated with the degree of oil import dependence. And second, conceptually, if what matters is the price of oil—the domestic price of which is determined by the world price—then reducing imports would not alone improve energy security. That recognition shifts the burden of oil import policy to stabilizing the world price of oil during crisis situations, and, to this end, the SPR can be said to offer a sort of backstop strategy, although it begs the question of what stockpile magnitude is justified on cost-benefit terms.

A more basic and unresolved question is whether the vulnerability of the economy to energy price shocks is really as great as some interpretations of the events of the 1970s would have us believe. What is less debatable is that we cannot go wrong by doing what we can to increase the elasticity of energy supply and demand. For example, we can encourage technologies that extend the range of energy options. In addition, through environmentally justified policies (such as, arguably, a higher gasoline tax), we can lower the energy intensity of the economy.

But emotions and myths continue to influence the issue of how best to protect the country from energy shocks. One example: oblivious to the price controls and allocation schemes responsible for the gasoline lines in the 1970s and to our limited capacity to influence the world price of oil, Senator Patty Murray (of Washington) recently voiced her support for an extension of the ban on Prudhoe Bay oil exports, observing that “Alaska North Slope oil provides an insurance policy to consumers on the West Coast that the giant gasoline lines of yesterday will not reappear because of the irrational acts of some Middle East despot or a group of crazed religious zealots” (*Environmental and Energy Study Institute’s Weekly Bulletin*, March 14, 1994).

What did the energy crisis reveal about our ability to analyze, model, and project energy developments?

Again with the benefit of hindsight, it's easy to point to misjudgments made fifteen or twenty years ago, and not just in the policymaking arena. Academics and business planners—in whose judgments policymakers presumably placed some confidence—also turned in a pretty spotty performance. An example in the electric utility sector was the costly failure to perceive the dramatic reduction in electricity demand brought about by higher prices (see figure below). Construction programs based on historic growth rates, and often sanctioned by regulatory commissions, soured as excess capacity, higher interest rates, and (especially in the case of nuclear plants) cost overruns all took their financial toll, at which point many regulators blamed the utilities for imprudent planning.

A key analytical problem was that econometric studies of electricity or, say, gasoline demand provided little historical empirical basis for judging elasticities: the demand—or, for that matter, supply—response to sharply higher prices. In an interesting case of asymmetry, ten-year projections made by the U.S. Department of Energy in 1975 wound up overstating energy consumption by about 25 percent, not because of faulty economic growth assumptions, but because of flawed elasticity measures. At the same time, the projection for the U.S. oil supply led to a 35 percent overstatement. But then economists have always had trouble forecasting oil supply, which after all is predicated not merely on firms' strategic behavior but on technological and geological success as well.

Forecasting failures and scorekeeping aside, the general experience of the last twenty years reminds us that society does respond rationally to economic incentives. People alter the way they consume energy; firms invest in new

technology; and new institutions arise that inject greater efficiency into world energy transactions. In other words, what is taught in Economics 101 tends largely to be true. While these lessons are no guarantee against future energy shocks, the more reliable analytical insights and stronger empirical base that we now have should help us, at the very least, to avoid doing harm and, at best, define more judicious policy choices than those we embraced in the past.

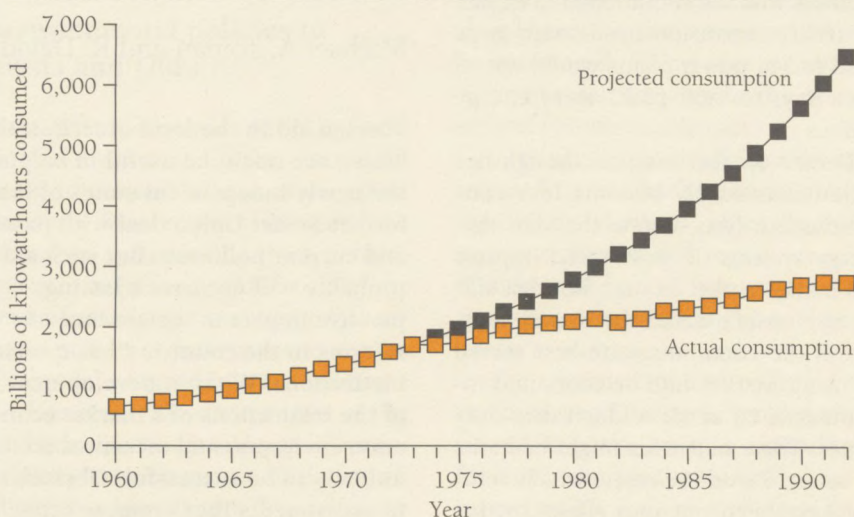
How have oil and related energy shocks altered the way we think about the environmental and other social consequences of energy?

It would be wrong to ascribe to the energy upheavals of the 1970s all the credit for the way in which our consciousness has been raised on the broader social impacts and ramifications of energy—namely, environmental and public health threats, resource scarcity, and sustainability.

Those issues had drawn visible attention *prior* to 1973 in the academic, ideological, and policy arenas. While some expressions of concern had an alarmist edge, there were also more restrained efforts to consider the possible dilemma of having to trade environmental integrity for economic growth and resource demands. The decade preceding the first oil shock also saw enactment of important statutes directed at health, safety, and environment—for example, the Occupational Safety and Health Act and the Clean Air Act. And plenty of examples in the economic literature can be cited that argued for socially efficient means to force polluters to bear the cost of their assaults on common-property resources.

But clearly the energy shocks of the 1970s had the catalytic effect of elevating these issues to a much more prominent plane, in part because alternatives to oil seemed especially vulnerable on environmental grounds. Mining coal was dangerous, and the use of coal released unwelcome combustion products. Synfuels posed a threat of major land disturbance and water contamination. Nuclear power, chronically confronted with

Actual and projected U.S. electricity consumption (1960–92)



Note: Projected electricity consumption for the period 1973–90 was extrapolated from actual consumption during the period 1960–72.

Source: U.S. Department of Energy (1993)

questions of radioactive waste management and proliferation, also had to contend with safety concerns.

These unpalatable alternatives lent substantial credence to those who saw—and continue to this day to see—aggressive attention to conservation as the principal route out of the quandary. Many individuals and groups have sparred over that point, sometimes with only casual fidelity to underlying facts. For example, differences among countries in energy/gross domestic product ratios tended to be almost reflexively equated with differences in successful conservation practices (and therefore capable of being emulated by the wastrels), rather than being seen, at least to a considerable extent, as reflections of differences in industrial structure, housing patterns, and many other factors responsible for variations in aggregate energy intensity among countries.

Closely related to the conservation debate was the more legitimate question about the extent to which market imperfections led to price signals inherently favoring supply options rather than conservation options and, moreover, supply options that (in the view of some) were tilted toward unwieldy “hard-path” facilities favored by technological traditionalists. In that view, planners who are conditioned to equate electricity expansion needs with large fossil-fueled power plants would not be alert, say, to “soft-path” solar energy options.

Debate on these issues, though not stilled, has surely become less contentious. Analysts tend to the view that energy systems do pose social impacts that betray market failures, but that efficiency, flexibility, and the overall interests of the community are best served by using market-like or economic instruments to achieve desirable outcomes. These outcomes might be limits on sulfur dioxide releases, which actually have been put into effect, or, for example, congestion pricing of rush-hour automotive commuting, which has not.

Conclusion

Did the oil price shocks of the 1970s constitute some kind of watershed or defining moment in our understanding of and ability to deal more rationally with energy upheavals, and more broadly, with the larger resource and environmental issues of which they are a part? Clearly, characterizations like “watershed” or “defining moment” are overly theatrical labels for the 1970s, which did not usher in an era in which cartels manipulated petroleum and everything else from Brazil nuts to bauxite. In a couple of respects, the 1970s did represent a significant benchmark: a sobering lesson on the misplaced confidence in the effectiveness of government intervention and, conversely, an appreciation (or maybe rediscovery)

that markets work and that energy is not wholly different from other economic necessities bought and sold in the marketplace. At the same time, notwithstanding the sometimes diversionary and hyperbolic preoccupation with doomsday scenarios, we have developed a heightened consciousness about the prevailing and long-term social impacts of energy that we must continue facing up to. And that is welcome.

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Environmental Policies, Economic Restructuring, and Institutional Development in the Former Soviet Union

Michael A. Toman and R. David Simpson

Foreign aid in the form of technical assistance might be useful in helping the newly independent states of the former Soviet Union deal with past and current pollution. But such aid probably will not have a lasting, positive impact in the absence of reforms in the countries' basic social institutions. Without development of the institutions of a market economy, environmental measures are unlikely to be successful. Obstacles to investments that promote economic and environmental improvements must be removed if these improvements are to be achieved.

Technical and regulatory efforts to improve the management of environmental quality in the former Soviet Union are a focus of programs to provide foreign assistance to the newly independent states that once made up that country. To assess the prospects for the success of these assistance programs, policymakers in the United States and other Western countries must address many basic questions about the new states' environmental policies and their transitions from planned economies to market economies. These questions fall into three categories.

First, what can we expect regarding the investment incentives of firms in these countries? How many low-cost investments that improve both the environment and the economy will the firms undertake, and why are these investments not already being undertaken?

Second, how will the restructuring of enterprises and institutions alter the responses of polluters to environmental policy instruments? Conversely, how do the challenges of restructuring that face enterprises affect the design of environmental policy?

Third, how will environmental policies and fiscal policies interact? How will environmental policies interact with industrial and overall social security policies? For example, where enterprises that are not viable in the long run are being temporarily maintained on social grounds, what investments should be pursued to reduce enterprise losses and environmental damages?

Based on our observations in Russia and Ukraine, and on extensive discussions with experts in those countries, we believe that real progress on environmental problems in the countries of the former Soviet Union will lag until there are substantial and far-ranging reforms in basic economic, legal, and social institutions. We do not deny that some targeted technical assistance could produce substantial improvements in environmental quality and quality of life for individuals affected by the assistance. Without basic institutional reforms, however, it is doubtful that these countries will have the capacity to continue the progress made possible by foreign assistance and to generate substantial environmental improvement on their own.

Our justification for this conclusion goes beyond the observation that the states of the former Soviet Union remain poor and that their resources available for environmental investment remain limited. It also goes beyond the observation that, in the absence of development assistance, excessively strict environmental regulation likely will be politically unpalatable.

Given these countries' current social institutions, it will be costly, if not impossible, to succeed in translating a public demand for environmental improvement into concrete action. The necessary political, legal, and economic accountability needed to do this effectively does not yet exist. Moreover, even if there were agreement on the need for change, institutional failures in the economy would likely raise the cost of enforcing environmental standards well above even the levels experienced under inefficient command-and-control programs in otherwise functional market economies.

These observations in turn raise doubts about the cost-effectiveness of major environmental assistance programs in the former Soviet Union without significant institutional reform there. Evidence is growing that improvement of environmental quality is a highly valued objective in the countries in question. However, environmental quality, as well as economic performance, might be better served first by assistance that helps the countries of the former Soviet Union to develop the institutions of a market economy, including the associated legal institutions of property, liability, and contract law.

Environmental policies in Russia and Ukraine

Environmental policies in Russia and Ukraine illustrate both the disarray in the environmental policies of the countries of the former Soviet Union and the difficulties in improving these policies without progress toward the development of market economies. Environmental policies in these countries consist of a hybrid of standards for emissions and fees on emissions in excess of the standards. Environmental regulators tax pollution at two rates: all emissions are subject to a low tax rate, but emissions in excess of standards set for each source are subject to a higher rate. In principle, environmental regulators also have the

power to order polluters to reduce emissions or to cease operations if the emissions pose a serious threat to public health or ecological integrity.

Emissions standards are based on essentially arbitrary distinctions among hundreds of pollutants. Far more standards exist than regulators can monitor or enforce. Standards also are set rigidly for individual sources of emissions, without regard for differences among the emissions reduction costs for each source or for differences among the impacts of each polluter on actual pollution concentrations. Regulators express

Pollution fees are too low to achieve much environmental improvement. In any any case, at current rates of inflation, increases in the fees are shortly rendered negligible.

concern that flexibility in the ways polluters are allowed to comply with emission standards, as with emission permit trading, would expand the opportunities of firms to exceed their emissions allowances—although current rules already require that emissions sources be monitored. This concern is ironic (even surrealistic), given the current scale of pollution violations.

In principle, these problems could be lessened by overhauling environmental regulations. However, other shortcomings in environmental regulation reflect economic and social concerns, as well as environmental concerns, and thus are harder to address.

The administration of pollution fees in Russia and Ukraine is problematic in several respects. Because expenditures for environmental protection are financed mostly by fees on polluters rather than from general revenues, environmental regulators are faced with a fundamental contradiction: to address envi-

ronmental concerns arising from one set of activities, they must tax pollution from other, quite possibly unrelated, activities. If regulators were to charge pollution fees high enough to encourage substantial reductions of pollution, they would risk undercutting the tax base.

Revenue raising largely motivates the setting of emissions standards. To maintain tax revenues, the government often sets emissions standards a few percentage points below prevailing emissions levels. If the system worked to reduce emissions, it would require a ratcheting upward of standards to raise revenues, compromising firms' incentives to make long-term investments in environmental improvement. However, pollution fees simply are too low to achieve much environmental improvement, especially for state enterprises that do not face the normal budget constraints of a market economy. Moreover, at current rates of inflation, increases in pollution fees are rendered negligible shortly after they are announced.

With fees having little impact on pollution, the only other line of defense is legal sanctions against egregious violators of pollution standards. In practice, however, the problems of economic and political transition render this option largely ineffectual as well. Because so much of the economy in the former Soviet Union remains under state control, attempts to enforce environmental sanctions become intramural conflicts among government ministries. In this situation, the rule of law with regard to the environment often is quite weak, especially in light of the strong vested interests in maintaining enterprise operations that we discuss below.

Aside from problems related to the administration of emissions standards and pollution fees, the allocation of funds for pollution cleanup and reduction projects leaves something to be desired. The determination of priorities for environmental expenditures is not necessarily linked to environmental benefits. Some effort to identify such benefits is made when different expen-

diture proposals are considered. However, an important criterion for allocating funds appears to be the financial need of the local government or enterprise proposing a pollution cleanup or reduction project. Thus funds are often made available for projects that local governments or firms cannot finance on their own, with little regard for the benefits the projects generate by reducing serious health or environmental risks arising from pollution.

Obstacles to making win-win investments

In the long run, the industrial pollution problems of the former Soviet Union can only be overcome by major investments in more efficient and cleaner production processes and equipment. Many such investments probably could be undertaken at very low cost and result in both substantial environmental benefits and lower production costs.

Many investments in more efficient and cleaner production processes and equipment probably could be undertaken at very low cost and result in both substantial environmental benefits and lower production costs.

The existence of such "win-win" investments begs an important question, however: If such options are available, why have they not been pursued? Some of the reasons that these possibilities continue to be unexploited may be traced to the Soviet legacy, others to the difficulties of the transitional period, and still others to problems of information and oversight common, to greater or lesser degrees, in all economies.

One impediment to win-win investments is the morass of regulation and licensing requirements left over from central planning. These requirements make starting new businesses and instituting substantial reforms in existing ones extremely difficult. As a result, they discourage the establishment or retooling of firms that are both more profitable and less polluting.

A second part of the Soviet legacy that impedes win-win investments is the tradition of propping up faltering firms with public funds. This tradition undermines incentives for both increased efficiency and pollution reduction. If enterprise managers know that they will be bailed out with public funds, regardless of the performance of their firms, they have little incentive to seek cost-saving production innovations. Moreover, they may have little incentive to adopt even low-cost solutions to their environmental problems if they believe that these solutions will sooner or later be financed out of public funds.

One ongoing impediment to win-win investments is obstacles to both foreign and domestic private investment. Such investment is limited by several factors. First, the process of privatization has just begun in Russia and is even less advanced in many other states of the former Soviet Union. Second, the institutions that characterize capital markets and the banking system in Western economies are just now coming into being in these countries. For example, corporate law is very incomplete, and accounting procedures that would enable outside investors to determine the value of potential investments have not yet been adopted. Third, taxes on the profits of firms in the countries of the former Soviet Union are substantial. These taxes, along with exchange controls and high inflation (which triggers high interest rates), limit the attractiveness of new investment.

A second ongoing obstacle to win-win investments is the limited capacity of the labor market to adjust to the transition from planned to market econ-

omies. Labor mobility remains limited because workers have traditionally obtained all social services (including housing) through the enterprises that employ them and because internal migration is subject to state control. Another circumstance that has made it difficult for the labor market to adapt to the transition is the financial stake employees have in some newly privatized enterprises. Share ownership in

Ongoing impediments to win-win investments include obstacles to foreign and domestic private investment and the limited capacity of the labor market to adjust to the transition from planned to market economies.

such enterprises is largely concentrated among workers and managers, increasing the financial losses that employees would face if these enterprises fail. Because employees realize that they face risks of financial loss and unemployment in emerging market economies and because they distrust the prospects for success with new investment, they are exerting political pressure for their governments to subsidize firms or to take other measures to prevent firms from failing.

A seemingly simple solution for overcoming the obstacles to win-win investments would be to allow firms to sink or swim on their own merits. However, this solution may not be feasible under the current circumstances of the transition from planned to market economies. These circumstances may combine to deprive even deserving enterprises of the financing they will need to survive. Thus, in deciding which otherwise failing enterprises receive financial aid and regulatory leniency, decision makers in the countries of the former Soviet Union

must distinguish between firms that make obsolete products using archaic production methods and those that are trying to make needed products using newer, cleaner production methods. Moreover, given restrictions on the social "safety net," decision makers need to take into account social factors that may outweigh considerations of narrowly defined economic efficiency in making these decisions.

Thus the limitations on private activity to improve the environment and the economy at the same time also hinder governmental policies for pollution control. While the possibility of publicly funded bailouts exists, polluting firms will be unresponsive to economic sanctions. Moreover, legal or economic sanctions that threaten employment, the viability of enterprises, and the social fabric will be vigorously opposed by enterprise managers, employees, and the branches of government that still oversee polluting industries. As long as public and private decision makers remain unaccountable for their decisions, firms' capacity to change their environmental behavior is very limited.

Institutional reforms

Environmental policies per se probably will have relatively little effect until there is progress toward greater general strengthening of economic and legal institutions. The development and maturation of the institutions of capitalism in the former Soviet Union may be facilitated by increased macroeconomic stability, the establishment of legislation to govern corporate conduct and reduce regulatory barriers to the creation of new businesses, the reform of financial markets, and the revamping of the provision of public goods and social security.

While the transition from planned to market economies proceeds, it is important that environmental policy move in tandem with the general development of economic, legal, and social institutions. For example, while some flexibil-

ity in approaches to the enforcement of environmental regulations is called for, it is also important that decision makers be able to predict the effects of these approaches. Actions that would further decrease the confidence of potential investors could be counterproductive, even if they achieved some short-term environmental improvement.

It is also important that the institutions of environmental policy reflect the changing technical capabilities of regulators, the evolution of judicial and other institutions, and the increased stability of firms. Case-by-case reviews of compliance strategies should be replaced by general regulations that incorporate flexibility in compliance. Incentive-based measures, such as limited emissions-permit trading programs, should be established and expanded as opportunities arise. A more concerted effort to set priorities for environmental expenditures and to limit soft enterprise budgets (budgets that are based on the expectation of publicly provided funds to make up losses) would probably improve the efficiency of environmental expenditures while the economy as a whole makes the transition toward greater private financing of environmental improvements. Finally, some simplification of the environmental standards themselves would be beneficial.

Building better economic and political institutions is time consuming and does not offer the immediate and tangible rewards that technical support systems may afford. However, institutional reforms are crucial if the technical support programs for environmental improvement that are now being championed in foreign assistance debates are to be successful.

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