RESOURCES IS PUBLISHED FOUR TIMES A YEAR. PRINTED IN THE U.S.A.

RESOURCES FOR THE FUTURE
1755 Massachusetts Avenue, N.W.
Washington, D.C. 20036

Nonprofit Org.
U. S. POSTAGE
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This nineteenth annual Highlights issue of Resources *gives an account of events and issues that were of special interest in 1982 and will be of continuing concern for some time to come. The intent is to report events accurately and readably and to provide relevant background information and comment. The treatment is selective, representing the judgments of a number of RFF staff members, and does not purport to be a comprehensive roundup of resource and environmental issues. The views reflected here are those of individual contributors and are not official points of view adopted by Resources for the Future.*

Resources

NO. 72 RESOURCES FOR THE FUTURE, FEBRUARY 1983 ISSN 0048–7376

What works?

AT RFF's 1981 FALL FORUM, U.S. Senator Paul Tsongas (D–Mass.) appealed for "rationality and an approach free of ideology, in which the question is, What works? Not what should work, not what would we like to see work, but indeed, what works?"

While "what works?" is at least an implicit question running through every number of *Resources*, it is the explicit theme of this, our nineteenth annual "Highlights" issue. What were some of the key events of the last year concerning natural resources, energy, and environmental quality, and what do they portend for the near future? Looking further ahead, which trends and issues are likely to shape events for years to come?

Some highlights of 1982. The Reagan administration's move to sell some federal lands provoked outrage. Sterling Brubaker (page 4) finds major problems in federal land management, but concludes that land disposal may have too many political enemies to be implemented.

The last Congress failed to reauthorize the Clean Air and Clean Water Acts. John Mullahy and Paul Portney outline (on page 6) basic information needs of the Air Act, and Henry Peskin predicts (on page 12) that the new Congress will approve the Water Act without much change, but questions whether this is an unalloyed good.

A mild winter only partially stifled the outcry over rising natural gas prices in the midst of abundant supplies. Milton Russell explains (on page 22) how to keep the natural gas debate in perspective.

Last year saw much activity within the Reagan administration concerning electric utility regulation. On page 14, Mark Lyons offers a tour of the issues and interests that make up electric power politics.

The mid-term future. Net farm income now invites comparison with the Great Depression, but Kenneth Farrell argues (on page 17) that too tight a focus on current problems can create lasting damage of greater dimension.

Whatever happened to synthetic fuels? Hans Landsberg and Michael Coda (on page 12) question some basic assumptions about synfuels development and suggest a fundamental shift in purpose for the Synthetic Fuels Corporation.

The federal ban on chlorofluorocarbon-powered spray cans only slowed—not stopped—CFC emissions to the stratosphere. Alphonse Forziati and others lay out (on page 8) damages from CFCs and suggest ways emissions might be further slowed.

The longer term. Are universities now up for sale? Herbert Morton's page 20 article outlines the recent history of corporate–university arrangements and discusses their implications.

China has embarked on an ambitious program to develop private fuelwood plots to help meet her needs for rural energy supplies. On page 10, Robert Taylor assesses China's progress.

Resources begins with Mancur Olson's sweeping examination of what works—and what does not—for national economies. Why is the United States mired in recession? What accounts for differences in national and regional performances? Olson advances a unique and provocative answer.

Why both the Right and the Left have failed

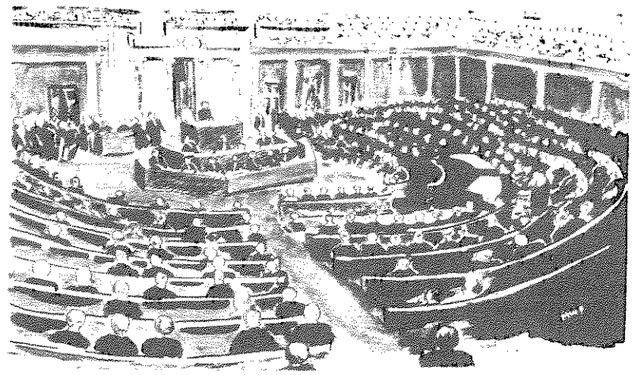
EVERY AMERICAN—no matter how partisan—realizes that neither major political party has had much success lately in making the U.S. economy work. President Carter was denied a second term in part because of the sad state of the economy, and President Reagan certainly has yet to deliver the prosperity he led voters to expect. We must go back to the administration of Lyndon Johnson to find a time when the economy was performing reasonably well, but it was during his presidency that today's inflationary policies began. This succession of failures should make us wonder if the familiar economic ideologies of the Right and the Left are sufficient to deal with the current economic crisis.

The experience of other developed countries offers still more reasons for questioning these ideologies. None of the doctrines is sufficient to explain why some economies have been performing relatively well while others have been doing poorly.

Great Britain's economic performance has been worse than that of any comparable country. This poor-growth performance began in the last two decades of the nineteenth century, when that country had perhaps the closest thing to laissez faire that the world has seen, became conspicuous after post-war Labour governments had created a welfare state, and continues today under Prime Minister Thatcher's Conservative government.

The Federal Republic of Germany and Japan, by contrast, enjoyed "economic miracles" after World War II, and lately have suffered less stagflation than Great Britain and the United States. I suggest that it was not the economic ideologies of these countries that was mainly responsible for their growth.

Within the United States the industrial northeastern and midwestern states have declined economically, while the western and southern states have grown, even though all regions of the country are subject to the same succession of national administrations and economic policies.



Interest group influence

A clue to the reason for this is offered by the lobbies that influence our political system and the groups that combine in the marketplace to raise prices or wages—the pressure groups, labor unions, farm organizations, professional and trade associations, and groups of firms colluding to fix prices. Such organizations are a disparate group, to be sure, but they all share a common problem.

All—whether acting as lobbies or cartels—provide some benefit or service that automatically goes to everyone in a category, even if they have not borne any of the costs of the collective action. If a lobby wins a tariff or a tax loophole, every firm in its category benefits. If a labor union negotiates a higher wage, every worker in its category receives the extra pay.

It follows that, at least in large groups, it is expedient to be what economists call a *free rider*: you get the benefits from collective action by others whether or not you have contributed. Since your individual efforts will not be sufficient in any case to change the outcome appreciably, it pays to "let George do it." But George also is better off if he contributes nothing. The individual bears all of the costs of any action he or she takes in the interest of the group, and in a large group gets only a minuscule share of any gains brought about. Thus, it is irrational to contribute voluntarily.

Those large groups that succeed in organizing have devices (often covert) that can punish the individuals who refuse to join or reward those who do. These range from the union shop, the "closed bar," and social pressures, to health and welfare benefits and patronage dividends. Any large organization for collective action that lasts has some selective pressures or rewards that, unlike the collective benefits the individual would get anyway, offer the individual an incentive to participate.

The few versus the many

Since large-scale collective action requires coercion or subtle rewards, and these inducements are difficult to arrange, it can take a very long time before any given group succeeds in organizing. In particular, both favorable circumstances and able leadership are needed for success. A favorite example: when a large shipment of ripe strawberries arrived at a warehouse on a hot day and needed immediate shipment to retailers, a young Jimmy Hoffa seized on that moment to organize the workers into a union. In any society it takes a long time before every group will have both the circumstances and the leadership needed to organize.

Once an organization is successfully established, however, it is likely to keep going indefinitely unless destroyed by some violent upheaval. The officers are not likely to close down an association that gives them jobs and power, and members can be retained by the devices that require or reward membership. Thus, any society that does not destroy organizations for collective action in violent convulsions will accumulate more of them as time goes on.

Such organizations lobby for special legislation—government subsidies or tax loopholes—or restrict the supply of goods or workers' output to obtain monopoly prices or wages. Special interest legislation and cartelistic prices and wages greatly reduce the productivity and efficiency of the economy. The organizations therefore usually do not produce anything themselves; rather, they struggle to get a larger share of what society produces for their members.

Just as with the free-riding individual, a typical special interest organization (representing only a small part of the whole society) receives all of the extra share of society's output that it has won in distributional struggle. But it bears only a minuscule share of the loss in society's productivity. Accordingly, most special interest groups are like wrestlers battling over the contents of a china shop: they destroy more than they carry away.

In some parts of the world, such as Scandinavia and West Germany, some organizations encompass such a large part of society that their members bear a large share of any loss in society's productivity that results from the organization's policies. Such an encompassing organization has an incentive to keep any reduction in society's output to a minimum. Tellingly, none of the special interest organizations in the United States or in Great Britain encompasses enough of the society to have an incentive to take into account the effects of its policy on the productivity of the society.

Now we see why Germany and Japan enjoyed economic miracles. Totalitarianism and Allied occupation destroyed their special interest groups, and some of the organizations that have been created since the war are relatively encompassing. South Korea and Taiwan have grown so rapidly because, as colonies of Japan, they had not been allowed to develop independent organizations.

Britain is the slowest growing of the developed democracies because it has the longest history of stability and freedom from invasion. In the United States, the older northeastern and midwestern states are declining economically because they have had a longer time to accumulate special interest organizations than the more recently settled West or the defeated South. Neither of the political parties can make the economy work any longer because the special interests are more numerous than ever, and neither the left-wing nor the right-wing ideologies recognize this.

Steps in the right direction

The situation is depressing. Is there any way to alleviate or eliminate the problem, apart from a violent upheaval in the political system? Yes, there are some actions that probably would ease the problem now, and a fundamental solution might be feasible later.

The situation might be improved a little by encouraging special interest organizations to become more encompassing. They still would be concerned mainly with distributional struggles rather than production, but they would then have an interest in minimizing the loss in output that results from such struggles.

A better way to lessen the problem is promised by some remarkable examples of economic growth. The six founding partners of the European Common Market grew rapidly in the 1960s. Germany, a relatively poor area in Napoleon's time, grew rapidly after it created its Zollverein, or customs union, and then established a unified state. Japan began to grow rapidly after its Meiji restoration in 1867–68. Going farther back, Great Britain began its commercial and then its industrial revolution after strong monarchs or central governments replaced its mosaic of medieval fiefs and semiautonomous towns with a unified nation-state. The United States grew impressively in earlier periods of its history.

In all of these cases, a much wider market was created within which free trade prevailed, either by agreement to eliminate tariffs or by national unification that eliminated local restrictions on trade. The power to determine many economic policies was shifted to some larger jurisdiction.

The widening of the market took away the restrictions that protected the special interest groups from outside competition. In preindustrial Europe and in Japan these special interest groups mainly were guilds, especially those of merchants and masters. As soon as consumers were free to buy manufactured goods and handicrafts produced outside of their town, more efficient industries sprang up in rural areas, new towns and suburbs—places with no guild restrictions. The shift of economic policymaking to larger jurisdictions required lobbies of a larger scale that could not be created quickly, so the guilds could not get the government to repress the industry.

Freer trade also can ease the current economic crisis. Indeed, such international trade as we now permit is forcing the United States to reform or move out of highly concentrated and heavily unionized industries, such as steel and automobiles, into areas, such as high technology, where there are fewer special interest organizations. If America takes the road to a brighter economic future, it will drive in foreign-made cars.

Eventually, the problem might be solved by tackling it head on. If the diagnosis set forth here should someday come to be generally accepted, then policies to cure the disease would become politically feasible. National leaders could simply repeal all special interest legislation and vigorously and impartially apply antitrust laws to every combination to obtain monopoly prices and wages. But this will not happen until either the left-wing ideology, or the right-wing ideology, or both of them, begin to take account of the most serious obstacles to economic progress that the nation faces.

Author Mancur Olson is a professor of economics at the University of Maryland and a consultant to RFF's Quality of the Environment Division. This article, based on his new book, The Rise and Decline of Nations, *is adapted from an article in* Newsday *and is published here with its permission.*

Cassettes available

MANCUR OLSON DISCUSSED *The Rise and Decline of Nations* in an RFF-sponsored FOCUS radio show broadcast nationwide in January. Entitled "Focus on Economics and Society," the program was selected by National Public Radio for inclusion in its catalog of cassette offerings. Readers of *Resources* who would like a half-hour audio cassette of the show may order one from National Public Radio—Customer Service, Post Office Box 818, Niles, Michigan 49120; enclose a check or money order for $9.00 (purchase orders are accepted only from institutions). To order with MasterCard or VISA, call toll-free (800) 253-0808; in Michigan, call (616) 471-3402.

Also available, direct from RFF, are half-hour cassettes of "Focus on U.S.–Japanese Agricultural Trade," featuring Emery Castle and Fred Sanderson (see *Resources* No. 71). Send a check or money order for $9.00 to Patricia Parker, Resources for the Future, 1755 Massachusetts Avenue, N.W., Washington, D.C. 20036. Sorry, no phone orders.

Both shows were hosted by Harry Ellis, senior economics correspondent for the *Christian Science Monitor* and regular panelist on the PBS television show, "Washington Week in Review."

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Land, lots of land

IN THE HEADY CHAMPAGNE of federal policy debates, proposals to sell off federal lands are merely one small bubble. But over the past year that bubble has risen to the top. It also may have popped.

The first century of U.S. history was an active time of acquisition and disposal of federal lands as the new republic spread across the continent, giving geographic, demographic, and social content to the concept of manifest destiny. There followed a pause in which park and forest lands were reserved from disposal, even while croplands and some grazing lands continued to make their way into private hands. By the 1930s, with the economy in shambles and important areas of the country suffering from wind and water erosion because of imprudent use, the era of disposal came to an effective halt. This shift was formalized by the recommendations of the Public Land Law Review Commission in 1970 and by the enactment of the Federal Lands Policy and Management Act of 1976, which committed the government to intensive, multiple-use, environmentally sensitive management of most remaining federal lands—a management style that already had been gathering momentum for a quarter-century.

Rebels, right turns, revenue raising

With the issue apparently so firmly and recently settled, what should one make of the current effervescence? It appeared first as the Sagebrush Rebellion, in which a few western states sought to assert claims to the federal lands—lands which in some cases comprise half or more of their territory. But that was only the most dramatic manifestation of a growing frustration with federal management felt by many ranchers, foresters, and recreationists. Stricter laws and regulations, rising prices for the potential output of federal lands, and greater competition as the land has grown more valuable all focused unprecedented attention on federal land management.

This stirring coincided with new ideological and budgetary pressures. Although conservationists and some political liberals continue to place their faith in scientific management and (somewhat inconsistently) in politically responsive solutions to federal land use problems, many other citizens are turning away from the long ascendancy of American liberalism toward a more constricted view of the role of government. At the same time, the Reagan administration, faced with an embarrassingly large deficit, perceived a double-edged opportunity to raise some revenue through land sales while diminishing the size and reach of government. Under the flag of "asset management," proposals were advanced for modest sales of federal lands, with the hint of more to come.

Of course, there is no one correct line between the private and government sectors in modern societies, but in the United States the general rule and most of the public rhetoric is on the side of private management unless special circumstances prevail against it. What, then, explains the persistent anomaly of federal ownership of almost one-third of the nation's land, most of it used primarily for commodity production of a sort identical to that occurring in the private sector? History, inertia, and balance among competing interests each play a role, but the intellectual rationale for this outcome is far from clear.

Contending views

Classic conservation arguments stressed the danger of resource exhaustion (especially of timber) under private management, watershed and environmental damages charged to private operators, and the lack of long-run private interest in maintaining the productive capability of the land. Trained government managers were seen as appropriate guardians of the long-run viability of resources using scientific management criteria that in many cases would not appeal to private owners.

However, as Marion Clawson has noted, while the land has been publicly owned, most of the uses on it have been privately managed. As ranchers, recreationists, environmentalists, timber operators, miners, and local communities all learned to defend their interests in the use of federal land, the ideal of scientific management became bound in uneasy partnership with political decisions that sought to balance the competing interests—a system some term *interest-group liberalism*. Criteria of efficient management have been attenuated, and political decisions have come to predominate. With so many interests contending, the inevitable course has been to pry open the federal treasury to satisfy them.

Critics of federal management see these problems as the predictable result of the lack of private property rights. They argue that the original fears of resource shortage were misguided. As the age of resource plenty has receded, private operators have proved quite willing to grow trees or grass. Moreover, the critics expect private operators to do so more efficiently because they are motivated by the discipline of the market to be more agile in their management and investment decisions and more responsive to changing circumstances.

Nonmarket benefits

But are there other products of the federal lands that public management can provide that would be neglected by private owners? Most of the federal land in question is in the multiple-use category and is expected to produce not only marketable commodities but nonmarketable benefits as well, including watershed protection, wildlife habitat, and recreation. Private firms usually lack incentives to produce optimum amounts of nonmarketed goods. Presumably they could be induced by a combination of regulation and incentive to protect the environment and provide habitat for wildlife in addition to producing commodities efficiently for their own account. But neither defenders nor critics of public ownership have focused much on this possibility. One reason may be that no one knows even how to define an optimum mix—under either system of management—much less how to secure it.

Most people feel that unique scenic and ecological resources, such as are found in the national parks and much wilderness land, should remain in federal hands to assure their continued existence for all Americans, present and future. When one departs from these lands, however, to examine the more ordinary timber, grazing, and recreation lands that make up most of the federal estate, this consensus begins to dissolve.

It is easy to imagine various ways in which private or local public entities could substitute for federal control on much of the land. Public corporations might be used to ensure greater financial responsibility in management. Long-term leases could be contracted under which private managers would produce the output. Responsibility for recreational and watershed lands used by local or regional populations might be turned over to local authorities. Or lands with obvious commercial uses could be sold outright. In all cases the terms of the arrangement could, if desired, provide for environmental protection and some degree of public access much like that presently enjoyed.

Vested interests

In truth, the present system has powerful inertia. The parties at interest know fairly well where they stand and have adjusted to that situation: changes could be risky for them. And, because the federal government spends a good deal to manage the land, any change that weakens the federal commitment threatens to reduce financial support that benefits the most influential parties.

Ranchers, once ardent Sagebrush Rebels, have grown concerned that competitive sales of grazing lands might place them in competition with better-funded oil companies and urban cowboys. By contrast, their below-market federal grazing fees and routinely renewable permits to use the land look attractive. Miners like their free access to hardrock minerals and the comparatively open-handed approach to leasing of other minerals. They are content to hang onto that while badgering the government to limit wilderness and other withdrawals of land. Some forest industry firms would welcome a chance to buy timberlands, but others depend on the right to bid for federal stumpage—a standoff. Most recreational use is free or at nominal charge, and users are not anxious to see changes. State and local governments already receive most of the revenues generated on federal lands while providing only minimal services to them. Absent any clamor from their citizens, they are in no rush to claim responsibility except on a selective basis.

Those who lose under the present arrangement are the nonusers—mainly eastern taxpayers who subsidize western commodity producers and recreationists. However, most easterners are neither vitally interested nor widely informed on these matters and they are not easily inflamed over remote resource issues. Even when they are concerned, often they are inclined to romantic notions about a pristine West in which they own a share; they, too, become defenders of the status quo.

Federal mismanagement?

Meanwhile, serious-minded complaints about federal management abound. Both the forest and grazing lands operate at large deficits even though no capital charge is made for the land. Most national forests outside the Pacific Northwest are not commercially viable for sustained timber production. Analysts have figured that managing the surface estate of grazing lands costs about four to five times the revenues generated by that use. Are these discrepancies matched by the value of nonmarketed goods produced on the land? No one ever has established that to be the case. In fact, it seems implausible for much of the land, which is without any special distinction.

Some who are committed to federal ownership plead that management deficiencies can be corrected. One suggestion has been to inject more economic analysis into the planning process and to seek to produce a result similar to that which would be attained were markets able to operate. But the cost of planning in the case of Bureau of Land Management (BLM) land has become grossly disproportionate to the value of the resource, and Forest Service planning also has been severely criticized as unwieldly, even by its one-time supporters. Although nearly all economists agree that a nondeclining even flow of timber from national forests makes no economic sense, the Forest Service persists in its adherence to the concept. And lightly timbered forests in the Rockies that have low potential for sustained output nonetheless are managed as if they were productive for wood. Thus, many serious analysts are not sanguine that managerial improvements can succeed. Indeed, they find the problems endemic in the very nature of public bureaucracies.

Backing off

Still, the disposal bubble may have popped. Early in 1982 the air was rife with rumors of plans for large-scale disposal of federal land. Government and private economists were discussing the idea of "privatizing" public lands, and a high-level property review board was established within the government to facilitate the transfer of unneeded properties as a means of reducing federal debt. Now, however, a somewhat different tone prevails. The limited character of the program is being emphasized, and the immediate target is only some 4 to 5 million acres, most of it identified over decades of planning as unsuited to federal administration. An ultimate target of no more than 35 million acres, or 5 percent of all federal land, also is being mentioned. Great attention is being given to the use of established laws and procedures in identifying candidates for sale on the BLM lands. The Forest Service has identified only a very small acreage as immediately available for sale and hints that very little of that termed *subject to further study* would make it through the screening process and be offered for sale. Any extensive sale of National Forest System land would require new legislative authority.

The cautious tone evident in recent discussions of disposal seems to reflect current political realities. With principal user groups not keen on disposal—or at least not united on it—the primary advocates have been a coterie of academics and some conservative think tanks and advocacy groups. In the face of unbending opposition from most environmentalists and conservation groups, that simply is not a constituency sufficient to move policy.

Political realities aside, however, there remain major problems with the management of federal lands. Unless more rational solutions can be found than now appear on the horizon, the issue almost surely will rise again.

Author Sterling Brubaker is senior fellow and associate director of RFF's Renewable Resources Division

Health and air quality—In search of missing links

THE UNPLEASANTRIES associated with air pollution are many, ranging from smog and obvious soot on buildings, vehicles, and clothing to the more subtle damages to crops and ornamental plants and shrubs for which a variety of pollutants is suspect. As far as federal clean air legislation is concerned, however, one purpose is paramount—protection against pollution-related sickness and death.

Section 109 of the 1970 Amendments to the Clean Air Act mandates uniform, national air quality standards that allow for "an adequate margin of safety . . . requisite to protect the public health." This provision in particular and a general concern about air pollution and health stemmed from two factors: first, several very serious air pollution inversions that resulted in immediate sickness and death; and second, a less well-documented suspicion that much lower levels of pollution might be harmful if endured over long periods of time. Indeed, the search for the latter kinds of cause-and-effect relationships between environmental conditions and human health is a tenuous science: study results often conflict—or appear to—and even the most respected experts sometimes voice diametrically opposed views. The legislators who drafted the Clean Air Act recognized this and provided in Section 103 for a program of research designed to eliminate as many uncertainties as possible.

Identifying health effects

There are three primary means of identifying any adverse health effects associated with air pollution. First are laboratory animal experiments typified by the "saccharin-and-rats" studies: lab animals are exposed to a broad spectrum of air pollutants, with dosages varying widely both in terms of intensity and duration, and health effects are observed. Obvious problems arise if we wish to draw conclusions about human reactions to pollution from such studies. First, the animals might react differently to air pollution if the exposure were to take place in a more natural (less controlled) setting. Second, even if we could be sure that we understood animal reactions perfectly, it would require a major leap of faith to extrapolate directly to human beings. This is not necessarily to doubt the value of such laboratory research; indeed, it is important. But it must be interpreted and used very carefully.

The second major method of study—clinical research—bears certain resemblances to animal experiments. Here, individuals volunteering for such studies are administered controlled doses of air pollutants (well below levels considered to be lethal or otherwise harmful), and the difference between "before" and "after" health status is then taken to be some indicator of the effects of the dose on whatever bodily functions are under study. Naturally, the results from such human experiments are intuitively more appealing than those obtained from animal tests.

Clinical studies are far from conclusive, however. Again, one is confronted with the problem of artificial dosage. That is, an individual's exposure to air pollution in the experimental setting is certain to be quite different from that he or she encounters in everyday activities where factors held constant in the clinical environment in fact are anything but constant. Then, too, clinical studies typically are plagued by small numbers of subjects, thus rendering nearly nil the possibility of obtaining robust statistical estimates. Finally, and most important, clinical studies do not allow a consideration of the possible long-term or chronic effects of air pollution on health.

The third means for studying the effects of pollution on human health is epidemiological research. The major difference between epidemiological and clinical work is that the "subjects" in epidemiological research have not been exposed to air pollution in a controlled experimental setting. Rather, their exposure comes from the "real world," and individual variation in health status over time or across geographic areas is examined for some link to the different pollutant concentrations to which individuals actually are exposed. A typical epidemiological study examines two or more distinct groups of individuals, where the grouping is based on different exposures to the environmental factors being analyzed. The study design attempts to keep all other characteristics of the groups similar so that other possibly influential factors can be assumed constant. Then, statistically significant differences in health status are attributed to the differentials in air pollution or other environmental factors.

Epidemiological strengths

There are several strengths and weaknesses to the epidemiological approach. On the positive side, epidemiological studies can, but do not necessarily, escape the three problems enumerated above that plague clinical analysis: artificial dose, small numbers, and inability to identify chronic effects. In epidemiological studies, the "dose" measurements come from actual ambient air pollution monitors, which should reflect exposures typical for the individual in his or her normal sphere of activity. Next, epidemiological study samples normally are larger than clinical study groups, thus circumventing some of the statistical problems inherent in clinical work. Finally, given sufficient consideration in studying design for time lags, the possible long-term or chronic impacts of pollution on individual health status are measurable, at least theoretically, in an epidemiological framework.

. . . And weaknesses

Yet, the drawbacks in epidemiological research are by no means trivial. Data sufficient to characterize precisely any one individual's exposure to environmental contaminants—in air, water, or land—simply are not available for any study framework yet devised. Even if current air pollution readings were a good proxy for historic concentrations, the difficult problem would remain of knowing *which* air pollution monitor in a particular area to use to characterize exposure. After all, concentrations of sulfur dioxide, ozone, particulates, and other pollutants vary widely within one metropolitan area—thus, use of an areawide average will be misleading. Even using data from a monitor near an individual's home is not perfect: significant variations in the concentrations of many airborne substances can occur within a few meters of the pollution monitors. Moreover, important recent work indicates that indoor concentrations of some air pollutants might be a potentially greater threat to health than even the highest levels of outdoor air pollution a typical individual might expect to encounter.

Also, much epidemiological work is based on self-reported rather than medically diagnosed health status. Although this may introduce some error into dose-response estimation, the direction of the error is not clear. Some evidence suggests that individuals themselves identify only about one-third of the adverse health conditions that a doctor diagnoses in a comprehensive health exam. Although *perceived* health status is important, *actual* health status is certainly no less so. To blindly equate the two can result in biased results.

A third major problem with much epidemiological work is that studies purporting to hold constant factors other than air pollution rarely in fact do so. Grouping to eliminate the effects of these other factors also often eliminates much potentially relevant information. Unless statistical regression techniques are used, it is almost impossible to avoid situations where either too many individuals are eliminated from study because of "atypical" characteristics or too much intergroup variation is allowed to make plausible assumptions about lack of variation in the other factors.

Setting air quality standards

Because of these and other drawbacks, some close observers of the process by which air quality standards are set feel that epidemiological research is given relatively little weight as evidence of pollution-related health effects. Given the difficulties and uncertainties characterizing epidemiological results, some skepticism certainly is understandable. Nevertheless, for reasons described above, *no* study—clinical or otherwise—is without its problems: one might be concerned with overreliance on any one kind of study in identifying health effects associated with air pollution.

Whether to give weight to one type of study or another may not seem to be a burning policy matter. But it is. In fact, the U.S. Environmental Protection Agency is preparing to propose a revision in the national air quality standard for particulates. The precise level where this standard is set hinges critically on the acceptance or rejection of several major epidemiological studies. Because of the political sensitivity of the particulate standard (the electric utility, steel, and other major industries are directly affected by it), the outcome of this standard is important. It is sure to serve as a barometer of future sentiment toward relying on epidemiological results in the establishment or revision of air quality standards.

Future research

Regardless of the disposition of the particulate standard, if the concern about the health effects of air pollution is real—and there is no reason to doubt that it is—then research must continue. Improvements in both data and methodology are essential to the progress of research in this field, and work currently under way at RFF is attempting to meet problems on both these fronts. Active research continues on analytical methods to help deal with the knotty statistical problems that arise in all epidemiological research. Also, a large data base consisting of information on 110,000 individuals is being assembled for use in air pollution studies and other kinds of epidemiological research.

The refinements being built into the data base are considerable. Air pollution exposures will be estimated more finely—in both the temporal and spatial dimensions—than is the custom in studies using similar methodologies. For example, rather than use an average of all monitors in the metropolitan area to characterize an individual's exposure, individuals will be matched with the monitor(s) nearest their dwelling. Rather than use annual average pollution data, readings during the specific period for which health information is collected will be used. Both are noteworthy improvements. In addition, detailed information on pollen and weather is included, as are several measures of health status, socioeconomic information, and some occupational characteristics. A crude measure of exposure to indoor air pollutants also will be included, as will the all-important information on individual smoking habits. Further, data on residential mobility, using a sample of individuals who have always lived in the same place, will make it possible to explore any chronic health effects associated with air pollution.

Admittedly, these improvements are not a panacea for all problems. Data on the true doses of air pollution that people get still are not available, and we have only very rough measures for indoor air pollution concentrations. Moreover, no information is available on the measures individuals take to defend themselves against air pollution (the installation of air filters, for example), or to ameliorate any ill effects that do result. Finally, we lack diagnostic confirmation of many of the adverse health effects that individuals report.

In spite of these shortcomings, environmental epidemiology is improving rapidly. Data are now available for individuals where areawide average measures of health status were used before. Confounding factors often ignored in the past—smoking, diet, exposure to indoor pollutants—now are routinely controlled for. Environmental factors other than air pollution are being taken into account. And more powerful, and appropriate, statistical techniques are being used to analyze data. Further improvements are possible, but it is clear that with time there will be available more and better information linking the health of men and women to their environment.

Authors John Mullahy, a research assistant, and Paul R. Portney, a senior fellow, are in RFF's Quality of the Environment Division.

Vice President

RESOURCES FOR THE FUTURE is seeking outstanding candidates to fill the position of vice president, preferably beginning in the fall of 1983.

The person selected will be President Emery Castle's principal deputy and will assist him in performing all duties of his office. In addition, the vice president will have primary responsibility and authority for the following functions:

Development and adminstration of the research program, including interdivisional research program development and coordination. As appropriate, the vice president represents RFF to the research and funding communities.

Review and evaluation of all book-length manuscripts submitted for RFF publication. The vice president chairs the Publications Committee and on behalf of the committee recommends to the president for or against publication.

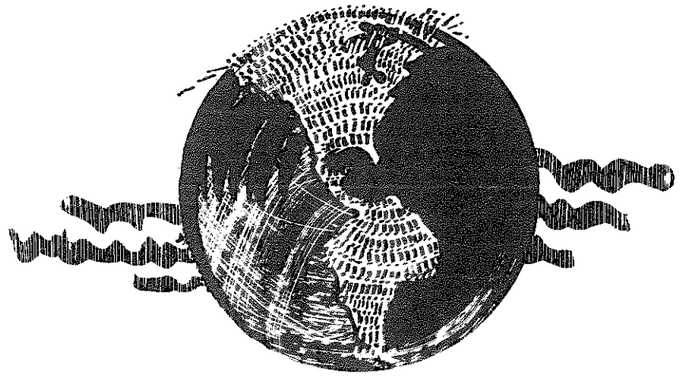
Administration and coordination of all grant, fellowship, and scholarship programs.

As readers of *Resources* are aware, RFF's strengths are in resource and environmental economics, but candidates are sought with broad experience in applied economic and multidisciplinary research and administration. The capacity for effective leadership of a 100-member staff is an essential qualification, as is the ability to represent RFF to other institutions and to the public.

Applicants should send a letter and resume by May 1 to President Emery N. Castle, Resources for the Future, 1755 Massachusetts Avenue, N.W., Washington, D.C. 20036. Nominations also are welcome, provided that they are accompanied by a resume of the nominee.

Resources for the Future is an equal opportunity employer. Women and minority candidates are encouraged to apply.

The chlorofluorocarbon problem



CHLOROFLUOROCARBONS ARE a series of chemical compounds containing chlorine, fluorine, and sometimes hydrogen directly bonded to carbon; hence the name Chloro-fluoro-carbon, abbreviated CFC.

CFC compounds were developed by Du Pont research chemists a half-century ago to meet the needs of the refrigeration industry, and in this they have performed admirably. CFCs are nontoxic, nonflammable, and have optimum thermodynamic properties—boiling point, freezing point, and heat of evaporation—for all types of mechanical refrigerators. They also are very stable and inert toward the metallic components of the refrigeration system. Despite the passage of time, CFCs still are the best fluids for all refrigeration uses, including the direct-immersion fast-freeze food industry. All substitutes require compromise of some performance characteristics.

Chemists later discovered that CFCs are very good solvents and that mixtures of CFCs make ideal aerosol propellants for hundreds of household and commercial substances. These uses range all the way from hair sprays and pesticides to making polyurethane foams and degreasing parts for heavy machinery. Cans filled with CFCs even power fog horns for small boats. The demand for CFCs for these nonrefrigeration uses—sometimes referred to as "nonessential" uses—eventually far exceeded the capacity of plants built for the refrigeration industry. New plants were constructed in most of the developed countries of the world and in some emerging nations, and production soared. In 1975 1.5 billion pounds of CFCs were released into the atmosphere; only 19 percent of this was from refrigeration systems. Since CFC releases are estimated to double about every five to seven years, the present (1982) release is about 3 billion pounds.

CFCs and ozone

The very desirable property of inertness that makes CFCs so useful means that the huge outpourings of CFCs accumulate in the lower atmosphere, known as the troposphere: nearly 90 percent of all the CFCs released from 1955 to 1975 are estimated to be still present in the troposphere.

But a very small portion diffuses into the upper atmosphere—the stratosphere—where eventually the CFCs play havoc with stratospheric ozone (O_3), a high-energy form of oxygen. In brief outline, the CFC molecules are exposed to intense, short-wavelength ultraviolet radiation from the sun and are decomposed, releasing the chlorine atoms. These atoms enter into a regenerative cycle whereby one chlorine atom destroys thousands of ozone molecules before the cycle is interrupted by a side reaction that binds the chlorine atom to a hydrogen atom. This forms the very water-soluble hydrogen chloride molecule that eventually is rained out.

Ozone also is destroyed by other regenerative cycles involving oxides of nitrogen, hydrogen, and bromine. However, most observers believe that the chlorine cycle will be dominant in the future.

If CFC releases continue to rise as in the past decade, stratospheric ozone may be reduced by about one-quarter by the year 2025 and perhaps by as much as 57 percent (at steady state) about one hundred years from now. Even at the 1975 release rate—considerably lower than the present rate—ozone reductions of 11 to 16 percent are predicted, at steady state. What are the consequences of these ozone reductions?

Ozone absorbs solar radiation in the ultraviolet, visible, and infrared regions of the spectrum, to varying degrees, with absorption in the ultraviolet range being the most important to society. According to scientific consensus, a 1 percent decrease in stratospheric ozone is accompanied by a 2 percent increase in biologically damaging ultraviolet radiation, generally designated as DUV, and a 1 percent increase in DUV produces a 2 percent increase in skin cancer incidence. Thus, a 1 percent decrease in ozone results in a 4 percent increase in skin cancers. Accordingly, the 11 to 16 percent ozone reduction corresponds to a 44 to 64 percent increase in the incidence of skin cancer—about 162,000 additional cases per year in the United States. Most of these will be of the relatively less dangerous, nonfatal variety, but some 5,770 probably will be melanotic and result in 1,890 deaths within five years. Again, these skin cancers and deaths are in *addition* to the current annual U.S. incidence of 300,000 skin cancers, including 10,500 melanomas and 3,500 deaths.

Exploratory studies also indicate adverse impacts on human and animal immune systems and on agriculturally important crops, forest tree seedlings, and commercial fisheries.

The greenhouse effect

But biologically damaging ultraviolet radiation is only part of the problem posed by CFCs. Even wider in scope is their contribution to the potential warming of the planet—the so-called greenhouse effect prominently associated with atmospheric accumulations of carbon dioxide (CO_2).

CFCs contribute to temperature change in two ways. The first is through stratospheric ozone reduction, but the computed effects in this case are small and somewhat uncertain. The second is the role played by CFC compounds in the troposphere, which is much larger than the stratospheric effect and indeed may dwarf that attributed to CO_2. CFCs appear to be almost 100,000 times as effective as CO_2 in raising the temperature of the earth's surface due to the greenhouse effect. Hence, as the concentration of CFCs in the troposphere rises, the CFC contribution to the greenhouse effect could outstrip that due to CO_2 and may do so in the not too distant future, if CFC releases are not curbed. As the contributions of both CFCs and CO_2 are rising, serious geologic and sociopolitical problems could loom ahead, including changes in national and worldwide agricultural patterns and rising sea levels that theoretically could swamp major coastal cities.

The most recent studies conducted under the auspices of the National Academy of Sciences indicate that ozone reductions may be one-half the amounts predicted in a 1979 National Academy report—the 11 to 16 percent reduction cited above. But the biological effects of given levels of ozone depletion now are seen as likely to be more severe than previously expected, as regards both the incidence of skin cancer and negative impacts on human and animal immune systems. Hence, though considerable uncertainty still pervades the issue, the effects of ozone reduction could be quite serious and surely should not be ignored. Moreover, even if the 11 to 16 percent reduction in ozone is scaled back to 5 to 8 percent, the effects are not halved forever, but only postponed by a time factor of two. Eventually—if no corrective measures are taken now—the problems and damages will occur.

What can be done?

Neither precipitous nor wide-ranging action probably is appropriate given the broad uncertainty of the CFC-ozone set of problems and the high costs of imposing additional limits on CFC use. Also, much valuable information can be gained by letting current emissions levels continue at least to the point where definite physical links can be established among CFCs, ozone damage, and changes in climate.

But the cost of doing business as usual rises sharply if inaction begins to lead near irreversible catastrophe. Where does that point begin, and how can we anticipate it in time to pull back effectively? No one knows. Clearly, more research is needed on this key issue and on the other pieces of what now is mostly a puzzle. To err on the side of prudence, however, should not some action be taken now?

The United States, of course, already has taken an important step that has slowed the rate of increase in CFC emissions: a federal ban on CFC aerosol propellants in spray cans was announced in 1977 and became fully effective two years later. But CFC emissions are a global, not a national, problem—no national frontiers exist in the stratosphere—and few countries have followed the U.S. initiative. Moreover, as the affluent nation that invented CFCs and introduced their use on a broad scale, the United States is not in a strong position to urge other nations—some of them much poorer—to cut back on, say, refrigeration or air conditioning.

The options include further unilateral U.S. controls over domestic CFC production and use (although this may boomerang: U.S. production facilities may simply relocate in other countries). And the United States could affect other producing nations through a variety of import and export controls. Or U.S. foreign assistance could be denied to projects to develop CFC production facilities or that otherwise involve major use of CFCs.

Multilateral action needed

Even leaving aside high dollar and diplomatic costs, however, unilateral U.S. actions can make only a partial (if large) difference to stratospheric levels of CFC compounds. Thus, most observers agree that the problem CFCs pose can best be dealt with multilaterally.

At least at the start, this does not mean involving all nations emitting CFCs or potentially affected by them. Since a dozen countries account for 80 percent of CFC production, an agreement on limitations among this group would go a long way toward solving the problem. Principles that might help to foster an agreement would include Principle 21 of the Declaration of the United States Conference on the Human Environment: "States have . . . the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction," and the Organisation for Economic Co-operation and Development's principles of conduct in transfrontier pollution that call for "good neighborship."

In due course, a treaty or agreement among the major CFC-producing and -consuming nations that prohibits or restricts CFC emissions could emerge. Legal precedents and bilateral or multilateral agreements do exist regarding environmental damages that range across national boundaries (for example, the Great Lakes Water Quality Agreement, the Convention on Third Party Liability in the Field of Nuclear Energy, the Convention on Civil Liability for Oil Pollution Damage, and the Scandinavian Convention on the Protection of the Environment). The history of diplomacy indicates, however, how difficult it is even to achieve agreement, let alone effective multinational programs. Precedents for managing the stratosphere by an international agency are not encouraging.

Given the pessimistic outlook for a multilateral agreement and the fact that the United States appears to be more risk averse in CFC emissions management than other nations, the United States may find it useful or necessary to "bribe" or compensate "holdout" nations to achieve CFC emissions reductions overseas. The victim-must-pay principle naturally strikes most people as unjust, but unilateral CFC regulation by the United States may change the structure of incentives for other nations. Hence, side payments in exchange for emissions reductions may leave both the United States and other nations better off.

U.S. leadership

But the United States is the major user of CFCs, accounting for about half the world's total consumption, though its share recently has been declining. If further research and information-gathering narrow the broad uncertainties that now characterize the CFC problem, and the benefits of unilateral action are deemed to outweigh the costs, the United States could substantially reduce the global risk and serve as a moral example. Morality does not equal efficacy in global affairs, but further U.S. self-deprivation coupled with a range of incentives to reduce CFC emissions might persuade other nations to follow the U.S. lead.

But the problem clearly is international, and the United States should seek ways, beyond example, of persuading other countries to act together in the interests of the world as a whole. If the United States feels strongly that procrastination cannot be permitted in ozone layer and climate protection and finds multilateral efforts to be unsuccessful or bogged down in interminable delay, it could turn to unilateral measures aimed at reducing CFC emissions overseas. As suggested, such tools are likely to be highly controversial and unpopular, both at home and abroad. Some even could strain relations with other nations and induce retaliatory actions against the United States.

But if the case against CFCs becomes strong enough, such costs will have to be borne.

This article is adapted from material in The Economics of Managing Chlorofluorocarbons: Stratospheric Ozone and Climate Issues, *edited by John H. Cumberland, James R. Hibbs, and Irving Hoch. The principal contributor to the article is Alphonse Forziati, who from 1977 to 1979 was director of Stratospheric Modification Research at the U.S. Environmental Protection Agency.*

Fuelwood for China

THE OIL PRICE REVOLUTION of the 1970s has severely affected the economies of both developed and developing countries, and both groups of countries now face a major challenge in managing the transition to an era of high-cost energy. Many developing countries, moreover, confront a "second energy crisis" regarding the supply of traditional biomass fuels to rural households. As rural populations increase, shortages of fuelwood and crop and animal wastes are becoming more acute, often resulting in severe damage to environmental quality and to agricultural systems.

High population pressures on the land make rural household fuel problems in the People's Republic of China particularly serious. But China also has developed a series of approaches to these problems, many of which show promise. While energy problems (and possible solutions) differ from country to country, China's attempts to solve its problems may be highly relevant to other developing countries as well.

Table 1. Current Rural Household Energy Consumption in China

Fuel	Physical quantities (10^6 tons)	Energy (10^6 TCE)	Percentage of total
Crop by-products	266	129.2	44.4
Fuelwood	180	115.7	39.7
Coal	53	37.9[a]	13.0
Dung	10	5.5	1.9
Kerosine	1	1.5	0.5
Electricity	—	1.0	0.3
Biogas	—	0.6	0.2
Total	—	291.4	100.0

Sources: Individual fuel consumption figures are taken from the All-China Exhibition on Rural Energy, Beijing (September 1982); and Wu Wen, Chen En-Jian, and Li Nianguo, Guangzhou Institute of Energy Conversion, "Our Views to the Resolution of China's Rural Energy Requirements," (paper prepared for the Joint CAS–NAS Science Policy Conference, August 1982). The total energy consumption figure is consistent with the figure of 290 million TCE resulting from a survey conducted by the China Energy Research Society in 1979.

[a] Chinese coal has an energy content of about 5,000 kcal per kilogram, whereas the international standard for 1 kg of coal equivalent is 7,000 kcal.

Table 2. Current and Planned Fuelwood Supply Through Legitimate and Organized Collection

Year	Fuelwood supply by type of forest (10^6 tons)					
	Timber forest	Protective forest	Shrub land	4-Around plantings	Fuelwood lots	Total
1981	33	1	16	19	21	90
Early 1900s	37	4	15	32	82	170

Source: The All-China Exhibition on Rural Energy, Beijing, September 1982.

Renewable energy development

To date, only China's development of rural biogas systems and small-scale hydropower plants has received a significant amount of international attention. Not nearly so well known is another key aspect of renewable energy development in rural China—fuelwood lots. Yet, during the last two years, China's leaders have given unprecedented emphasis to the development of additional fuelwood supplies through afforestation. Especially interesting is that China plans to establish large numbers of small, privately owned fuelwood lots.

China's rural households currently consume about 290 million tons of coal equivalent (TCE) for cooking, heating, and lighting, accounting for about one-third of total primary energy consumption (table 1). More than 85 percent of the rural total consists of directly burned biomass fuels. For the future, Chinese policy is clear: locally produced biomass fuels must continue to provide the lion's share of the energy needed by rural households. Given production, transportation, and financial constraints, a dramatic increase in the supply of fossil fuels for rural household consumption is not a realistic option. Thus, rural energy development plans are aimed at improving the existing renewable energy supply and consumption system. Biogas certainly will have an important place in rural energy development, but other means to improve the rural energy system also must be promoted—to match different needs in different settings—and the development of fuelwood lots is principal among them.

Fuelwood cultivation

According to recent Chinese estimates, rural households annually consume about 90 million tons of "legitimately" collected fuelwood, that is, collection is organized and supervised to minimize environmental damage. About one-third of this comes from the organized pruning and thinning of forests primarily designed for other purposes, such as timber forests (table 2). Another fifth is collected from "four-around" plantings (plantings along roads, along rivers and canals, around homes, and around villages), both by pruning trees planted for protective purposes and by harvesting trees specifically planted for fuel. Only 23 percent currently is supplied from collective fuelwood lots.

In addition to the legitimately collected fuelwood, another 90 million tons is collected at random by individuals from uncultivated land. Trees, grasses, and brush are stripped from local hillsides in a disorganized and desperate fashion that often exacerbates existing water and soil conservation problems. China's leaders would like to eliminate this random and damaging gathering by rapidly developing more rational supply methods. The ten-year goal is to increase the supply from fuelwood lots fourfold, primarily through establishing new, private fuelwood lots (see table 2). Increased fuelwood plantings in collectively owned four-around forests also are planned, so that the fuelwood yield from these forests can be boosted by about 70 percent.

Private fuelwood lots are not a new concept in the People's Republic of China. Indeed, the first attempt to promote such lots occurred during the early 1960s, but the policy fell victim to political conflict over the proper role of private economic activity and never was implemented. Today, political constraints concerning private lots have been eased, and widespread implementation already has begun.

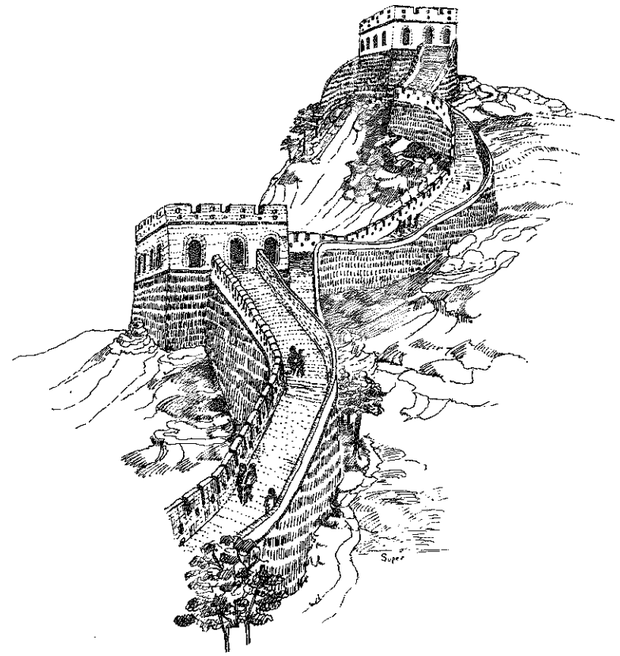
Policy implementation

On March 5, 1980, the Central Committee of the Chinese Communist Party and the State Council jointly issued a directive calling for the allocation of land for private fuelwood lots, and subsequent directives and laws have reinforced the decision. While basic guidelines have been set by the central government, most of the details of implementation have been left to local governments.

In areas where suitable barren land exists for afforestation—only nonforested land may be distributed—1 to 10 *mu* may be allocated for each household (1 *mu* equals one-fifteenth of a hectare). Households are not given ownership of the land—which still belongs to rural collectives—but certificates are issued to households guaranteeing their ownership of the trees they plant on the land, with the right of family inheritance. Households are allowed to plant only trees on their plots, and they must be planted by a specific deadline for families to retain use of the land. Families may use, sell, or give away the wood and brush they grow, as they see fit.

On the plains, where large uncultivated expanses of land are not available, small strips of marginal land along rivers and roads may be distributed for private planting, but most fuelwood planting probably will occur as part of the usual collective four-around afforestation work.

The major tree and bush species to be used for fuelwood cultivation include willow, poplar, locust, and false indigo in the northern parts of China, and eucalyptus and acacia farther south. State and collective forestry organizations have been instructed to supply seedlings from local nurseries to individual households on a priority basis at low prices. When necessary, seedlings may be provided on credit, with repayment set at a date mutually agreed upon.



Results to date

According to incomplete statistics presented at the All-China Rural Energy Exhibition, almost 3 million hectares of land had been distributed to households for private fuelwood cultivation by October 1981–an amount roughly equal to the land area of all fuelwood lots previously planted (see table 3). According to the same source, roughly 10 percent of China's rural households have received land for fuelwood lots. In Sichuan Province, 10 million families were given land allocations by the end of 1981, and more than 800 million seedlings were planted privately.

Table 3. Forested Land Area in China

Forest classification	Area (10^6 ha)	Percentage of total
Timber	98.00	80.5
Economic	8.52	7.0
Protective	7.85	6.4
Fuelwood	3.67	3.0
Bamboo	3.15	2.6
Special	0.67	0.5
Total	121.86	100.0

Note: Economic forests represent forests that provide fruits, nuts, edible oils, and other cash crops. Special forests are used for aesthetic or experimental purposes.

Source: 1976 General Forestry Survey data, issued by the National Forestry Bureau. See *Zhongguo Nongye Dili Zonglun* (A General Treatise on the Agricultural Geography of China), Beijing, October 1980 [JPRS, *China: Agriculture*, no. 78054 (May 8, 1981), p. 182].

Judging from the limited information available, China's private fuelwood lot program appears to have gotten off to a good start. For real success to be achieved, however, a high level of government support must be maintained. Central and local forestry organizations must be prepared to offer assistance concerning the supply of seedlings, proper species selection, and scientific planting and tending techniques. If government assistance is adequate, the Chinese should have a good chance of fulfilling their goals. But if the government role is confined to allocating land, results of the household fuelwood lot program could be very disappointing—to China and to the other developing countries that desperately need a positive example of rural energy development.

Author Robert P. Taylor, a consultant to the World Bank, was a visiting scholar at RFF in 1981. He is the author of Rural Energy Development in China, *published by RFF in December 1981.*

Preserving illusions—The Clean Water Act after ten years

IF THE INCONCLUSIVE deliberations of the Ninety-seventh Congress are even a partial guide to the future, the Ninety-eighth Congress is likely to vote to extend the 1972 Clean Water Act with only minor changes. In contrast to the Clean Air Act, controversy surrounding the Water Act is almost nonexistent. Republicans and Democrats, industrialists and environmentalists, federal and local officials all seem quite satisfied with efforts to clean up the nation's waters.

Lukewarm opposition

The lack of strong opposition on the part of business is not hard to fathom. Despite occasional protests to the contrary, the act has not been much of a burden on industry, mainly because it emphasizes uniform application of "best" pollution-control strategies. Typically, *best* is defined by the Environmental Protection Agency (EPA) as that approach already used by the largest, most progressive firms in an industry. For those firms—which usually account for most of their industry's production—the additional cost of the EPA regulations over and above what they already spend is very small. As a result, for most of the industry the annualized costs of the act average well under 2 percent of each firm's sales. Even when additional costs are more substantial, the fact that the regulations apply uniformly to all firms in an industry means that most of these costs can be passed on in higher prices.

The sanguine attitude of local officials is even easier to understand. The 75-percent federal subsidy provided goes a long way to lessen the pain of the act's requirement to upgrade municipal treatment systems.

The approval of environmentalists is more difficult to explain. It is true that noteworthy improvements have been made in a few waterbodies, such as Lake Erie and the Potomac River, but overall the act has not done much to improve the nation's waters. According to monitoring data and theoretical water modeling, the biggest improvements appear to be in dissolved oxygen content. Yet this is a questionable achievement: in 1972—before the act—only about 30 percent of the nation's waters failed to meet acceptable dissolved oxygen standards.

More important, ten years of effort have produced very little improvement with respect to nutrients, sediment, and toxic substances. The 1977 amendments to the act may improve matters, but serious problems with these pollutants are likely to remain indefinitely, chiefly because of the act's relative neglect of the main "nonpoint" sources of pollution—agricultural and urban runoff. Urban runoff often is the major source of certain toxics, even in such highly industrialized cities as Houston and New Orleans.

Intentions and illusions

Measured objectively, the act's performance has been weak in precisely those areas where improvements were most needed. Why, then, does it receive so much support from the environmental movement? One possibility, suggested by Allen V. Kneese, is that environmentalists place a high ethical value on doing one's "best." Since most dischargers to the nation's waters have permits that supposedly guarantee the use of *best* technologies, the act from this ethical point of view has been a success.

Another possibility is that environmentalists—along with the rest of us—are forced to rely too much on monitoring data to determine how well or poorly the act has done. However, our monitoring is so sketchy that it would not be surprising if environmentalists are suspicious of this source of information. Uncertain of the effect on water quality, the environmentalists turn more confidently to the effects on polluters. Since these polluters—at least the industrial ones—have permits that restrict their polluting activities, the act offers the illusion of working.

The implication of either possibility is that it does not matter much how well the act does in cleaning up the water as long as tough action *appears* to be directed against polluters. Thus, without having to look at water quality, Sen. John Chafee (R–R.I.) can confidently assert that a "water quality-based approach to pollution control failed before 1972 and could clearly fail again." In a world where form has priority over substance, it is apparently easier than one thinks to make an environmentalist happy.

Author Henry M. Peskin is a senior fellow in RFF's Quality of the Environment Division.

Synfuels—Back to basics

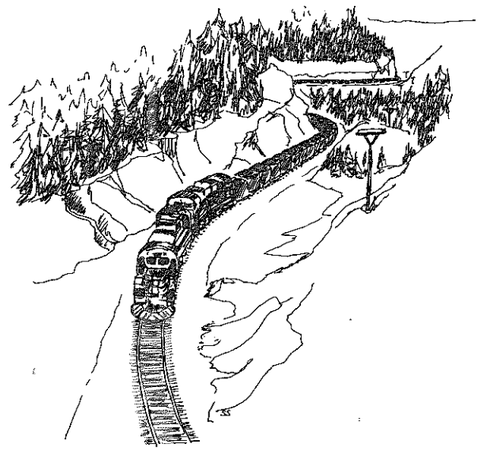
ONLY DREAMERS OR ZEALOTS expected that ten years after the oil embargo America would "fill 'er up" with gasoline derived from coal or shale. But many thought that several synthetic fuel plants would be on their way to constituting the beginnings of a rapidly growing industry. Instead, one after the other, synfuel projects have been canceled or deferred.

At the start of 1983 only two major plants are under construction, each initiated with government assistance before the Synthetic Fuels Corporation (SFC) was formed. One, the Great Northern Plains plant in North Dakota, is designed to convert coal to gas. The other, under construction in Colorado by the Union Oil Company and slated to begin operation later this year, will convert shale to oil. When completed, the former will produce gas at the oil equivalent of 22,000 barrels per day and the latter will produce 10,000 barrels of oil per day. But these plants will not come close to meeting the objectives expressed in the Energy Security Act of 1980 that established the SFC—500,000 barrels of oil equivalent per day by 1987 and 2.2 million barrels per day by 1992.

Basic problems

At least two of the problems that have emerged in attempting to develop a program of this size have profoundly affected corporate approaches and are big enough to cause a rethinking of government strategy on synthetic fuels. Whether they will is an open question. The first problem is that the energy world of early 1983 is almost the reverse of that in which the SFC was launched. Oil is plentiful, with some 12 to 13 million barrels per day of excess capacity overhanging the market. Prices not only have stopped rising, but have been declining since the spring of 1981. Demand is down, both because energy is used more efficiently and because the economy is dragging. Budget deficits are huge and rising, and the hunt is on for projects that can be deferred or terminated. Altogether, it is not a heady environment for costly projects with untested technology to meet uncertain contingencies.

The other problem is the SFC itself. Staffed with recess appointments during the latter part of the Carter administration, the corporation lingered without leadership for many months under the Reagan administration. Not until October 1981 did the new board have a quorum. In the meantime, in the expectation



that the SFC henceforth would be the place where synfuel business is done, the Department of Energy, which had solicited proposals in the past, began to back out of synthetic fuels. Then came two successive rounds of solicitations of projects from industry designed to give the SFC a broad choice in selecting worthy projects. The inevitable bureaucratic difficulties—aggravated by indecision within the SFC over whether to pursue quick and large production goals or to go for diversity of sources and technologies—delayed the program sufficiently to push it into the era of falling oil prices.

This may have been fortunate. Had the SFC moved quickly and spurred construction of several large plants, the situation today could be very bleak. The government might be making a choice between paying off on price and loan guarantees as industry failed to complete plants or coming up with more subsidies to ensure completion of projects.

Jumping ship

At any rate, with nominal oil prices at best stable and real oil prices on the decline, prior cost calculations based on a steady rise in oil prices no longer support the contemplated facilities, especially as cost estimates for the projects have risen. In the spring of 1982 Exxon withdrew its 60-percent participation from the largest planned venture, the Colony oil shale project in Colorado, that was to produce 45,000 barrels per day, announcing that estimated costs had more than doubled from an original $3.5 billion. On that recalculated basis, investment per daily barrel would have exceeded $150,000, and the oil would cost in the neighborhood of $100 per barrel. These numbers are much higher than the initial range of cost estimates and, specifically, more than twice the cost at which Union Oil expects to produce shale oil. (Union has a $42.50 per barrel price guarantee and appears to be moving on budget and on schedule.) Exxon's decision thus was hardly surprising, though it left many wondering how it had reached a position from which it had to extricate itself at considerable cost.

Rising costs and lower oil price projections also figured in Ashland's decision to abandon the Breckinridge project in eastern Kentucky, designed to produce 25,000 barrels per day from coal. In addition, the Hampshire coal liquefaction project in Wyoming (21,000 barrels per day) was delayed indefinitely after SOHIO pulled out. Both projects reappeared, however, in the third solicitation that closed in mid-January 1983. Including the new repeat entrants, there still are a few candidates for support, but their potential output is quite small. Nor are they the projects that offer the brightest hope for the future.

The survivors

The history of the first two solicitations reveals a striking number of casualties. None of the first-round proposals survived past December of 1982. Out of the second round of solicitations, entered by many that were unsuccessful in the first round, seven had advanced through various stages into what the SFC calls Phase II or actually were being negotiated. And in early December, SFC letters of intent were issued to three projects: a peat-to-methanol proposal (goal: 4,000 barrels of methanol per day), a heavy oil project (goal: 6,000 barrels per day of gas, naphtha, and fuel oil), and a tar sands project (goal: 4,000 barrels per day). These letters of intent are preliminary to contracting but do not commit either party. They merely say, "You seem OK." Table 1 presents a brief history of the project proposals.

The body count may differ from observer to observer, depending on how a project is classified, what is excluded, and so forth, but the broad conclusion is that few projects have survived. Moreover, the seven still in negotiation are an odd lot: only one involves coal liquefaction, one peat liquefaction, one involves coal gasification with electric power as the end product, one heavy oil, and, surprisingly, four plan tar sand conversion, surely the material that would have been voted "least likely" when the SFC was established. This is not because the tar sands technology is unknown—after all, the only operating commercial-sized synfuels plants in North America convert Canadian tar sands—but because U.S. resources are so much smaller than coal and oil shale.

Still, it is too soon to hold funeral services for the corporation. There is little question that synthetic fuels can play an

Table 1. Status of Two SFC Solicitations, as of December 1982

Process	*Applications received*	*Applicants failed to supply additional information*	*Passed maturity and strength review*	*In negotiations as of mid-December 1982*
Coal liquefaction	20	8	5	2
Coal gasification	15	12	1	1
Oil shale	15	5	1	0
Tar sands/heavy oil	15	5	6	4
Other	9	2	0	0
Total	74	32	13	7

Note: Tabulation excludes applicants that applied too late for consideration or withdrew after submission. It also excludes projects approved by the Department of Energy. Applicants that applied in both solicitations are counted only once. Of the two coal liquefaction projects, one uses peat as the feedstock. The difference between the total number of applications and the sum of the last three columns consists of applicants that did not get past earlier stages of review.

important role in the long-term U.S. energy picture as reserves of conventional oil and gas decline. The SFC, or some similar entity, can be critical to this effort. But a searching review of philosophy and progress is in order, and soon. Such a review must ask and answer a number of questions.

Production versus information

Was the original idea of setting a production goal wrong? At the time the SFC was created, some advocated "information and insurance" as the proper objective. That would have meant a program of constructing facilities large enough to reveal potential engineering, health, safety, and other problems, but too small to make a significant contribution to supplies. Also, such a program would have been spread over a sizable number of different technologies. This approach acknowledges that there still are unresolved questions about synthetic fuel technology, especially about the costs of production. The primary objection was that such a program would "fail to send the proper signal to OPEC." As it turned out, of course, the close-to-aborted production-oriented program sent a much worse signal! The question remains, Is it time to reorient the program toward information and insurance?

Short term misleading

Industry takes its cues from anticipated market behavior. As anticipations change, based on changes in basic parameters, so do industry's evaluations—high on synfuels yesterday, when oil prices were soaring, low today, when the oil market is in the doldrums. Unfortunately, too much emphasis may be given to short-term trends. It is impossible, for instance, to predict with certainty the path that energy consumption will take if the economy returns to steady economic growth. The question then arises, Is it not wise to isolate research and development decisions from current events and short-term price and supply changes? If so, is it not advisable to place information-and-insurance synfuels development in the hands of government in a way that industry performs the hardware portion but is in no position to give go or stop signals?

Lowering sights

The SFC may now draw on the U.S. Treasury for nearly $15 billion. With budgets getting tighter by the day, hungry legislators on Capitol Hill eyeing those billions may want to sink the corporation. The Ninety-eighth Congress probably will have before it several bills to snuff out the life of the SFC. The question is, Would it not be wise to clip the SFC's wings before detractors go for its heart? Such clipping could take several forms. One would be to reduce funding, in conformity with a changed objective. Another would be to abandon altogether the 1985 claim for an additional $68 billion. In any event, since this is based on estimates of no-longer-valid windfall profit tax revenues, that figure is unlikely to have much meaning.

Joint ventures

The original act directs the SFC to enter joint ventures with industry only as a last resort, only for small-scale ventures, and only if it takes no more than 60 percent interest. But industry has shown only sporadic interest to act on its own. Government involvement may be necessary to get projects off the ground. The question is, However skeptical one might be of government's capacity to be heavily involved in industrial-type enterprises, is it not time to reconsider the limitations on joint ventures?

New approach needed

It is quite possible that matters will be allowed to drift, with no important changes in policy by Congress. After all, it would be embarrassing to basically alter a course that less than three years before was lavishly funded and heralded as fundamentally changing the U.S. energy outlook. But the risk of a hands-off policy is obvious: the SFC—anxious to do something— will be tempted to spend money on activities of questionable value. Thus, the final question, Is this not the time for the Congress or the president, or both, to undertake a profound but rapid search for new ways of tackling the matter? Such a review would be the more helpful if it gets away from considering the program as one to quickly provide significant production. Instead, government should approach synthetic fuels as a long-term continuing task with socially valuable objectives that fall outside the planning horizon and profit-oriented interest of industry.

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Power politics

IF LAST YEAR'S ACTIVITY is any indication, 1983 could be the year Ronald Reagan leads his presidency through the political briarpatch of electric utility regulation. Beginning last February, the White House turned its attention to the troubled utility industry when Vice-President Bush called a meeting of electric company representatives and nuclear vendors to discuss the causes and potential effects of recent power plant delays and cancellations.

In May an intergovernmental task force was formed—the Cabinet Council Working Group on Regulation, Competition, and Efficiency in the Electric Utility Industry—to study the industry's problems and recommend solutions. This twenty-one-member group since has been focusing on the relationship between the financial condition of the industry and investments in new capacity. Preliminary findings indicate that financial constraints are causing underinvestment in elecricity supply capability, and that the source of the problem is politically motivated price controls by utility regulators. Thus, the recommendations discussed so far center on reforms in rate regulation—changes that might be made in rate-making procedure as well as altering the basic jurisdictional framework of electric utility regulation itself.

The group, known informally as the Electricity Policy Project (EPP), has not sent its report to the White House yet, and no one now knows which, if any, of its recommendations ultimately will find their way into proposed legislation. One thing, however, is certain: whatever proposals are made surely will attract a great deal of political attention. Electricity is an area in which political interests are as widespread and interconnected as the grid itself. Any change in the current structure of regulation is bound to affect many of those interests, and the EPP already has caught the eye of some of the strongest lobbies on Capitol Hill.

Part of the EPP's work has been to synthesize the results of thirty-three analytical reports, some done at the Department of Energy's Office of Policy Planning and Analysis (OPPA), but most performed under contract by outside consultants. Aside from these paper studies, the project is aggressively fact-finding by speaking with industry representatives, regulators, trade associations, and Washington-based policy groups, a process EPP members feel is important to building a consensus for its proposals.

Regulation and long-term supply

According to Hunter Chiles, EPP chairman and director of OPPA, the central issue under investigation is the effect of rate regulation (or government price controls, as he puts it) on the long-run supply of electricity. In a November speech before the National Assocation of Regulatory Utility Commissioners, Chiles outlined the "danger signs" that indicate to him that traditional utility rate regulation is ineffective—and perhaps even counterproductive—in sending utility managers the investment signals conducive to assuring an efficient supply mix over the long run.

The first of these danger signs, says Chiles, is that while utility regulation traditionally has taken place in an era of declining costs for electricity, that period ended in 1969 and commissions have shown no sign of adapting to new conditions. Contrary to the conventional wisdom, he says, electricity demand—stronger than total energy demand since 1973—may well continue to be strong in the future, especially if the economy experiences a vigorous recovery. While the market for electricity appears strong, however, price controls of the type imposed under conditions of falling costs now have increased the risk of new investments in capacity. The result, Chiles says, is that utility managers now are canceling projects in response to short-term financial indicators at the expense of long-run efficiency or "need-for-power" criteria. A real danger, according to Chiles, is that regulators may be institutionally incapable of authorizing the revenue increases necessary to build new power plants. Commissioners who are elected rather than appointed, he says, tend to reflect the views of the rate-paying public and—because the public fails to draw a connection between current rates and future electricity supply—this disassociation will continue to characterize utility regulation.

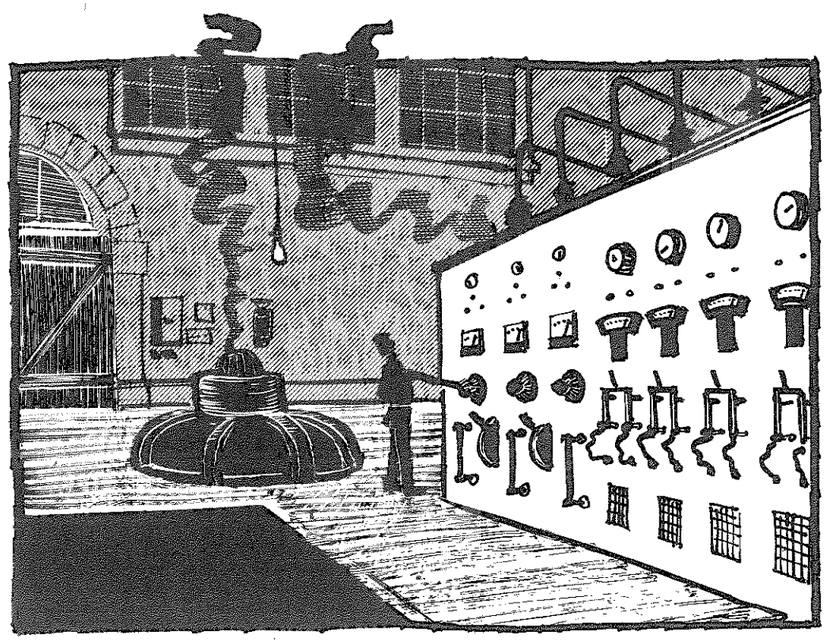
One of the central building blocks of the EPP's analysis is a February 1982 OPPA report titled *The Nation's Electric Future: Perspectives on the Issue of Electricity Supply Sufficiency*. This study makes the point that declining profitability in the utility industry, caused by a drop in companies' allowed rate of return from 6.2 percent to 2.2 percent between 1970–80 (adjusted for inflation), has placed financial constraints on new capital expenditures. The report concludes that if this trend continues through the early 1980s, "continued utility financial problems against a background of modest electricity demand growth may cause a long-term shortfall in electricity supply."

Upbeat views

While project spokesmen view their study's findings as a cause for real concern, there are those who think the situation is not nearly as bad as the EPP makes it out to be. An example is the Electric Consumers Resource Council (ELCON), a trade association that represents the nation's largest industrial electricity consumers. According to Executive Director Jay Kennedy, ELCON's members have perhaps a bigger stake in an adequate supply of power than anyone, and they simply do not share the EPP's gloomy view of the future.[1] For one thing, Kennedy disagrees with the project's basic assumption that utilities are in financial trouble. Citing lower fuel prices, interest rates, and inflation, and $8 billion in recent rate increases, Kennedy thinks electric companies are in better shape than they were two years ago. Moreover, he says, the evidence on future supply capability is mixed; he cites an August 1982 report by the Congressional Research Service—*Do We Really Need All Those Electric Plants?*—that uses essentially the same numbers as the OPPA study but concludes that "most areas of the country are expected to be in rather good condition in regard to electric generating capacity in the future, assuming moderate economic growth and the middle capacity case."[2]

Another group that finds fault with the EPP's articulation of the utility problem is the American Public Power Association (APPA), which represents 1,750 publicly owned power systems throughout the country. APPA Deputy Executive Direc-

[1] Interview in *Energy Daily*, October 27, 1982.
[2] Ibid.



tor Larry Hobart took issue with Hunter Chile's belief that private power companies are not earning enough money to make investments that are in the national interest.[3] In support of his point, Hobart quoted Austin Koenen from the investment firm of Lehman Brothers Kuhn Loeb, Inc.: "The investor-owned electric industry is currently experiencing a major secular improvement in its underlying operational and financial characteristics due to slower load growth, responsive regulation, improved cost recovery mechanisms, lower inflation, and a moderate energy crisis."[4]

"The overriding reason for power plant cancellations," Hobart said, "is not financial constraints, but a falloff in expected load growth."[5] He cited recent plant cancellations by two large investor-owned utilities, which company spokesmen attributed to declining demand projections.

Members of the EPP do not dispute that projections for future electricity demand have been scaled down considerably from the historic rate of 7 percent per year. But, they say, two factors may serve to boost load growth over the next ten years: a slow rise in the real price of electricity compared to prices for substitute forms of energy, and an increase in economic growth. The EPP's primary concern is that if such conditions did spur electricity demand, we might well get caught with our plants down, and regulators would be institutionally incapable of providing the revenue relief required to undertake new construction.

To guard against such a possibility, the EPP would recommend reforms in the way rates are established for utilities as well as a redistribution of authority over electricity planning and regulation from the federal and state levels—where it currently is lodged—to newly created regional bodies.

The specific proposals discussed so far within the EPP center on three basic objectives: deregulation of certain types of electric power transactions; the development of a "model policy" for utility regulation that draws a legal link between rates and a preapproved supply plan; and the establishment of regional planning and regulatory bodies.

Partial deregulation

As an example of its thinking, the EPP believes that sufficient competitiveness exists in the market for bulk power sales to justify at least partial deregulation of wholesale transactions between willing buyers and sellers and for sales from new generating facilities dedicated to the wholesale market. If this assumption is true, competition also may serve better than regulation as a means of removing inefficiencies (high costs and low supply) from the bulk power market.

The APPA, however, is not so enthusiastic about the idea of deregulating wholesale rates. APPA members—mostly small and predominantly unregulated publicly owned power systems in forty-nine states—are both competitors and customers of their large, privately owned neighbor utilities. The mistrust between public and private power systems is long-standing and has many sources. On a philosophical level, investor-owned utilities feel that public systems are unfairly subsidized through their access to tax-exempt financing and that this is not only inequitable, but also economically inefficient. On a more practical level, private companies find more often than not that the rates charged for public power are less than those they can afford to charge, a circumstance that sparks competition between public and private companies for choice industrial customers.

While a little healthy competition is usually a good thing, the situation in this case is complicated by the fact that some 900 of the APPA's members also are customers of private utilities and from them purchase most or all of the power they need to serve their systems' requirements. In light of the fact that bulk power purchases account for three-quarters of the total cost of the power supply for these public systems, it is easy to see why they feel federal regulation over wholesale rates continues to be important to them.

Linking rates and supply plans

The idea of establishing legal and regulatory links between rates and electric supply planning also has a good deal of merit, but here again the political reception for any such proposal depends heavily on the specifics. It is no secret that traditional utility planning has been rather one-dimensional: facing a steadily increasing growth rate for demand, a company has had only to decide whether to build a new large power plant. Meanwhile, increasing sales, coupled with falling unit costs, always ensured that sufficient revenue would be generated to pay for the plant when it came on-line.

But traditional utility planning has gone the way of the nickel phone call. Today's utility planners are far less sure how fast demand will grow or where they will get the capacity to meet it. About the only thing they are sure of is that whatever they do need will be very costly.

Recent developments have added a whole new dimension to utility planning. Least-cost strategies for meeting electrical demand have come to include customer investments in conservation and energy efficiency measures as well as alternative sources and configurations for electric generation. The institutionalization of new approaches to low-cost supply planning would be an important step toward reducing the risk of utility planning error. At the same time, linking the rates a utility may earn and its implementation of a supply plan that has received prior public approval seems to be an equitable way of allocating any remaining risk among all who benefit from the system, rather than laying it solely upon the company itself.

Among those who have responded to this concept, the Natural Resources Defense Council (NRDC) has expressed initial support and cited its past interest in model legislation that assures consideration of least-cost means of delivering energy services. But what NRDC means by least-cost energy planning may well differ from what those in the Electricity Policy Project have in mind. The environmentalist group points to the Northwest Power Planning Act as its idea of good prototype legislation. This act gives priority to conservation and renewable energy resources in developing a least-cost plan.

By contrast, the Department of Energy's vision of long-run cost minimization reflects a decided supply-side perspective. The EPP articulation of the problem as the need to build central station power plants already has raised the suspicions of environmentalists and renewable energy advocates that its effort is more teleological than objective. Before these groups endorse the EPP's idea that planning should guide rate regulation, they would certainly want to know more specifically how plans are to be established and approved, and by whom.

Regional bodies

There is a lot to be said for the idea of bringing electric system planning and regulation to the regional level. The current regulatory structure follows political lines, with wholesale rates set by the Federal Energy Regulatory Commission and retail rates—and a variety of other aspects of utility operations—regulated in fifty slightly different ways in the states. Unfortunately, this political framework for regulation does not accurately reflect the economic and engineering realities of the electric power business. Some utilities do

(Continued on page 19)

[3] Written testimony presented at the November 22, 1982 meeting of the National Governor's Association's Electric Utility Task Force.
[4] Ibid.
[5] Ibid.

Food and agricultural policy—Old wine in new bottles

ONE YEAR AFTER ENACTMENT of four-year legislation, U.S. agriculture and agricultural policies are in turmoil. Federal outlays to support farm commodity prices and income ballooned to $12 billion in the fiscal year ending October 1982—the highest in more than a decade. Aggregate net real farm income for 1982 was the lowest since the Great Depression. For the first time in thirteen years, last year's value and volume of U.S. agricultural exports declined, and a further decrease is forecast for 1983. Charges and countercharges of unfair trade practices reverberate across the Atlantic. American farmers, squeezed by high fixed production costs and low commodity prices, increasingly are restless and critical of the adequacy of current policies to cope with their income and resource adjustment problems. The Congress and the Reagan administration have reacted by taking or proposing a series of "emergency" legislative and administrative actions, some of which strain the very fabric of the 1981 Food and Agriculture Act and reverse the recent market-orientation of agriculture.

Only a few years ago concern was widespread about the ability of U.S. agriculture to respond to rising global demand for food and fiber. Some, in the euphoria of seemingly insatiable export markets of the 1970s, proclaimed a new era for American agriculture—one of relative scarcity of resources, upward trends in commodity and food prices, and more passive, less intrusive intervention by government to manage agricultural production. What went awry? Were the events of the 1970s unique, illusory, and unsustainable? Or are the back-to-back record-breaking crops and low commodity prices of the last two years merely short-term aberrations in a long-run trend of relative scarcity of food supply?

As in medicine, a proper policy prescription for agriculture's current malady depends on expert diagnosis of the problem in which symptoms are differentiated clearly from the disease. And as in medicine, care must be taken lest the prescription worsen the problem or produce unintended side effects.

Diagnosis and prescriptions

The immediate source of U.S. agriculture's economic problems seems clear enough—record-breaking crop production coupled with recession-weakened demand at home and abroad. The predictable weakness in crop prices fell heavily on operators whose production costs had been ratcheted upward in preceding years by inflation and investments in assets priced in expectation of much higher economic returns. As supplies mounted and prices fell, government outlays soared for commodity storage and deficiency payments to meet legislated target prices.

Despite mounting political pressure for much more drastic action, the policy prescriptions have been moderate. Of course, stimulating demand for farm products (except by direct subsidies to foreign or domestic consumers) largely is beyond the reach of agricultural policy. And despite a good deal of rhetorical brinksmanship with the European Community, gestures in the form of loosened export credit terms, and disposal abroad of some surplus products, the administration has refrained so far from actions that might trigger an all-out trade war. Thus, corrective prescriptions mostly have centered on policies to adjust domestic supply of commodities.

Two major objectives have driven domestic supply adjustment policies—constrain production to enhance market prices, and reduce government budget exposure

in 1983–84—and a two-pronged program has been mounted to achieve them. The first encourages diversion of 20 percent of the cropland base for cotton and for food and feed grains, for which farmers will receive payment on 5 to 10 percent of the base and eligibility for other program benefits for commodities produced on the unrestricted portion of their base.

The second establishes payments-in-kind (PIK), whereby farmers complying with the cropland diversion program may retire as much as an additional 30 percent of their base and receive payments in the form of surplus commodities at the rate of 80 to 95 percent of the normal yield in PIK acreage.

In theory, this administration sleight-of-hand should produce several results: 1983 production is reduced and market prices are increased from otherwise prevailing levels; current large stocks (government-owned or farmer-owned under government programs), stock management costs, and government budget exposure in 1983–84 are reduced; the farmer's out-of-pocket costs are reduced by not producing on as much as 50 percent of his cropland (or possibly his whole farm) while receiving cash and commodities to dispose of as the farmer sees fit. The administration estimates that as many as 30 million acres might be removed from production in 1983. Budget savings of about $3 billion are estimated in 1983–84 from the PIK alone.

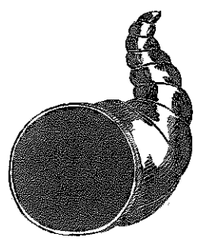
To implement the PIK program, a vast web of administrative rules and regulations governing release of stocks, certification of diverted acreage and its use in approved conservation practices, and the resale of PIK commodities will be required. To avoid geographic concentration, land diversions will be limited to not more than 50 percent of the cropland base in any single county. Although the estimated 30 million acres to be held out of production is far short of the 60 million acres withheld in the 1960s, the program could have substantial secondary effects on industries supplying production inputs to agriculture. And the program raises various equity problems related to the value of stocks released and the distribution of program benefits between landlords and tenants and among farms by size.

Payments-in-kind have been cast as an emergency one- to two-year program in the hope that resulting supply reduction coupled with strengthened demand from economic recovery at home and abroad will improve agricultural prices and incomes in the immediate years ahead. But prospects for economic recovery themselves are elusive and uncertain both in the United States and in foreign markets on which U.S. agriculture has become highly dependent. A combination of weak economic recovery and less than the hoped-for results from 1983 supply management schemes could well be precursors of even more intrusive government agricultural policies in 1984.

Short-run vision, long-run needs

The atmosphere of crisis now permeating farm policy discussion reflects the disarray that for some time has plagued economic policy in general and agricultural policy in particular. Despite fundamental changes in the structure and economics of agriculture in recent decades, farm policy continues to be largely bound by the concepts and legislation of the 1930s: in an increasingly complex, globally interdependent economy, economic policies and policymaking are partial, fragmented, and frequently predicated on outdated concepts. Expediency and the quest for immediate solutions to long-range economic adjustment problems too often prevail in the formulation of public policy.

Contemporary U.S. agriculture is highly diverse in its economic organization. Although some 2.4 million farms still exist by official definition, 12 percent account for 68 percent of annual sales. A mere 5



percent of the farms—large in scale, highly capitalized, science-oriented, and boasting sophisticated management—account for 50 percent of annual sales. These farms have been growing both in number and in economic significance.

At the other extreme are nearly 1.5 million relatively small farms, many owned and managed by part-time operators whose household income mostly is derived from off-farm employment. These farms contribute only 6 percent of national production of food and fiber. In between are 674,000 largely full-time farmers who work moderate-scale farms. Many in this group also have substantial off-farm household income.

Each of these subsets faces different circumstances concerning resource endowments and management. Some are economically more affected by industrial employment opportunities and macroeconomic policies than by agricultural prices and policies. Some receive benefits of agricultural price and income policies highly disproportionate to their numbers. The mix of public policies, if any, appropriate to deal with such disparate circumstances is quite different. Yet many agricultural policies, particularly the price and income policies that currently command the bulk of federal agricultural outlays, implicitly regard the sector as if it were homogeneous. The income distribution effects of such policies are much different than espoused policy objectives.

Interdependence and instability

One of the evolutionary changes of fundamental importance is that U.S. agriculture has developed closer, more immediate links with other sectors of the domestic economy. The most obvious example is the close linkage which has been forged in the capital and labor markets. Consider also the importance of food prices in the Consumer Price Index and the role that indicator plays in macroeconomic policy decisions. But mutual interdependence by no means is confined to the domestic economy. The United States dominates world trade in cereals, feed grains, and oilseeds. Disturbances and instability are transmitted quickly and directly in both directions, with agricultural market and macroeconomic repercussions. Moreover, the terms of trade in world agricultural markets are not related only to supply and demand for commodities: they are powerfully influenced by exchange rates, other aspects of international monetary policies, and by trade and foreign policy. Market distortions resulting from national policies—be they agricultural, macroeconomic, or foreign policies—are readily transformed into international market distortions. Yet U.S. policies and policymaking processes have been slow to adjust to such realities and to achieve that nexus of coordination appropriate to complex, interdependent economic systems.

In 1945, Nobel laureate Theodore W. Schultz published his classic *Agriculture in an Unstable Economy*. If a reminder is needed of the validity of Schultz's thesis concerning the instability of agriculture, the 1970s and the early 1980s should suffice. In the course of but ten years, the world has experienced a major shortfall in food production and seen lesser shortages and surpluses in several countries, capped by current large U.S. surpluses that rival the 1960s' chronic surpluses. Future fluctuations in world food production are inevitable. Only their timing and magnitude are in doubt.

For all of the advances made in agricultural science, food production continues to be powerfully influenced by weather, climate, pestilence, and disease. Although current U.S. commodity stocks are large, global stocks—at 17 percent of annual use—are not out of line by historic standards and indeed probably are minimal. A food security policy—preferably coordinated international food security policies—would view U.S. abundance as an opportunity to build valuable reserves against future production shortfalls. In the absence of an adequate food security policy in the United States and internationally, politics tends to take over. Thus, the inclination is to short future markets and manage domestic stocks to enhance farm prices and incomes in the immediate future, to incur opportunity costs by shutting down the productive capacity of millions of acres, and to run substantial risk of future weather-induced shortages and instability in an inherently unstable world agriculture. The lessons of the 1960s and 1970s should not so quickly be forgotten.

Although experience has shown that internationally linked food security policies are fraught with difficulty and frequently negated by nationalistic motives, global interdependence and the instability of agriculture argue for continued efforts to develop such institutions *before* the next major world food shortfall. Within the United States, that means higher priority must be given to longer-run food security and that policy objectives concerning the management of commodity stocks must be clarified and disentangled. The current attempt is simultaneously to provide short-term support of farm prices and income and, secondarily, to meet the quite different objective of food supply security.

Through a glass, darkly

No one can be certain of how the future will unfold. Whether today's record-setting crops and low commodity prices are aberrations about a longer-run trend of relative food scarcity can be determined only in retrospect. The economic and political events of the last decade may well turn out to have been unique and provide only an illusory and unsustainable vantage point from which to approach the 1980s and 1990s.

The experience of the last three decades is clear: given adequate economic incentives, improved managerial capabilities, and access to science-based technology, global food productive capacity is resilient and elastic. Just as clearly, effective global demand for food will expand substantially in the next two decades if the projected growth of population to some 6 billion in 2000 is accompanied by economic growth. Of course, the capacity to sustain economic growth at rates of recent decades is now in question.

So what can we expect from the future? Rather than the abrupt turning point proclaimed for agriculture in the 1970s and the cataclysmic shortages projected by some by the year 2000, we might anticipate continued growth in food production along a highly irregular path, one characterized by shortages and surpluses within countries and occasionally on a global basis. Also likely are gradually increasing real prices to induce adjustments and investments. Whatever the course, it will be marked by continued uncertainty and instability.

But the fact that the future is unknowable does not mean that its outlines cannot be influenced. Indeed, public policies undoubtedly will shape the course of future agricultural development. The critical need is to reexamine the precepts that undergird current policies and to develop and evaluate policy alternatives in the context of the realities—not the myths—of contemporary agriculture. The 1930s, after all, were a half-century ago.

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(Power, continued)

business in more than one state and different regulatory treatment from the commissions involved can make the development of a uniform company plan quite difficult. Even utilities that operate wholly within one state are interconnected with other systems and their planning is designed to capture whatever economies and opportunities for risk reduction may exist by virtue of intersystem coordination. Substituting regional bodies for the arbitrary political boundaries that now define regulatory policies could be an excellent way of changing regulation to fit reality.

But is the concept of regional bodies politically acceptable? On its face it is a neutral proposition. In practice, such bodies might be charged with anything from developing nonbinding supply plans for their region to regulating wholesale and retail rates. The National Governor's Association and the National Conference of State Legislatures have expressed initial reluctance to support any proposal for regional cooperation that is not voluntary. The latter, in particular, is concerned that regional bodies might usurp state authority over plant siting and rates, issues that have critical importance for local economies. Until the details of any proposal for regionalization are made known, it is likely that these and other representatives of state interests will assume a wait-and-see attitude.

Overcoming inertia

Apart from the specific concerns that these interest groups may have with EPP proposals, perhaps the greatest obstacle to their implementation will be indifference. As one informed Capitol Hill energy staffer pointed out before the National Governor's Association Electric Utility Task Force, the congressional agenda in 1983 already is overcrowded with more urgent issues, and if the Reagan administration wants anything done in the electricity area it will bear the burden of proving that the wolf is at the door.

It may be difficult to demonstrate the existence of a crisis urgent enough to get congressional attention. Conditions in the utility industry have improved, financial indicators are up, demand forecasts are down and—with everyone complaining about rates—there seems to be little political inclination to make changes that might boost rates still higher. The important issue, however, is not what things are like today, but what they will be like in the future: the real lesson of recent experience with electrical planning is that it has become more complex and that the costs of an error will continue to rise.

The investment climate for electric supply indeed has changed dramatically in recent years, and with the cost and supply pressures temporarily low, this would appear to be an appropriate time to develop a national policy for the industry that accounts for those changes. In the abstract, the Electricity Policy Project proposals represent at least an initial approach to such a policy, and on that score they deserve consideration. But these or any other proposals are unlikely to enjoy any real political consensus until interest groups are satisfied with the details, and until Congress is convinced that a problem truly exists.

Author Mark Lyons is a former fellow in RFF's Center for Energy Policy Research.

New data directory

Researchers in RFF's Quality of the Environment Division have compiled a *Directory of Environmental Asset Data Bases and Valuation Studies* covering national, regional, and state data sets that provide detailed information on parks, forests, wilderness areas, recreational facilities, and similar U.S. environmental assets. The content and form of the data, as well as the names, addresses, and telephone numbers of the appropriate personnel are included.

The authors—David Yardas, Alan J. Krupnick, Henry M. Peskin, and Winston Harrington—also survey methods for generating estimates of the value of the physical assets in dollar terms. In addition, the Directory contains an annotated bibliography for the reader's convenience.

Copies may be ordered directly from Henry M. Peskin, Room 720, Resources for the Future, 1755 Masachusetts Avenue, N.W., Washington, D.C. 20036. The Directory is priced as follows: single copies, $4.50; two to ten, $2.50 per copy; ten or more, $2.00 per copy.

Minds, money, and markets

AN EMERGING STYLE of collaboration between industry and the universities is causing considerable soul-searching on campus and in the boardroom. It is closer, larger in scale, and governed by different terms than are traditional grants to outstanding researchers or routine consulting arrangements. For participating universities, the new arrangement means huge sums of money for research; for donor corporations, it promises an inside track on the commercial development of new discoveries.

The new collaboration was dramatized last June by a $23.5 million grant from the Monsanto Company to its neighbor, Washington University in Saint Louis. The grant was hardly unprecedented. A $50 million grant in 1981 from the German pharmaceutical firm Hoechst A.G. to Massachusetts General Hospital (affiliated with Harvard) was bigger and had many similar provisions. But it was large enough and innovative enough to focus attention on the potential conflicts between university objectives and the goals of profit-making institutions implicit in such arrangements.

Only three months before the Monsanto grant, a group of leading university presidents and business leaders met at Pajaro Dunes, California, to discuss the implications of the emerging style of partnership. The issues were considered sufficiently touchy to warrant the exclusion of outsiders in order to assure a full and frank discussion. By the end of the year, the partnership question was high on many agendas. According to the British periodical, *New Scientist*,[1] university-industry relations are "matters of equal concern in Britain where the Prime Minister last autumn asked the Advisory Council for Applied Research and Development to report on university-industry links." They also were reported to be on the agendas of the Association of American Universities and the American Association of University Professors. A December conference on industry and universities as Partners in the Research Enterprise drew 400 scientists, business representatives, and others to the University of Pennsylvania, and *Business Week* detected the flowering of an "unprecedented spirit of cooperation" in business-university relationships that "deserves careful nurturing."[2] The magazine also acknowledged "the legitimate concerns" of educators about academic values, concerns that received particular attention in educational and scientific publications. At Philadelphia, as well as Pajaro Dunes, the participants stressed the need to avoid setting rules or establishing formal guidelines. They were intent primarily on identifying issues and examining their implications.

Whether the new style of collaboration proves salutary or troublesome, significant or only marginal, for the moment, at least, it occupies center stage.

The quid pro quo

Several provisions distinguish the Monsanto agreement and others like it from traditional corporate grants. The agreement sets forth an institution-to-institution relationship and provides for close working relations between company and university researchers. It establishes a board of four representatives from the company and four from the university to decide which grant applications from faculty should be supported, sets up an outside advisory board to comment both on the quality of the science and the effects of the program on Monsanto and on Washington University, and grants the company an exclusive license to develop any discovery financed solely by the firm that has commercial application (the patent being retained by the university). The right of researchers to publish their findings is affirmed, but with a procedural modification: publication will be delayed for thirty days while the company reviews the article and considers its implications for commercial follow-up; any royalties will go to the university, rather than to the individual researcher. The general field of research is specified, but not individual projects.

The Monsanto-Washington University provisions were reported in *Science* magazine,[3] which devoted considerable space during the year to university-industry relations. *Science* also noted that to prevent a preoccupation with applied problems, the agreement specified that 30 percent of the money was to be devoted to basic research.

Precedents existed for most of the specific provisions in other agreements, though the precise details took some three years to work out. The Hoechst agreement, for example, provided for exclusive licenses, an especially touchy issue and one that drew considerable attention at the Philadelphia meeting.

Implications for technology

University-industry partnership has implications for technological innovation as well as for scientific inquiry. The process of technological innovation, which encompasses minds, money, and markets, has been of increasing concern in the United States for many reasons—declining productivity, increasing foreign competition, controversies over the size of federal support for research and development, the need to develop substitutes for scarce materials or ways to make existing resources go farther, the search for ways to reduce pollution, and so on.

A corporate rationale for supporting an academic partnership is that it is likely to have a better payoff than a comparable expenditure on company laboratories. In some areas—biotechnology has been cited—some university researchers are ahead of their colleagues in industry. Collaboration can give a corporation access to more advanced work and at the same time provide an opportunity for company scientists to catch up or move into new areas.

To the extent that the partnership enables companies to speed up the development process—to reduce the lag between discovery and commercial exploitation—the consequences have broad economic implications. Economists long have stressed the role of the market in inducing technological advances. As they see it, when a resource is in short supply, its price rises and an incentive thereby is provided to introduce new technology that can alleviate the shortage. Historically in the United States, the shortage was labor, thus creating a strong incentive to develop labor-saving inventions; later, high wages stimulated automation and robotics. In an era characterized by increasing concern about material shortages, resource-saving innovations rise to the top of the incentive list. It could be argued that the greater sensitivity to market needs that presumably characterizes the corporation could more effectively be expressed through a partnership with university research.

But innovation does not merely reflect the pull of the market: a good deal of technology develops semiautonomously. Consumers and industry may not know what they want or what they could use profitably until the logic of a discovery has carried research and development fairly far along. To make researchers wholly beholden to company needs easily could choke off lines of inquiry whose potential cannot be detected until a later stage of development.

The most productive university-industry partnerships cannot, of course, assure success. The specter of uncertainty, if not failure, cannot be banished, even in an area as highly touted as genetic engineering. Last year provided a reminder of an old lesson: not every firm that is an early entry into a new field and that seems destined for success will survive. One widely heralded firm, Southern Biotechnology, filed for bankruptcy when it lost its partner in a projected joint venture and was unable to find a buyer for its large stock of interferon. Wall Street reports generally reflect a dimmer view of biotechnology than was the case even a year ago. Money for biotechnology firms is difficult to raise and there is talk of a possible shakeout in the industry.

Long-run consensus needed

Research and development and technological innovation are inescapable concerns for anyone interested in long-run resource availability. Twenty-five years ago RFF sponsored a public forum in which leading scientists explored the outlook for technological advances, and RFF researchers have continued to try to take into account technological factors in analyzing public choices. Currently a seminar series is exploring the feasibility of a broad study of technology and natural resources.

Funding represents only one concern. Others include the supply of scientists and engineers, the development of new energy sources, the possibilities of genetic engineering and other biological research, and corporate strategies for developing new technology. As in the funding issue, each of these areas requires the delicate balancing of industry and university objectives. And to one degree or another, each requires the tacit approval—in some cases the explicit approval—of the larger society.

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Funding R & D

IN RECENT YEARS corporate spending for research and development has risen more rapidly than has federal funding (and faster than the rate of inflation). Thus, though private sources accounted for only about half of all R&D spending in the mid-1960s, they now account for more than half, according to data from the National Science Foundation. For 1983, projections by the NSF, the Battelle Institute, and others indicate a further increase in real private spending.

But industry still is only a relatively minor source of funds for university scientific research. According to a study reported at a Philadelphia meeting in December (see accompanying story), corporate sources make up only about 4 percent of the total university scientific research budget.

H.C.M.

[1] *New Scientist*, vol. 23, no. 30, December 1982, p. 780.

[2] *Business Week*, Dec. 20, 1982, p. 92.

[3] *Science*, June 18, 1982, pp. 1295–1296.

The natural gas price puzzle

NATURAL GAS IS back in the headlines, but unlike six years ago, price—not supply—is the issue.

Then, schools were out, factories were on short hours, and shopping malls were closing early because there was not enough gas to go around. Now gas supplies are adequate, but average prices to residential consumers have risen more than 50 percent in real terms since 1978, with about half of that increase coming since last winter. Further increases are in prospect.

Why have natural gas prices gone up so much, while oil prices recently have even declined? Why are prices rising now with supplies so abundant that some gas is going unsold? How much higher will prices go? What factors form the backdrop of the natural gas battles that now seem inevitable in Congress and, looking ahead, in the 1984 campaigns?

Origins of the problem

Today's natural gas price story begins with the Supreme Court's 1954 *Phillips* decision that imposed Federal Power Commission—now Federal Energy Regulatory Commission—price controls on the wellhead price of most gas flowing in interstate commerce. (Sales for use *within* producing states were not regulated under the decision.)

While a system to control wellhead prices took almost a decade to work out and had little direct effect until the mid-1960s, by the late 1960s underpriced gas was being consumed more rapidly than it was being found. More seriously, the low price was signaling consumers to install more long-lived gas-using equipment than could be served by the amount of gas that could be produced at those prices. The ultimate result was the system of curtailments and restricted access to gas that gave some users (including those in producing states) all they wanted at a submarket price, while forcing others to pay very high prices for alternative energy sources—oil or electricity—or do without energy.

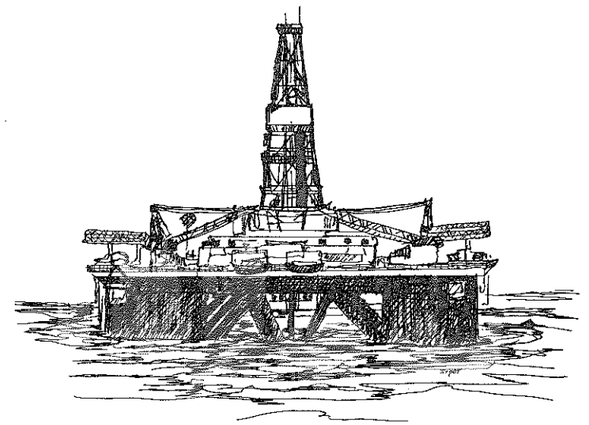
The waste, inefficiency and, above all, the unfairness of a system that left gas prices too low led to demands for congressional action. The gap between existing and free market prices had to be closed. But if this were done quickly, the price increase could mean a shock to the economy, significant harm to some consumers, and windfall gains for some producers.

A legislative fix

After a marathon effort that left all parties exhausted (and many embittered), the Natural Gas Policy Act of 1978 (NGPA) was passed. It met some of the goals of its drafters: prices were started on an upward track toward free market levels; gas was shifted from consumers in producing states to others to relieve critical shortages, at least for the near term; the early burden of rising prices was placed disproportionately on industrial rather than residential or commercial consumers; and price increases were concentrated on potential gas sources where the supply effect was expected to be greatest. Today, however, consumers see most clearly another outcome of the NGPA—the rapid and, for some, devastating increase in their gas bills.

As it turned out, NGPA pricing provisions offered more latitude for increases in the average price of gas than its framers expected; thus, the gap existing in 1978 started closing quickly. Moreover, the price level at which competition from other fuels would take over the constraining role from regulation jumped as oil prices doubled less than a year after the NGPA was enacted. Competition for supplies, fueled by past, present, and expected shortages, pressed prices of controlled gas against regulated ceilings and allowed producers to obtain three or four times as much for the small quantities not subject to controls.

True, the decline in oil prices in real terms over the past year—by about 11.8 percent for heavy fuel oil and 9.3 percent for home heating oil—now has left natural gas prices with less catching up to do. But until the gap is fully closed—with falling oil or rising gas prices—further increases in the average wellhead price will be in store. Still, the 15 percent or so annual increases of the past few years may soon be over. Evidence suggests that, on the basis of supply and demand fundamentals, prices will stabilize this year or next—barring further disruptions in oil markets.



Price hikes and the "glut"

But for now consumers are seeing big jumps in gas rates—with more to come—at the same time that some producers are complaining that they cannot find markets for some of the gas they want to sell. How can this be? Part of the explanation rests on the lags of price increases between the wellhead and ultimate consumers, and part on special circumstances, mentioned below. But fundamental factors also are operating, at both the producing and the downstream levels.

Wellhead prices

To begin, it is not clear that field market prices are above the level that in the long run would balance supply and demand. A glut exists, but it may be a surplus of short-run deliverability—ability to produce gas from already existing wells—and not of gas supply in a more basic sense. There are several reasons to believe this may be the case.

First, demand is depressed by the recession; with recovery, use will rise, and possibly by more than enough to offset further conservation in response to price increases that already have occurred.

Second, the rapid increase in price led to a spurt of drilling in established production areas. This increased short-term producibility, but did not yield commensurate reserves to support production over the longer term.

Third, until the glut appeared in full force, pipelines bid against one another for reserves by promising producers they would take gas at near-capacity output levels, whether there turned out to be a need for it at the burner tip or not. They could not offer what the gas was worth because of price controls, but through high "take-or-pay" contracts they could entice producers to sell by giving them revenue security and an earlier payout. With producers guaranteed sales (or at least revenues), pipelines lost flexibility to lower purchases when recession, tougher competition from oil, and conservation shrunk anticipated markets. Higher minimum takes thus led to a once-and-for-all spurt in gas available to end users.

Finally, the glut at current average prices is partly an artifact of wellhead regulations. Much gas is controlled at prices well below those required to induce replacement of the reserves being depleted, but it will continue to be produced until reserves are gone. Part of the resulting "cushion" between the price regulated gas could command in the market and what pipelines must pay for it is absorbed in very high prices for "deep" gas (from below the 15,000-foot level) that is not controlled under the NGPA. More of the cushion goes to pay for gas imported from Canada and Mexico at about twice the domestic price, and for a small quantity of even more expensive gas imported in liquefied form from Algeria. But this still leaves, for a while at least, more gas flowing than would be the case if the current average price were paid for all gas.

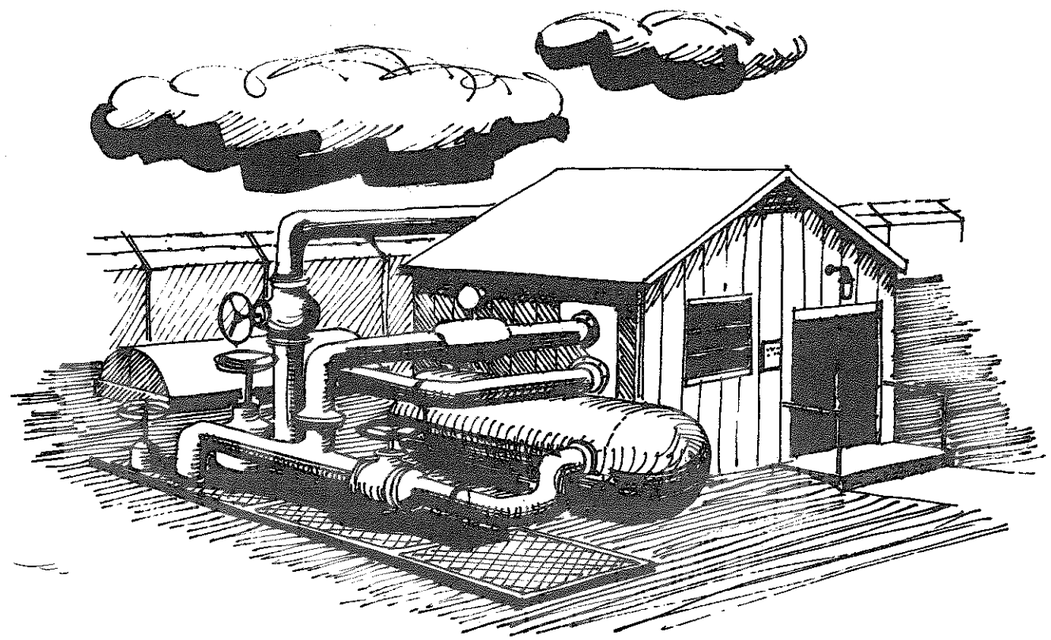
Surpluses in deliverability thus exist even though the average field price may still be too low to balance supply and demand once transitory phenomena pass. But why have prices not fallen temporarily to reflect this temporary condition? The answer can be understood on two levels, based either on the way regulations and private contracts work or on the economic fundamentals involved.

As for the first, long-term contracts between pipelines and producers—common in this industry—typically prevent adjustment of prices downward to meet fluctuations in demand. In the short run, when demand falls, the only recourse of pipelines is not to purchase more gas. The result, paradoxically, is to leave the price of gas going into the pipeline at the same high level *and* to leave some producers with gas they cannot sell—even at a lower price.

With respect to underlying economic factors, long-lived investments characterize every phase of the industry—from expenditures to find gas reserves that will be produced over a decade or more to similarly long-lived delivery systems and gas-using equipment. The economy as a whole—and that ultimately means consumers—cannot escape the cost of sustaining capacity through the ups and downs of demand due to the business cycle or to outside shocks such as those from fluctuating oil prices. The question is whether consumers will pay for the capacity required by paying more when demand is high and less when it is low, or instead, as is the case now, have stable prices with transitory gluts followed by supply stringencies. Long-term, fixed-price contracts served the economy reasonably well in the tightly regulated pre-NGPA era. But shorter terms and price flexibility may now be more in keeping, and indeed this is the direction the industry has been moving for the past year or so. (Extraordinary prices for deep gas are being negotiated downward, for example.) This is not a costless change, however, and it is creating strains up and down the line.

Transportation and delivery costs

The "rising prices in a glut" story does not end with the conditions surrounding the bargains struck between pipelines and producers. Consumers also must pay for transporting and delivering gas. While these costs are getting smaller relative to rising gas prices at the wellhead, they also have risen. The contributions of various causes to the increase vary system by system. In addition to general inflation, they include increased interest costs, higher costs for the gas they use themselves, larger charges for "uncollectables" (due to the



recession and to the higher fuel prices some consumers have not been able to pay), and higher unit costs because fixed costs must be spread over fewer units actually sold.

This last phenomenon is important. It also is exceedingly frustrating to residential and commercial consumers who are trying to conserve to cut down on fuel bills. Such consumers have lowered their use, yet many costs of serving each one—metering, billing, maintaining a delivery system—remain the same. On a national basis, compared to 1978, 5.8 percent *more* consumers used 8.8 percent *less* gas in 1981; the 1982 conservation results will be even more striking. Given the large element of fixed costs, it is no surprise that distribution company rates were driven up. The same forces are at work pushing up pipeline transportation charges.

This rather straightforward supply, demand, and cost explanation of the price picture, accurate enough on a national basis, is vastly more complicated when specific producers, pipelines, distributors, and consumers are considered. The average cost of gas as it enters a particular pipeline, for example, depends on historical accident, location, timing, and bargaining power. Management decisions turn out well in some cases and poorly in others, and sometimes may favor pipeline interests even when that means higher prices down the line. As to individual consumers, their rates may depend on who serves them, which other customers share their system, and the goals and skills of state regulators who monitor distributor costs and rate structures.

The legislative agenda

While rectifying the underpricing of gas and distortions in its production and use have beneficial effects for the economy as a whole, the transition costs are large. What, if anything, can be done to reduce these costs and to share them more fairly?

Price increases have placed near-intolerable pressures on the poor in cold climates who rely on gas for heat. Higher bills have not been covered by additional welfare payments and have come too swiftly for the near-poor to adjust their budgets. Local relief agencies are swamped and some distribution companies are sinking under uncollectable bills of consumers that the law and humane concern demand they continue to serve. State utility commissions are helpless, though they bear the burden of public antipathy. Only added state and federal funds can help. The solution is clear, but it is difficult to implement in an era of shrinking budgets.

Dissatisfaction with sometimes idiosyncratic outcomes, with price disparities that are inequitable and inefficient, and with the prospects for further problems as, under the NGPA, more gas is decontrolled at the end of 1984, have sparked demands that federal regulations be changed. Contradictory themes are emphasized, however, and greatly different prescriptions are offered.

As suggested above, underlying factors constrain what gas legislation can accomplish. The poor can be protected only at extraordinary cost because submarket prices cannot be sustained in the long run without shortages. Gas demand fluctuates and the cost of sometimes idle capacity must be borne to make service available when times are better. Legislation can shift costs among parties, by altering contract terms and limiting take requirements, for example, but laws cannot make costs go away.

The transition toward more efficient use of natural gas and other resources that began with the NGPA has yet to run its course. Problems remain and strains continue that deserve careful and thoughtful consideration.

Because of the importance of natural gas and the strong emotions that it arouses, the coming debate is likely to be great political theater. As an antidote to bemusement, the wise spectator will keep in focus the economic forces that ultimately determine the limits of what can be accomplished.

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New RFF books

Current Issues in Natural Resource Policy. Paul R. Portney, editor; with the assistance of Ruth B. Haas. 316 pp. Hardcover, $27.50. Paperback, $9.50.

This work examines some of the most important natural resource problems that must be faced in the coming years and the ways in which they are affected by U.S. laws and policies. Written in nontechnical language, it describes the present state of this country's major natural resources, issues surrounding their use, and current policies.

Most important, it recommends policy approaches that would alleviate some current problems. For example, while freshwater supplies probably would be adequate to meet current and future needs if water were priced at its true value, federal cheap water policies almost certainly guarantee future shortages. On the other hand, ozone depletion and atmospheric build-up of carbon dioxide have received little attention, and yet these events may have far-reaching consequences if their potentially adverse effects are realized.

Because it takes a careful and dispassionate look at a number of controversial issues, this book will be of interest to a wide range of readers—legislative and administrative policymakers, the environmental and business communities, students, and interested laypersons. Topics covered are agricultural lands, climate, ocean fisheries, fresh water supplies, private forests, public lands, nonfuel minerals, and endangered species.

Discounting for Time and Risk in Energy Policy. Robert C. Lind, Kenneth J. Arrow, Gordon R. Corey, Partha Dasgupta, Amartya K. Sen, Thomas Stauffer, Joseph E. Stiglitz, J. A. Stockfisch, and Robert Wilson. 484 pp. $42.50.

The standard measure of investment analysis in which benefits and costs are forecast into the future and then discounted to their present value is not very useful when evaluating many energy decisions, particularly when those benefits and costs—such as the benefits of R&D or the environmental costs of nuclear wastes—are in the distant future.

This book is the first to provide a comprehensive discussion of the issues pertaining to the choice of the discount rate for such benefit–cost studies. The authors address and clarify the many conceptual issues and offer practical guidance to policy analysts on accounting for time and risk in preparing benefit–cost studies. Written by eminent economists in the field of public investment and policy analysis, the book will be useful to both theorists and practitioners alike who are concerned with the economic evaluation of policies and programs.

In particular, Lind offers to policymakers a methodology that gives specific guidance on the appropriate methods of evaluating energy policy decisions. He develops a framework for analyzing decisions that equates the social rate of discount with the social rate of time preference and that also accounts for the opportunity cost of capital by making adjustments in benefits and costs. In this way, it is possible to specify a single rate of discount for evaluating social investment decisions and to develop an analytical procedure to incorporate opportunity costs of these invesments and of the risks associated with them. In this, Lind truly has broken new ground.

This book is the result of a conference sponsored by the Electric Power Research Institute and conducted by Resources for the Future.

Freshwater Recreational Fishing: The National Benefits of Water Pollution Control. William J. Vaughan and Clifford S. Russell, with the assistance of Charles Paulsen and Richard Carson. RFF Research Paper. 222 pp. $12.00.

The 1972 amendments to the Federal Water Pollution Control Act dramatically redirected the nation's water pollution control efforts and set ambitious national goals for discharge controls and the resulting water quality. Criticism of the amendments and debate over their goals and requirements began during the legislative process. Among other things, the critics charged that the benefits to be expected from meeting the goals were not large enough to justify the cost of compliance.

Seeking to inform the debate, the authors of this work attempt an improved estimate of one segment of benefits attributable to the Clean Water Act. Using national survey data, they estimate equations to predict changes in fishing participation that would result from changes in the amount of available water of various quality levels. To value fishing days, estimates were derived from a travel-cost analysis of a large number of fee-fishing operations across the United States.

Vaughan and Russell design several scenarios corresponding to levels of implementation of the federal water pollution control laws and resulting changes in the quantity of available fishing water. The scenario for implementation of best available technology produced estimates of total annual benefits (in 1978 dollars) that ranged widely, depending on the assumptions made in valuing a fishing day and the statistical procedures used.

While there are problems of data availability, the authors point out that the general methodology has considerable appeal for those who wish to estimate recreational benefits of national water pollution control policies. They suggest, for example, how the method might be applied to marine recreational fishing, to boating, swimming, and other water-based activities more generally, and to the study of such special problems as the acidification of water bodies.

Oil Prices, Energy Security, and Import Policy. Douglas R. Bohi and W. David Montgomery. 220 pp. $25.00.

This book examines the ways in which the nation can respond to high prices and uncertain supplies of oil. A thorough economic analysis of the arguments for government action to reduce oil imports indicates that while a modest tariff is an important part of sound energy policy, a large tariff or other heroic efforts to reduce long-term import dependence are not necessary for limiting vulnerability to supply disruptions.

The authors disagree with the popular perception that concentration on import policy is the best way to deal with disruption risks and turn instead to private and public inventories as the most cost-effective way to minimize potential market dislocations. Using risk analysis, they examine how the private sector responds to changes in oil prices and market risks and conclude that private responses are crucial to the efficiency with which the economy responds. Government policy, they say, should be designed to encourage rather than distort private incentives.

Private actions, however, may or may not be consistent with the national interest and thus will determine the appropriate form of government intervention. Government energy policies are evaluated in light of their ability to fill this role. The analysis points up the important difference between policies that affect demand and those that affect supply, and describes the role for import policy when the Strategic Petroleum Reserve has been filled.

Bohi and Montgomery apply microeconomic theory to the problem of disruptions in energy supplies, analyze the rationales for government intervention, demonstrate how private sector responses can affect the success of an import policy, and indicate the kinds of energy policies needed to address the import security issue. The result is a definitive analysis of the central problem of designing energy policy in an uncertain world.

Regional Conflict and National Policy. Kent A. Price, editor. 160 pp. Hardcover, $18.00. Paperback, $6.95.

Sunbelt versus snowbelt. Energy-rich versus energy-poor. The Sagebrush Rebellion, disputes over scarce western water, accusations by one region that another is the source of its pollution. Conflicts among states and regions over natural resources seem to be growing in both number and intensity. Is the United States facing a new civil war over resources?

The contributors to this book find that the conflicts are real enough but that they pose few serious long-term threats to the state of the union. In fact, regional conflict has characterized the nation since its very beginnings and often has served as an engine of positive change.

Following Kent A. Price's introduction, Nathan Rosenberg explores the history of regional conflict in the United States. Hans H. Landsberg examines current conflicts through the prism of the energy "crisis" that began in 1973–74, including the impact of changing energy prices on population movements, per capita income, and consumers. Three typical case studies are offered by Allen V. Kneese: increasing salinity in the Colorado River, the Montana coal tax, and the proposed nuclear waste disposal site in New Mexico. Richard B. Stewart's detailed examination of the U.S. legal structure for dealing with such conflicts ranges from the Articles of Confederation to the most recent cases decided by the Supreme Court. Clifford S. Russell shows how and why society makes decisions to handle regional change and conflict.

Gilbert F. White offers a wide perspective of regional problems in an epilogue and Sen. Paul E. Tsongas conveys a political and regional point of view in the foreword. This scholarly but lively and nontechnical study will interest faculty and students as well as laypersons concerned about the dynamics of growth and change in the United States.

RESOURCES CUMULATIVE INDEX

Nos. 64 through 72 (January 1980–February 1983)