NATURAL RESOURCES JOURNAL

Volume 26
Issue 3 *Summer 1986*

Summer 1986

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Recommended Citation
James L. Regens & Robert W. Rycroft, *Options for Financing Acid Rain Controls*, 26 Nat. Resources J. 519 (1986).
Available at: https://digitalrepository.unm.edu/nrj/vol26/iss3/5

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Options for Financing Acid Rain Controls†

Over the past decade, the phenomenon of acid deposition, commonly referred to as "acid rain,"[1] has been subject to growing scientific research as well as widespread media coverage. Such attention has fostered a corresponding increase in public awareness as well as acrimonious debate about the extent to which acid rain constitutes an environmental risk requiring prompt regulatory action to mitigate or prevent its effects. As a result, acid deposition has been transformed from a relatively unnoticed area of scientific inquiry into one of the paramount environmental issues of the 1980s.

Acid rain first emerged as a public policy concern at the 1972 United Nations Conference on the Human Environment in Stockholm when Swedish scientists asserted that precipitation acidity attributable to sulfur dioxide (SO_2) emissions from man-made sources, primarily industry and utilities, was causing adverse ecological and human health effects.[2] Largely in response to the Swedish study, the Norwegian Interdisciplinary Research Program, the SNSF Project, was started in 1972. It focused on establishing the effects of acid precipitation on forests and fish.[3] In 1972, acting under

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†An earlier version of this article was presented as a paper at the 45th annual Conference of the American Society for Public Administration, Denver, Colorado, Apr. 8-11, 1984. It received the James E. Webb award as the most meritorious paper presented at that Conference.

[1] "Acid rain" commonly refers to what is more precisely identified as the wet and dry processes for the deposition of acidic inputs to ecosystems. Acidity is measured on the logarithmic pH scale (pH equals the negative log 10 of the hydrogen ion concentration); a solution that is neutral has pH 7.0. The "natural" acidity value often is assumed to be pH 5.6 calculated for distilled H_20 in equilibrium with atmospheric CO_2 concentrations. However, the presence of other naturally occurring species—SO_2, NH_3, organic compounds, windblown dust—can produce "natural" values of pH 4.9 to 6.5. *See* Charlson & Rodhe, *Factors Controlling the Acidity of Natural Rainwater,* 295 NATURE 683 (1982).

[2] Royal Ministry for Foreign Affairs and Royal Ministry of Agriculture, Pollution Across National Boundaries: The Impact on the Environment of Sulfur in Air and Precipitation (Sweden's Case Study for the United Nations Conference on the Human Environment, Stockholm, Sweden, 1982).

[3] The SNSF Project, entitled "Acid Precipitation—Effects on Forest and Fish," was the largest multidisciplinary study in Norwegian history. Its annual budget was approximately 10 million Norwegian Kroner ($2 million U.S.) for the period from 1972 to 1980. The SNSF Project involved cooperative research by 12 Norwegian institutions and more than 150 scientists; it produced two major scientific conferences, the first held midway through the study at Telemark, Norway, in June

the auspices of the Organization for Economic Cooperation and Development (OECD), eleven European nations also launched a cooperative effort to measure the contribution of local and transboundary sources to each participating country's sulfur deposition.[4] The OECD study concluded that SO_2 emissions could be transported long as well as short distances. In five of the eleven countries participating in the study, more than 50 percent of total sulfur deposition was estimated to come from non-domestic sources.[5] While meteorological changes and more accurate emissions inventories can significantly alter an individual country's contribution, the OECD study reinforced the conclusion that some proportion of the acid deposition occurring over almost all of northwestern Europe is due to transboundary pollution.

During the early 1970s, studies conducted in Canada and the United States produced similar concerns about acid deposition's possible environmental consequences.[6] Thus by the mid-1970s, Sweden, Norway, Canada, and the United States reported declining pH and speculated about possible impacts on aquatic and terrestrial ecosystems.[7] Other western European countries such as the United Kingdom, the Federal Republic of Germany, the Netherlands, and Austria have become increasingly more concerned as potential acid deposition impacts have been identified in both their own and neighboring states.[8]

1976. *See Report of the International Conference on the Effects of Acid Precipitation in Telemark, Norway*, 5 AMBIO 200 (1976), and Impact of Acid Precipitation on Forest and Freshwater Ecosystems in Norway, Research Report (F.H. Braekke ed. 1976). The second conference, at Sandefjord, Norway, in March 1980, concluded the SNSF Project and provided a forum to evaluate the state-of-existent-knowledge. *See* L.N. Overrein, H.M. Seip & A. Tollan, Acid Precipitation—Effects on Forest and Fish (Final Report of the SNSF Project 1972-80, SNSF Rep. No. 19) (1980).

[4] ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT [HEREINAFTER CITED AS OECD], THE OECD PROGRAMME ON LONG-RANGE TRANSPORT OF AIR POLLUTANTS (1977). Austria, Belgium, Denmark, Finland, France, the Federal Republic of Germany, the Netherlands, Norway, Sweden, Switzerland, and the United Kingdom actively participated in the study. Italy participated on a more limited basis in some of the data collection. Data collected by aircraft sampling and at 76 ground monitoring sites were reported monthly to the Norwegian Institute for Air Research which coordinated the study. *See* Ottar, *Monitoring Long-Range Transport of Air Pollutants: The OECD Study* 5 AMBIO 200, 203-16 (1976).

[5] *Id.* The five net importers were Austria, Finland, Norway, Sweden, and Switzerland. However, because of serious problems with national emissions data as well as the accuracy of atmospheric transport models, the OECD findings are subject to plus or minus 50 percent error for individual receptor estimates.

[6] *See* Beamish & Harvey, *Acidification of the LoCoche Mountain Lakes, Ontario and Resulting Fish Mortalities* 29 J. FISHERIES RESEARCH BOARD OF CAN. 1131 (1972); Likens, Bormann & Johnson, *Acid Rain*, 14 ENV'T 33 (1972); Cogbill & Likens, *Acid Precipitation in the Northeastern United States*, 10 WATER RESOURCES RESEARCH 1133 (1974).

[7] E.B. Cowling, An Historical Resume of Progress in Scientific and Public Understanding of Acid Precipitation and Its Consequences (Oslo, Norway, SNSF Project 1981); and Cowling, *Acid Precipitation in Historical Perspective*, 15 ENV'T SCI. & TECH. 110A (1982).

[8] *See* ECOLOGICAL IMPACT OF ACID PRECIPITATION (Oslo, Norway, SNSF Project 1980) (D. Drablos & A. Tollan eds. 1980).

Acid rain's prominence has produced attempts to develop policies which address it in a variety of forums in the years since the 1972 Stockholm Conference. The OECD has adopted recommendations for national SO_2 emissions control programs and endorsed attempts to reduce transboundary air pollution.[9] Parallel efforts initiated in the United Nations Economic Commission for Europe (ECE) culminated with the 1979 Convention on Long-Range Transboundary Air Pollution. The Convention provides a basis for multilateral cooperation and formally became active in 1983 after receiving ratification by twenty-four of the thirty-four ECE member countries. Both the OECD and ECE endeavors reflect the "polluter pays" principle. That concept of international law, emerging from the *Trail Smelter* case as well as the 1972 Stockholm Conference, states that nations bear a responsibility to ensure that their actions do not damage foreign environments.[10] However, the OECD and ECE rely on voluntary international cooperation to achieve compliance with any emissions targets. Presumably, such compliance would be achieved through the use of the best available technology that is economically feasible.[11]

In the North American context, the United States and Canada have made limited progress in developing a bilateral agreement on transboundary air pollution. In 1978, the two governments established a Bilateral Research Consultation Group on the Long-Range Transport of Air Pollutants to coordinate the exchange of scientific information on acid deposition.[12] During the fall of 1978, the United States Congress passed a resolution calling for bilateral discussions to preserve and protect the two nations' mutual air resources. On August 5, 1980, the two governments signed a Memorandum of Intent concerning Transboundary Air Pollution (MOI) as a framework for bilateral negotiations. Formal negotiations to address air pollution problems started in the fall of 1981 and currently are marked by disagreement over a 1982 Canadian proposal for joint 50 percent reductions in SO_2 emissions. U.S. officials labeled the idea as

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[9] MacNeill, *Coal and Environment: Constraint or Opportunity* in OECD, COSTS OF COAL POLLUTION ABATEMENT 55-62 (E.S. Rubin & I.M. Torroens eds. 1983).

[10] The OECD countries unanimously subscribed to the 1972 U.N. Declaration on the Human Environment, including Principle 21, which states:

> States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and 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.

[11] *See* G.S. WETSTONE & A. ROSENCRANZ, ACID RAIN IN EUROPE AND NORTH AMERICA (1983); and Carroll, *Acid Rain—Acid Diplomacy,* in THE ACID RAIN DEBATE (E.J Yanarella & R.H. Ihara eds. 1985).

[12] A.P. ALTSHULLER & G.A. MCBEAN, THE LRTAP PROBLEM IN NORTH AMERICA: A PRELIMINARY OVERVIEW PREPARED BY THE UNITED STATES-CANADA BILATERAL RESEARCH CONSULTATION GROUP ON LONG-RANGE TRANSPORT OF AIR POLLUTANTS (1979).

being "premature" and instead urged continued cooperation under the auspices of the MOI to enhance scientific understanding of the phenomenon.[13]

As a consequence, the Canadian government initially declared that it would unilaterally seek to reduce emissions by 25 percent.[14] Subsequently, the environment ministers of Canada and nine western European countries signed a declaration in Ottawa on March 21, 1984 to reduce sulfur emissions at least 30 percent in the coming decade as a means to pressure neighboring countries to make similar pledges. Since then, the United States and Canada have continued to discuss possible efforts to address the acid rain problem. The most recent product of these negotiations is a March 19, 1986 joint endorsement of a report prepared by Canadian and American special envoys on acid rain. This report recommends the initiation of a five-year, five billion dollar program for commercial demonstration of clean coal technologies.[15] While the United States and Canada have not concluded a bilateral agreement to control transboundary air pollution, especially acid deposition, legislation proposing substantial reductions in United States SO_2 emissions has been introduced in each Congress since 1981. Support for the various proposals is mixed in the full Senate and House, but it is clear that the politics of acid rain are increasingly fluid.[16]

The focus of the acid rain policy debate, internationally as well as domestically, has shifted increasingly away from questions of scientific knowledge to discussions of how to allocate the costs of emissions reduction programs. Because sulfate ($SO_4^=$) is the major constituent of acid deposition in eastern North America as well as in Europe, advocates of controls have emphasized reducing SO_2 emissions. As a result, this article examines how control costs might be financed. It considers revenue generation under the normal utility rate-making process or by alternatives to that process, and what the political implications of those financing options might be. However, because the very complexity of the phenomenon in conjunction with the cost of controls makes agreement on equitable reduction strategies difficult to achieve, it is important to consider the

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[13] *See* Sweet, *Acid Rain*, in EDITORIAL RESEARCH REPORTS, ENVIRONMENTAL ISSUES: PROSPECTS AND PROBLEMS 61-80 (1982); and Marshall, *Ruckelshaus Disappoints Canadians on Acid Rain*, 22 SCIENCE 401 (1983).

[14] Marshall, *Canada Goes it Alone on Acid Rain Controls*, 223 SCIENCE 1275 (1984).

[15] D. Lewis & W. Davis, Joint Report of the Special Envoys on Acid Rain (mimeo, Jan. 1986); and Remarks by the President and Prime Minister Mulroney in Signing of NORAD Agreement and Statement on Acid Rain (mimeo, The White House, Office of the Press Secretary, Mar. 19, 1986).

[16] A.M. FREEMAN, THE BENEFITS OF ENVIRONMENTAL IMPROVEMENT: THEORY AND PRACTICE (1979); Maraniss, *Congress' Search for an Acid Rainbow*, 1 WASH. POST WEEKLY ED. 6-7 (Feb. 13, 1984); and Crandall, *An Acid Test for Congress*, 8 REGULATION 21-28 (1984).

scientific and economic justifications for such a program before examining the possible options for financing.

THE SCIENCE AND ECONOMICS OF ACID RAIN

Scientific Aspects of Acid Rain

Robert Angus Smith, an English chemist, might well lay claim to the title of "father of acid rain." Smith's pioneering studies of precipitation chemistry and its effects first used the term "acid rain." Drawing upon data from England, Scotland, and Germany, Smith demonstrated that variation in regional factors such as coal combustion, wind trajectories, the amount and frequency of precipitation, proximity to seacoasts, and the decomposition of organic materials affected sulfate concentrations in precipitation.[17] Smith's work, however, was largely ignored and failed to generate follow-up research.

Professor Ellis Cowling asserts that contemporary concern about acid deposition and its effects originated in three seemingly unrelated areas: limnology, agricultural science, and atmospheric chemistry.[18] Svante Oden, a Swedish scientist, in the first major attempt to integrate knowledge from those disciplines, maintained that analyses of air mass trajectories matched to temporal and spatial changes in precipitation chemistry indicated that sulfur and nitrogen were transported long distances.[19] Oden asserted that clearly identifiable source and receptor areas existed making acid rain a large-scale regional phenomenon with long-term adverse ecological consequences. Thus, information produced by a complex and rapidly evolving body of research forms the scientific basis for defining the acid deposition problem.

With the exception of the Hubbard Brook Experimental Forest in New Hampshire, continuous North American precipitation monitoring data have been available for less than a decade. As a result, long-term trends for the United States and Canada are defined poorly.[20] Precipitation chemistry data collected in the 1970s, however, do indicate that acid deposition occurs throughout eastern North America. The area of greatest acidity is

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[17] R.A. SMITH, AIR AND RAIN: THE BEGINNINGS OF CHEMICAL CLIMATOLOGY (1872).

[18] Oden, *The Acidification of Air and Precipitation and Its Consequences in the Natural Environment*, SWEDISH NAT'L SCI. RESEARCH COUNCIL ECOLOGY COMM. BULL. (No. 1, 1968).

[19] *Id.*

[20] Trend studies for North America have been subject to considerable controversy because of differences in collection methods, siting criteria, chemical analysis techniques, sample storage methods, and quality assurance. The lack of a sufficient number of continuous sampling sites is a source of possible error, too. For an elaboration, *see* Regens, *Acid Rain: Does Science Dictate Policy or Policy Dictate Science?*, in ECONOMIC PERSPECTIVES ON ACID DEPOSITION 5-19 (T.D. Crocker ed. 1984).

concentrated over eastern Ohio, western New York, and northern West Virginia.[21] Higher elevation, rural areas in the western United States also have low pH rainfall, most probably due to significant increases in nitrogen oxide (NO_x) emissions from multiple sources throughout the region.[22] While broad geographical generalizations derived from individual monitoring site data are subject to considerable uncertainties,[23] there is a potential for near continental-scale impacts.

Conclusive evidence exists for chemical and biological alterations, including fish losses, in lakes and streams which have limited capacities to neutralize acidic inputs.[24] While documented losses are limited to a small percentage of the U.S. lakes that have been studied, there are possibly thousands of sensitive watersheds throughout eastern North America which may be susceptible to acidification.[25] For example, a preliminary estimate indicates that 74.2 percent of the lakes in the northeastern and 4.2 percent of those in the midwestern United States are sensitive.[26]

Evidence of damages to nonaquatic ecosystems, especially forests, as well as to unique cultural artifacts and buildings or other structures, is largely circumstantial; yet, such damages are plausible and evidence is growing.[27] For example, adverse effects may result from the leaching of soil nutrients or via the mobilization of toxic metals. As a result, concern exists about harmful, long-term effects which acid deposition may have

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[21] U.S.-Canada Work Group 2, Atmospheric Science and Analysis (Final Report, EPA 1982).

[22] Lewis & Grant, *Acid Precipitation in the Western United States*, 207 SCIENCE 176-77 (1980).

[23] Work Group 2 of the U.S.-Canada MOI concluded that individual monitoring station values were reasonably accurate but that the uncertainty in isopleth map lines generalized from site data was about ±20 percent in magnitude and 50-200 km in position for eastern North America. The degree of uncertainty would be higher for western North America because fewer monitoring stations are located there.

[24] Alkalinity provides a measure of the instantaneous ability of water bodies to assimilate acidic inputs. Lakes with surface water alkalinity in excess of 200 microequivalents per liter (μeq/l) generally are assumed to be resistant to acidification. Because disagreement exists with respect to a threshold value below which lakes are sensitive to current deposition loading rates, the 200 μeq/l may represent an upper bound. The actual loss in aquatic alkalinity depends on how much of the increased SO_4 is balanced by increases in base cations. *See* J.M. Omernik, Total Alkalinity of Surface Water (EPA Envt'l Research Lab., Corvallis OR, 1983).

[25] The reader should be cautious about equating sensitivity with actual damages. For example, a 14 year study (1966-80) with periodic sampling of biological, chemical, and physical data from 1,140 Wisconsin lakes, that was supplemented by general limnological data collected in 1979 through a comprehensive random sample of 25 percent of all lakes and impoundments 75′ deep and 25 acres in size, provides no conclusive evidence that would indicate any lake has experienced permanent change in pH or alkalinity since early this century. *See* Lillie & Mason, *Limnological Characteristics of Wisconsin Lakes*, in 138 WIS. DEPT. NAT. RESOURCES TECH. BULL. (1983).

[26] M. Levin, Acres of Low Alkalinity Lakes in the Northeastern and Upper Midwestern U.S. (unpublished paper for EPA) (1983). The study calculated the proportion of total lake area (acres of water) with alkalinity levels below 200 μeq/l. The upper Midwest includes northern Wisconsin, upper Michigan, and northeast Minnesota. The northeast includes New England and New York. The Great Lakes and Lake Champlain were excluded from the analysis.

[27] *See* Johnson & McLaughlin, *The Nature and Timing of the Deterioration of Red Spruce in the Northern Appalachian Mountains*, in NATIONAL RESEARCH COUNCIL, ACID DEPOSITION: LONG-TERM TRENDS 200-30 (1986).

on trees, particularly on spruce, pine, aspen, and birch. Professor Herbert Vogelmann asserts that studies of mature forests in the northeastern United States indicate reduced growth patterns as well as increased mortality in recent decades for primarily coniferous species.[28] However, because linkages are complex, conclusions about forest effects remain somewhat equivocal since acid deposition is one of a variety of stresses affecting forest ecosystems. Growing concern exists about the possible impacts of acid deposition on cultural artifacts, buildings, and other structures. Field studies have linked such damage to air pollution, especially in areas having high ambient SO_2 concentrations. Unlike respirable sulfates, however, acid deposition does not appear to represent a direct risk to human health. But limited health risks may be associated with episodic events of acid fog or the leaching of metals such as lead into drinking water supplies.

Economic Aspects of Acid Rain

Professor Thomas D. Crocker and Professor James L. Regens provide a discussion of potential as well as limits of formal economic analyses to guide policy choice in the acid rain area. They note that a limited number of attempts have been made to assess those benefits and costs.[29] For example, the maximum annual economic benefits of eliminating all acid deposition effects on existing economic activities in the eastern third of the United States clearly appear substantial.[30] Yet, the estimates in Table 1 are based primarily on effects whose magnitude still is being delineated. In fact, while Professor Crocker and his associates are confident that the rank-ordering of benefit categories is accurate, their $5 billion damage estimate properly is viewed as illustrating a methodology for calculating such an estimate rather than an absolute value. Crocker makes this point:

> Given the scant knowledge available both about the changes physical and biological systems undergo when exposed to acid deposition,

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[28] Vogelmann, *Catastrophe on Camel's Hump*, 91 NAT'L. HIST. 8-14 (1982); and Wetstone & Foster, *Acid Precipitation: What Is It Doing to Our Forests?*, 25 ENV'T 10-12, 38-39 (1983).

[29] Economic analyses generally do no more than multiply natural science findings about service flow changes by an invariant price. The researchers then speculate, if they recognize them at all, how the resulting estimate would differ if price responses and agent adaptations were captured. Because of the differences in the behavior of emitters and receptors when a market in emissions rights does and does not exist, and because of the lack of parallel markets, economically efficient outcomes for the acid deposition problems may be impossible to trace exhaustively. The economic criterion is then reduced to whether those who gain from a change in precursor control could, in principle, compensate the losers and still have some residual gain. For a discussion of the theoretical basis for applying the technique to acid deposition control, see Regens & Crocker, *Applying Benefit-Cost Analysis to Acid Rain Control*, 1 MGMT. SCI. & POL'Y ANALYSIS 12-17 (1984).

[30] Crocker, Tschirhart & Adams, *A First Exercise in Assessing the Benefits of Controlling Acid Precipitation* in 7 METHODS OF DEVELOPMENT FOR ASSESSING ACID PRECIPITATION CONTROL (T.D. Crocker, et. al. eds. 1980).

Table 1. Rank-ordering of Annual Maximum Economic Losses Attributable to Acid Deposition in the Eastern Third of the United States[a]

Effects Category	Maximum Losses (1978 $ Billion)
Materials	2.00
Forest ecosystems	1.75
Direct agricultural	1.00
Aquatic ecosystems	0.25
Others (health, water supply systems, etc.)	0.10

[a]Estimates are for the potential total benefits due to the complete elimination of acid deposition effects.

From: Crocker, Tschirhart & Adams, *A First Exercise in Assessing the Benefits of Controlling Acid Precipitation*, in 7 METHODS DEVELOPMENT FOR ASSESSING ACID PRECIPITATION CONTROL BENEFITS (T.D. Crocker et al. eds. 1980).

> and the equally poor knowledge about the price, activity, and location responses of economic agents to these system changes, any estimate right now of the total benefits of controlling acid deposition appears foolhardy.[31]

Deriving cost estimates for any reduction strategy also depends upon the analyst making a variety of assumptions. It is necessary to speculate about the effectiveness of various control options, future trends in emissions, the political feasibility of the different options, the stringency of current and future environmental regulations, levels of economic activity, energy prices, and technological innovation. Clearly, uncertainty surrounds each factor. Nonetheless, information about control costs is somewhat more tangible, at least in an aggregate sense.

Control measures are available for reducing emissions of the major precursors of acid deposition. Technology exists to reduce man-made emissions of SO_2, NO_x, and volatile organic compounds (VOCs). If one assumes no change in existing environmental regulations, the current level and geographical distribution of SO_2 emissions by source category such as utilities, industrial boilers, and smelters should be roughly stable through the year 2000. Future trends for emissions of VOCs and NO_x are less certain. Total VOC emissions commonly are assumed to decline until 1990, primarily due to significant reductions in transportation sector emissions. After 1990, conventional wisdom holds that VOC emissions will then perhaps approach 1980 levels by the year 2000 due to increased industrial sector activity. The rate of growth in NO_x emissions should continue to decrease for the balance of the 1980s. Total NO_x emissions in 2000, however, are projected to exceed 1980 levels.[32] Given current

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[31] T.D. Crocker, Prior Information Required to Assess the Economic Benefits of Controlling Acid Deposition, in U.S. Environmental Protection Agency, Critical Assessment Document-Draft (1982).

[32] It is important to exercise considerable caution in making estimates of future NO_x levels. This is the case because NO_x estimates are extremely dependent on assumptions about vehicle miles traveled and industrial source emissions rates. As a result, future estimates should be viewed a "best judgment" rather than absolute approximations.

technological limits and realistic projections of economic growth, it is reasonable to conclude that SO_2 emissions are likely to remain stable at roughly the 1980 level over the next twenty years. On the other hand, it also is prudent to assume that emissions of the other major precursors may increase in the foreseeable future.[33]

Over the long-term, a significant reduction in SO_2 emissions may result as existing sources are displaced by facilities subject to new source performance standards (NSPS). The NSPS program was and still is envisioned by the Environmental Protection Agency (EPA) to be a long-term strategy for limiting total emissions of pollutants into the atmosphere. As older facilities are replaced by newer ones, NSPS limits emissions so that they will not increase proportionately with industrial growth. The NSPS also restrains the ability of individual states to "compete" for new industry by enacting standards that differ from those of their neighbors. Making the standard applicable only to new sources also protects existing markets for coal. Thus, it avoids the employment dislocations which would result from a wholesale shift from high-sulfur coal to low-sulfur coal by existing sources. However, as Regens notes:

> [b]ecause NSPS involves determining standards for individual industry categories, it is not the most economically efficient way to limit or decrease total emissions. The strategy also ignores the availability of cost-effective emission reductions from existing sources. Moreover, although the philosophy behind stringent performance standards for new sources is sound, the regulations have had less impact on *total* emissions than was originally expected . . . The strategy is also based on imposing costs in the future rather than in the present. Imposing significantly different standards between existing and new sources also promotes more subtle disparities. For example, the scrubbing requirement for new power plants. . . . As a result, older, dirtier plants are operating at a higher capacity to minimize total generating costs. In effect, the NSPS control system is providing less of an emissions reduction than society should be getting for the money which it is investing in air pollution abatement.[34]

It remains debatable, therefore, whether the replacement of existing sources with new ones will result in emissions levels sufficient to reduce acid deposition loadings to environmentally acceptable targets. Such replacement rests on three key assumptions. First, growth rates in the electric utility and other major emitting sectors must remain relatively

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[33] U.S.-Canada Work Group 3B, Emissions Costs and Engineering Assessment (Final Report, EPA 1982).

[34] Regens, *The Regulatory Climate for Coal Development* in COSTS OF COAL POLLUTION ABATEMENT 104-11 (E.S. Rubin & I.M. Torrens eds. 1983).

low in comparison to historical rates. Second, technological advances must permit the adoption and implementation of more stringent NSPS or innovative incentives for emissions control must be developed, thereby reducing aggregate emissions. Finally, no significant adverse ecological effects, especially irreversible damage, can occur within the next thirty to forty years. To the extent these assumptions are valid, then the opportunity costs of achieving additional reductions now are substantial relative to known as opposed to plausible damages.

Given uncertainty regarding dose-response functions, it is also possible to argue that widespread but not necessarily irreversible damages may occur unless large reductions in emissions, especially SO_2, happen in the near-term. Proposals for imposing control strategies now focus on reducing SO_2 emissions to achieve $SO_4^{=}$ deposition reduction because of the greater difficulty in capturing significant NO_x emissions reductions and the uncertainty over whether nitrate acidity (NO_3^{-}) is as harmful as sulfate acidity.[35] Moreover, because of economics of scale for pollution control efforts in the utility sector vis-a-vis the industrial sector, capturing SO_2 reductions from utilities instead of industrial sources appears to be relatively more cost-effective.[36] Table 2 indicates that it is generally more cost effective to switch to lower sulfur coals or residual oil rather than to employ flue gas desulfization. However, such switching poses potential social and economic problems in terms of regional losses of miners' jobs due to coal market shifts. While the engineering economics of limestone injection multi-stage burners (LIMB) seem promising, LIMB commercialization does not appear likely prior to the mid-1990s. In addition, because of the time required to move from the pilot to demonstration to commercial stage for a new technology, LIMB is not going to be a major option for retrofit on existing power plants before then even if its development and demonstration expenses are underwritten substantially by the federal government.

In order to estimate the actual costs of an SO_2 emissions reduction program in terms of control costs, coal market shifts, or electricity rate increases, the analyst must specify a number of prior conditions. Both the size of the emissions reduction, commonly called a "rollback," and the geographical area in which those emissions reductions are required have to be defined. The time schedule for the implementation of additional

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[35] J.A. Fay, D. Golumb & J. Gruhl, Controlling Acid Rain, Mass. Inst. Tech. Energy Laboratory Rep. No. MIT-EL83-004 (1983).

[36] Electric utility sources produced an estimated 65 percent of total SO_2 emissions in 1980 for the United States and are projected to dominate future trends. Coal-fired power plants are the primary source of those emissions. But because most plants are located in attainment areas, compliance with the current National Ambient Air Quality Standard (NAAQS) is not likely to significantly reduce SO_2 emissions from existing sources. *See infra* note 32.

Table 2. Incremental Costs of SO_2 Emissions Reduction Strategies

Reduction Strategies	Costs ($/Ton SO_2)	
COAL CLEANING		
N. Appalachia & E. Midwest Coal	$50-600	
S. Appalachia Coal	$700-1000	
UTILITY STRATEGIES[a]		
Fuel Switching		
Shift from High to Low Sulfur Coal	$250-350	
Shift from High to Medium Sulfur Coal	$350-400	
Shift from Medium to Low Sulfur Coal	$400-500	
Shift from High to Low Sulfur Residual Oil	$300-400	
Flue Gas Desulfurization (FGD)		
Shift from Unscrubbed High to Scrubbed High	$400-600	
Shift from Unscrubbed Medium to Scrubbed Medium	$600-1500	
Shift from Unscrubbed Low to Scrubbed Low	$1800-3000	
Limestone Injection Multi Staged Burners (LIMB)[b]		
High Sulfur Coal	$250-500	$200-350
Medium Sulfur Coal	$300-1100	$250-700
Low Sulfur Coal	$600-2000	$500-1200
INDUSTRIAL STRATEGIES[c]		
Fuel Switching		
Shift from High to Low Sulfur Coal	$250-350	
Shift from High to Medium Sulfur Coal	$350-400	
Shift from Medium to Low Sulfur Coal	$400-500	
Shift from High to Low Sulfur Residual Oil	$300-400	
Flue Gas Desulfurization (FGD)		
Shift from Unscrubbed High to Scrubbed High	$400-600	
Shift from Unscrubbed Medium to Scrubbed Medium	$600-1500	
Shift from Unscrubbed Low to Scrubbed Low	$1800-3000	

[a] Representative costs for 500MW power plant. Costs will vary for each region and year.
[b] Removal of SO_2 for retrofits expected to be between 50% and 60%.
[c] Representative costs for 170MM Btu/hr industrial boiler. Costs will vary for each region and year.

controls is also a major determinate of program costs. The imposition of further controls now, for example, requires the use of currently available technology. Delay in achieving actual reductions until after the early 1990s allows consideration of possible new technologies as a potential option. The presumed advantages of such delay, however, must be weighed against the potential for environmental damages in the interim. Additional parameters such as the permissibility of emissions trading, requirements for NO_x caps, NO_x substitution for SO_2 reductions, and coal miner protection also affect the magnitude of cost estimates. Finally, it is important to note than an actual strategy, if implemented, might well include mitigation measures as well as emissions reductions, thereby influencing the ultimate cost total.[37]

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37. Liming has been suggested as one mitigation strategy for inhibiting the aquatic effects of acidification. However, the effective use of lime requires a great deal of information about the hydrological and chemical properties of each water body. To date, only small-scale attempts at restoration using liming techniques have been made. While costs for individual lakes may vary, it is possible to estimate an average cost per lake. Those costs probably would fall into a range of $75-$200K/lake if one assumes: x cost equals $200/hectare (ha) for materials and application; (2) x lake size equals 20 ha; and (3) preapplication planning and post-application monitoring based on

A number of studies provide information about the overall costs to representative emitters for reducing the precursors of acid deposition.[38] These analyses provide substantial insight into the costs under alternative control regimens, especially for capturing SO_2 reductions. Conclusions about the costs of achieving aggregate SO_2 reductions in the utility sector have been quite uniform across studies. Annualized cost estimates range from $1 to $2 billion for a 40 percent reduction, and from $2 to $4 billion for a 50 percent reduction. Cost consequences of $5 to $6 billion are estimated for 66 to 75 percent reductions.[39] The estimated average increases in electricity rates to accomplish such a reduction in utility industry SO_2 emissions have ranged from 1.4 percent for a four million ton rollback to 8 percent for a twelve million ton rollback. Naturally, rate increases as well as control costs for individual utility systems may be substantially greater than the average values.

Surprisingly, at least to economic intuitions, these recent studies suggest that the control cost consequences of alternative strategies for SO_2 control have only minor differences. State Implementation Plan (SIP) systems tend to be as effective as economic incentives systems in addressing long-range transport.[40] This is mainly because of the greater

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historic costs for EPA's Clean Lakes Program. More monitoring of results and practical experience might eventually reduce costs, but one must question society's willingness to make the necessary heavy investments in time and dollars to characterize the limnology of tens of thousands of lakes, ponds, and streams. Widespread liming of forest soils to mitigate acid deposition impacts also would appear to be nearly always economically and probably technically impractical. Liming, therefore, does not seem to be a viable economic means for overcoming widespread acidification unless the perceived benefits of restoration are extremely large or unless no less costly means of restoration are available. Thus, although the efficacy of mitigation strategies such as liming and/or accelerated research have been debated, congressional attention has focused on the merits of emissions reductions strategies based on cost or equity criteria. *See* A.V. Holden, *Surface Water*, in ECOLOGICAL EFFECTS OF ACID PRECIPITATION, A REPORT OF A WORKSHOP HELD AT GATEHOUSE-OF-FLEET, U.K., SEPT. 4-7, 1978 (M.J. Wood ed. 1979).

[38] Rubin, *International Pollution Control Costs of Coal-fired Power Plants*, 17 ENV'T SCI. & TECH. 366-77 (1983); U.S. Office of Technology Assessment, The Regional Implications of Transported Air Pollutants: An Assessment of Acidic Deposition and Ozone, Interim Draft (1982); and McGlamery & Torstick, *Cost Comparison of Flue Gas Desulfurization Systems* in POWER GENERATION: AIR POLLUTION MONITORING AND CONTROL (K.E. Noll & W.T. Davis eds. 1976).

[39] None of the cost studies explicitly consider the rather unique decision problem of the utility industry, the manner in which these problems influence its institutionalized habits and modes of thinking, and therefore the observed costs on which the aforementioned studies are founded. There are circumstances under which costs of control in the industry are likely to be above those that would be experienced by profit-maximizing, perfectly competitive producers of the identical type of output. The size of the increase is unknown. *See* Goldberg, *Regulation and Administered Contracts*, 7 BELL J. ECON. 446-48 (1976); and Averch & Johnson, *Behavior of the Firm Under Regulatory Constraint* 52 AM. ECON. REV. 1052-69 (1962).

[40] At least in the economic literature, a broad consensus exists that economic incentive systems such as marketable emission permits are as much as an order-of-magnitude less costly than is the current SIP-based system of controls. *See* Seskin, Anderson & Reid, *An Empirical Analysis of Economic Strategies for Controlling Air Pollution*, 10 J. ENVT'L ECON. & MGMT. 112-24 (1983); and Atkinson & Tietenberg, *The Empirical Properties of Two Cases of Designs for Transferable Discharge Permit Markets*, 9 J. ENVT'L ECON. & MGMT. 101-21 (1982).

aggregate quantity of emissions that localized economic incentive strategies allow in order to meet a given local ambient standard.[41] Emissions are distributed spatially such that the dispersal properties of the local atmosphere are used more effectively. These greater emissions provide more material for long-range transport. Given the gradual way in which SO_2 combines with other atmospheric constituents to form $SO_4^=$, instead of imposing the primary sulfate burden on the surrounding area, each point source makes an incremental contribution to a regional sulfate problem. Moreover, each source's impact is related inversely to its impact on the local ambient problem. The more SO_2 that returns to earth close to the source, the less remaining for chemical transformation into $SO_4^=$ over longer temporal and spatial dimensions. When SO_2 is removed to meet ambient standards that account for long-range transport, the cost advantage of the economic incentive. strategies is drastically reduced.

It is clear from the preceding overview that alternative interpretations of the science and economics of acid rain are plausible. Table 3 dem-

Table 3. Alternative Interpretations of the Science and Economics of Acid Rain

Rationale for Maintaining Status Quo	*Rationale for Taking Action Now*
• Aquatic ecosystem effects are only documented damages in eastern North America. Fish population losses are limited to a small percentage of the lakes that have been studied in the U.S., primarily in the Adirondacks.	• There are thousands of potentially sensitive watersheds throughout eastern North America whose fish populations may be threatened by acidification.
• Non-aquatic ecosystem effects theoretically are plausible but only circumstantial evidence exists. Terrestrial ecosystem findings are complex and equivocal with only limited empirical data for adverse effects on forest productivity, crops or soils. Sensitive soils may require decades for cation depletion.	• Adverse effects on forest productivity and other terrestrial ecosystems may result from acidic deposition through mechanisms such as leaching of soil nutrients or mobilization of toxic metals. Responses are likely to be subtle and, therefore, difficult to detect prior to onset of major damages.
• The effects of acidic deposition are sufficiently ambiguous to preclude calculating a target loading rate that definitely alters aquatic or terrestrial systems.	• Sulfur appears to dominate on a long-term average basis. Aquatic responses have been shown on a limited empirical basis at deposition rates >30 kg/ha/yr with some responses observed in the 20 to 30 kg/ha/yr of wet sulfate range.
• Nitrate often dominates the acidity released during spring snowmelts in the northeast but insufficient data are available to develop target loadings for nitrate induced water quality effects.	• The areas of highest sulfate deposition lie over and immediately downwind from the region of maximum SO_2 emissions in eastern North America.
• Existing data offer little evidence that the acidity of precipitation in eastern North America has been increasing for decades.	• For a given emission magnitude, acid deposition attributable to a source will decrease as distance between source and receptor increases.
• Chemical transformation processes are not well understood so specific source-receptor relationships cannot be defined. Current uncertainties preclude specifying an optimal spatial strategy for imposing emissions reductions.	• Existing models and empirical data for zones of influence suggest that in the eastern U.S. sources more than 1000 km (600 miles) distant from receptors probably contribute much less acidic deposition than do closer sources.
• Lack ability to measure reliably dry deposition which may be especially important for local source contribution to total deposition.	• Existing models and data analyses can give a qualitative sense of the relationship between sources and receptors.
• Existing atmospheric models cannot predict event variability in deposition but episodes of high acidity may cause much of the acidification.	• SO_2 emissions reductions over a broad area for a long time period may produce essentially proportionate reductions in acid deposition.
• Control benefits are largely intangible while control costs appear to be large.	• Associated air quality effects on visibility, particulate matter loadings, and materials are highly likely and, while unquantified, may be economically significant.

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[41] Atkinson, *The Effect of Global Optimization on Locally Optimal Pollution Control: Acid Rain*, in Economic Perspectives on Acid Deposition 21-33 (T.D. Crocker ed. 1984).

onstrates how such existing information can be used to construct a policy rationale for either maintaining the status quo or taking further action now with respect to initiating acid deposition control measures. First, the extent as well as the rate at which damages are induced by acid rain remains uncertain. However, the perception that acid deposition is an environmental problem combined with its salience on the policy-setting agenda compels a response by government. Second, man-made sources generally are the overwhelming contributors to acid deposition in eastern North America. While expensive, control technology is available to reduce significantly emissions from those sources.[42] Third, a recent National Academy of Sciences report concludes that it is reasonable to assume that reductions in SO_2 emissions over a broad area for several years will produce an essentially proportionate reduction in annual average SO_4^+ deposition for that area.[43] Finally, other parameters of air quality in eastern North America such as regional visibility, particulate matter loadings, and ambient SO_2 levels are affected strongly by the precursors to acid deposition. They are likely to improve if atmospheric loadings of precursor emissions are reduced. Thus, while uncertainties about nonaquatic ecosystem effects and sitespecific changes in deposition patterns and pH within sensitive receptor areas persist, it is feasible to outline the elements of a control program. As a consequence, it is important to consider the revenue generation alternatives available for financing such a program.

ALTERNATIVES FOR FINANCING CONTROL COSTS

Acid rain forces policy-makers to confront a typical environmental controversy. While a scientific foundation for some kind of government action exists, popular perceptions of the degree of environmental risk may be more powerful motivations for government intervention than actual scientific evidence. Moreover, the United States has a long tradition of undertaking regulatory action to demonstrate public concern or to simply "do something" in the face of crises. And, as a society, we often implement risk-reduction strategies on the basis of only fragmentary evidence of hazards themselves or the relative costs and benefits of alternative strategies.[44] Senator John Glenn (D-Ohio) has noted, "The crux of the acid rain cleanup problem has always been the cost of cleanup and who should bear it."[45] As a result, the financing issue, including questions of

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[42] OECD, COAL AND ENVIRONMENTAL PROTECTION: COSTS AND COSTING METHODS (1983).

[43] NATIONAL RESEARCH COUNCIL, ACID DEPOSITION ATMOSPHERIC PROCESSES IN EASTERN NORTH AMERICA: A REVIEW OF CURRENT SCIENTIFIC UNDERSTANDING (1983).

[44] *See* THE SCIENTIFIC BASIS OF HEALTH AND SAFETY REGULATION (R.W. Crandall & L.B. Lave eds. 1981).

[45] Mosher, *Acid Rain Debate May Play a Role in 1984 Presidential Sweepstakes*, 15 NAT'L J. 1998-99 (1983). *See also* Sununu, *Acid Rain: Sharing the Cost*, 1 ISSUES IN SCI. & TECH. 47-58 (1985).

equity, increasingly has become the focus of both the public policy debate and the symbolic politics surrounding allocating the costs of an SO_2 reduction program.

The Electric Utility Rate-Making Process

In one of the more commonly discussed financial alternatives, the Congress or the EPA would set emission targets. Each state would then allocate its share of the required reductions among the electric utilities in that state.

Two scenarios exist for allowing the individual utility systems to determine how to achieve their reductions quotas. Under one scenario, each utility would decide on an appropriate strategy to achieve the necessary emissions reduction. The utility would then ask its state public utility commission (PUC) to permit the level of rate increases necessary to offset the additional control costs. This scenario leaves the actual choice of specific compliance approach to the discretion of the utility and/or the various state governments. The second scenario also would use the rate-making process to generate capital for financing acid rain controls. But the actual array of control options to be employed in order to accomplish the SO_2 emissions reduction would be statutorily mandated. Under either scenario, the affected utilities generally would have to pay for construction costs via their rate structures. Electricity cunsumers, on the other hand, would pay for emissions reductions only after the control technology became operational, unless construction-work-in-progress (CWIP) were allowed. The capital costs for acid rain controls typically would be amortized over a fifteen year period, although the amortization period could range anywhere from ten to thirty years. Operating costs for pollution abatement would be recovered on an annual basis. To the extent a utility was not fully reimbursed for its acid rain control investments, the remaining cost increment would be shifted to its owners and/or investors.

Because a program for reducing SO_2 emissions diverts capital away from availability for investment in other sectors of the economy, the electric utility rate-making process is one of the more economically efficient mechanisms available for funding such a program.[46] The incremental administrative costs should be relatively low, especially compared to other approaches, since the rate-making process relies on an established system. In addition, reliance on the rate-making process results in imposing control costs on those utilities which are required to reduce emissions consistent with the polluter pays principle which underlies most

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[46] An efficiently implemented eight million ton regional rollback in SO_2 emissions is estimated to cost $3.7 billion on an annualized basis in 1995. Utilities would pay $3.1 billion and other industries would pay an additional $0.6 billion. These cost estimates are based on an analysis of S. 3041 pereformed by ICF, Inc. *See* ICF, Inc., Analysis of a Senate Emission Reduction Bill (1983).

existing U.S. environmental statutes. According to economic theory, electricity generators (utilities) and consumers (rate payers) would receive information about the true costs, including the environmental impacts, associated with their production and consumption of electricity. Presumably this information would cause them to adjust their behavioral patterns accordingly.

Such an approach, however, is not without some disadvantages. Reliance on the utility rate-making process to finance acid deposition controls would tend to concentrate the costs of SO_2 emissions reductions on utilities burning high-sulfur coal. Table 4 indicates that electricity consumers in some states would receive relatively large rate increases in the initial years of such a control program. For example, a ten million ton reduction

Table 4. Percent Change in Electricity Rates for 10 Million Ton Reduction[a]

Region	State	Percent Increase[b]
New England	CT	6.1
	MA	6.1
	ME	3.2
	NH	3.2
	RI	6.1
	VT	3.2
Average		4.7
Mid-Atlantic	DE	3.2
	MD	3.2
	NJ	2.3
	NY	2.8
	PA	6.5
Average		3.6
Midwest	IA	3.3
	IL	0.7
	IN	13.5
	MI	3.6
	MN	-0.9
	MO	13.0
	OH	17.8
	WI	8.3
Average		7.4
South	AL	-2.1
	AR	2.9
	FL	3.7
	GA	4.6
	KY	10.8
	LA	0.4
	MS	12.8
	NC	1.2
	SC	1.2
	TN	10.1
	VA	2.6
	WV	6.0
Average		4.5

[a] Costs based on % charge in electricity rates in 1990 for a first year revenue requirement on a composite bill assuming intrastate trading.

[b] Excludes the District of Columbia.

Adapted from: Wetstone, *Paying for Acid Rain Control: An Introduction to the Trust Fund Approach*, 2 THE ENVT'L FORUM 14-20 (Aug. 1983).

might increase utility rates in the Midwest an average of 7.4 percent. While those midwestern states could partially or totally protect their low-income consumers from absorbing such an increase with some form of assistance, such a financial subsidy would require allocating a greater share of the overall control costs to more affluent individuals and/or industrial customers in those states adopting an assistance program.

A rate increase of that magnitude could have harmful effects on the Midwest's already depressed economy as well as on individual rate payers in the region. For example, many long-term investments have been made based on historical electricity rates. In addition, if rate increases actually are substantial, utility systems may seek to reduce their compliance costs by fuel switching, importing electric power from Canada, or reducing generation instead of scrubbing to achieve required emissions reductions.

To the degree that utilities are able to reduce their SO_2 emissions by switching from reliance on high sulfur local coals, the Midwest is likely to experience reduced growth in regional coal production. This threat to the future pattern of high-sulfur coal production is a plausible outcome for several reasons. The current electric utility rate-making system encourages the minimization of capital expenditures instead of minimization of generation costs per kilowatt hour (kwh). To the extent that utilities fail to receive a rate of return commensurate with the risks involved in capital expenditures, generation options with relatively high operating and maintenance (O&M) costs are viable choices for utility managers. For example, some electric utilities have been reluctant to convert their oil-burning units to coal. This is the case in spite of the fact that the long-term fuel saving for such a power plant conversion would more than offset the increased capital costs at the front end.[47] Similar considerations would tend to cause a utility to fuel-switch from a high-sulfur coal rather than install a flue gas desulfurization (FGD) system. Moreover, given widespread negative attitudes toward FGD among utility executives, switching instead of scrubbing is likely even if the costs per kwh for scrubbing were cheaper.

Finally, the rate-making system tends to front-load control costs into the early years of the payback period. The front-loading feature could make the first year's rates as much as 50 percent higher than the long-term average costs of the program. Rate-making reforms, such as allowing CWIP, could equalize rate increases over time. However, because the normal rate-making process forces utilities to raise the funds for financing acid rain controls through the capital market, utility systems with low allowable rates of return, poor prospects for future growth and/or high

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[47] Brenner, *Coal and Electricity Generation: An Economic Perspective* in OPEC, COSTS OF COAL POLLUTION ABATEMENT 282-86 (E.S. Rubin ed. 1983)

indebtedness are not likely to be capable of financing controls without some public sector assistance. As a result, irrespective of the science of acid rain, those utility systems are likely to fight control proposals based on economics alone.

Alternatives to the Electric Utility Rate-Making Process

Alternatives to the normal electric utility rate-making process are generally less economically efficient. However, those options may be preferred for several reasons. First, most allocate the costs of financing an SO_2 emissions reduction program over a broader segment of the population. Expansion of the base thereby reduces the probability that any one group receives substantial electricity rate hikes.[48] The alternatives to the rate-making process involve raising all or part of the funds for financing controls on the basis of electricity production, emissions, fuel use, general revenues, or a combination of these sources.[49] The options also provide opportunities to target funds on the basis of additional social or economic goals. For example, revenues could be used to provide subsidies to severely impacted rate payers, especially to low income consumers. They also might be used to mitigate adverse employment impacts in the Midwest due to shifts in the level of high sulfur coal production. The following section reviews the advantages and disadvantages of those alternatives to the normal utility rate-making process.

Generation Fee. Proposals for a generation fee on electricity production continue a recent trend in environmental legislation. Both the Superfund for hazardous wastes and the nuclear waste storage programs rely on forms of generation fees to subsidize clean-up efforts.[50] The most likely scenario for implementing a generation fee requires utilities to collect the revenues as a kilowatt hour surcharge. The fee could be imposed on all electricity generation or on fossil-fuel electricity production. Applying the fee to the latter seems more logical since hydroelectric and nuclear capacity are not sources of SO_2 emissions while fossil fuel-fired power plants are. The money collected by the fee would be invested in a trust fund administered by either the Treasury Department or the Environmental Protection Agency. Income from the trust might be used to fund capital costs, O&M costs, some combination of the two, or for other targeted purposes such as coal miner or rate payer assistance.

The fees proposed to date range from one to three mills per kilowatt

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[48] A argument can be made that it is less disruptive and, therefore, more socially desirable to require a number of small adjustments rather than a few large ones.

[49] All of these options would give two more congressional committees jurisdiction over legislation for acid rain control—the House Ways and Means and the Senate Finance Committees.

[50] *See* Wetstone, *Paying for Acid Rain Control: An Introduction to the Trust Fund Approach,* 2 THE ENVT'L FORUM 14-20 (1983).

hour.[51] A typical residential customer uses approximately 750 kwh of electricity per month.[52] A three mill/kwh fee would increase the consumer's monthly bill by about $2.25, although some slight regional differences would exist in terms of the actual percentage increase reflected in utility rates by adopting a generation fee. To the extent that the tax revenues did not fully subsidize control costs, electricity users would bear additional rate increases beyond the generation fee.[53]

In spite of the low rates, a generation fee, with the rate set in either real or nominal terms, can produce massive amounts of revenue. For example, using projected 1985 fossil fuel-based electricity generation, a one mill/kwh fee would raise approximately $1.2 billion per year in the eastern United States. If the fee were imposed on a forty-eight state basis as proposed by H.R. 3400, the estimated revenues would increase to $1.75 billion.[54] Clearly, a generation fee is an effective means for spreading control costs over a larger base, making the impact on individual regions or states relatively small. As a result, the generation fee approach should not significantly affect competition beteween electricity and other energy uses. A generation fee is also relatively simple to collect. It essentially is equivalent to a sales tax on electricity consumption so it is attractive from an implementation perspective. As is true for any of the options, the generation fee concept does have some bases for criticism. Although the generation fee is based on output rather than input, it still would make low-sulfur fuels more attractive than high-sulfur coal. Low sulfur fuels would be more appealing because, as noted above, utility companies would prefer to switch fuels instead of paying for the O&M costs of a scrubber. As a consequence, a premium would exist for low sulfur fuels unless their use was prescribed by control legislation.

The most serious weakness of the generation fee approach is its failure to give credit for current and historic pollution abatement efforts. Table 4 demonstrates this problem. Since an individual state's liability becomes a function of its generation level, states with high generation and relatively

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[51] A mill equals one-tenth of one cent.

[52] Personal communication, T. Brand, Director of Environmental Affairs, Edison Electric Institute, March 1984.

[53] Consumers would also be subject to an indirect cost—higher prices for goods produced by those industries subject to the tax. However, there are relatively few products other than possibly steel for which the cost of electricity is a major component of their total cost.

[54] With the exception of direct taxes imposed upon states in proportion to population, the rule of liability to federal taxes must take no account of geography. *See* Florida v. Mellon, 273 U.S. 12 (1927). While Congress is entitled to regulate by taxation, *see* Veazie Bank v. Fenno, 8 Wall. 533 (1869) and Mulford v. Smith, 307 U.S. 38 (1939), the uniformity clause may constitutionally preclude applying the revenue generation options examined in this section to some but not all states. Therefore, the appropriate base for examining these fees/taxes is probably all 50 states. For a more extended discussion of the uniformity clause, see THE CONSTITUTION AND WHAT IT MEANS TODAY (H.S. Chase & C.R. Ducat eds. 1974).

clean units would not be treated differently than those high electricity producing states with limited prior control. As a result, those consumers who have already paid for FGD systems or low-sulfur fuels would pay again to subsidize rate payers of utilities with relatively uncontrolled units. The criticism remains valid even if the revenues are to subsidize, rather than fully fund, control costs. Moreover, while a graduated rate based on emission rates provides some incentive for electric utilities to operate their less polluting units more intensively and offers some recognition of past actions, it would create a somewhat artificial, although probably marginal, economic discontinuity in load management decisionmaking.[55]

Btu Tax. A Btu tax is similar to a generation fee in many respects. But using energy consumption as the basis for allocating revenue generation makes it possible to access an even broader base. This follows because a Btu tax could be applied to all fossil fuel use or to consumption above a given level. For example, industrial boilers, process heat applications, and mobile sources in the transportation sector as well as utility boilers consume fossil fuels. That fuel use could be taxed on a Btu basis. As a result, if industrial and utility tax rates were the same, utilities would only provide approximately two-thirds as much revenue reflecting their share of total U.S. fossil fuel consumption.[56] The tax would either be calculated from fuel consumption or a surcharge on fuel purchases.[57] From an administrative standpoint, the latter would be much simpler to implement.

A Btu tax would impose a larger percentage price increase on coal than on other fossil fuels. Consequently, reliance on the Btu tax option to finance acid rain controls has a major drawback. But, the percentage price increases for coal, oil, and natural gas are roughly proportional to the relative adverse environmental externalities which each produces. Thus, to the extent an incentive is created, it would be for more efficient energy use. The fewer Btus consumed, the smaller the relative share of the tax borne by fuel suppliers and consumers. While a Btu tax encourages energy conservation, it further penalizes sources that have incurred energy penalties by installing such equipment as baghouses or FGD to control emissions. However, because it potentially uses fossil fuel consumption

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[55] Both nuclear power plants and hydroelectric facilities can only be substituted for fossil fuel-fired plants on the margin in most utility systems. Nuclear plants are base-load capacity units and hydroelectric capacity is constrained by the amount of water available for electricity generation. As a consequence, any differential in load management of fossil-fuel power plants is likely to stem from factors other than a generation-fee surcharge.

[56] A tax of 6.13 cents/10^6 Btu (real) would be roughly equivalent to a 1 mill/kwh (real) generation fee. The key difference is that about 35 percent of the revenues raised by a Btu tax would be provided by the industrial sector.

[57] It would be far easier to administer a surcharge on fuel purchases than to estimate consumption.

Table 5. Distributional Impact of Selected Options for Financing Acid Deposition Reductions (Revenue Percentage/State)

State	Generation Fee[a]	Btu Tax[b]	Emissions Fee[c]
Alabama	2.56	2.02	2.86
Alaska	0.13	0.41	0.07
Arizona	1.92	1.06	3.39
Arkansas	0.85	0.92	0.38
California	5.51	7.98	1.68
Colorado	1.32	1.24	0.50
Connecticut	0.62	0.88	0.27
Delaware	0.47	0.34	0.41
District of Columbia	0.02	0.11	0.06
Florida	4.78	3.30	4.12
Georgia	2.98	2.27	3.16
Hawaii	0.35	0.37	0.22
Idaho	—[d]	0.27	0.18
Illinois	3.93	4.96	5.54
Indiana	3.82	3.46	7.56
Iowa	1.10	1.30	1.24
Kansas	1.36	1.52	0.84
Kentucky	3.27	1.91	4.22
Louisiana	2.51	4.51	1.14
Maine	0.12	0.32	0.36
Maryland	0.97	1.36	1.27
Massachusetts	1.60	1.63	1.30
Michigan	3.25	3.64	3.41
Minnesota	1.16	1.54	0.98
Mississippi	0.84	1.04	1.07
Missouri	2.73	2.07	4.90
Montana	0.30	0.43	0.62
Nebraska	0.50	0.68	0.28
Nevada	0.80	0.44	0.91
New Hampshire	0.25	0.26	0.35
New Jersey	1.15	2.45	1.05
New Mexico	1.30	0.92	1.01
New York	3.56	4.71	3.56
North Carolina	3.57	2.16	2.27
North Dakota	0.78	0.48	0.40
Ohio	6.10	5.53	9.97
Oklahoma	2.44	1.85	0.45
Oregon	0.10	0.66	0.23
Pennsylvania	5.78	5.53	7.61
Rhode Island	0.05	0.20	0.06
South Carolina	1.29	1.10	1.23
South Dakota	0.15	0.26	0.15
Tennessee	2.75	1.91	4.05
Texas	11.71	12.10	4.81
Utah	0.63	0.71	0.27
Vermont	—[d]	0.10	0.02
Virginia	1.10	1.67	1.36
Washington	0.40	1.16	1.02
West Virginia	4.16	1.74	4.10
Wisconsin	1.43	1.71	2.40
Wyoming	1.45	0.78	0.69

[a] Based on 1981 conventional steam generation (i.e., non-hydro, non-nuclear) of electricity expressed as 10^6 kwh.
[b] Based on 1980 consumption of fossil fuels (coal, natural gas, and petroleum products) expressed as 10^{12} Btu.
[c] Based on 1980 SO_2 emissions estimates expressed as 10^6 tonnes.
[d] State shares <.001 percent of total U.S. revenue requirement.

as a base, it does provide a mechanism for capturing NO_x as well as SO_2 emissions reductions.

Emissions Fee. At least since the debate surrounding the adoption of the 1970 Clean Air Act, economists have argued about whether the emissions fee approach provides a cost effective incentive for dealing with air pollution problems.[58] Unlike generation fees or Btu taxes which impose equal costs on all, an emissions fee imposes a differential burden. In one sense, it embodies the polluter pays principle. Emissions fees allocate pollution abatement costs to sources relative to their prior success in controlling emissions. As a result, electricity prices better reflect their true cost, including the environmental impacts, of production. Presumably, an emissions fee approach to financing acid rain controls would be based on the number of tons of SO_2 produced by specified sources.[59] Emissions could either be monitored or calculated using data on fuel inputs and emission coefficients. Each approach to establishing a polluter's emissions level represents a substantial administrative undertaking, especially were continuous emissions monitoring (CEM) to be adopted.

Given its implementation barriers, the emissions fee approach to financing acid rain controls remains attractive to environmental economists for other reasons. An SO_2 emissions fee, unlike a Btu or generation fee, would address directly the SO_2 loadings problem by changing emission levels and raising revenue. Economic theory suggests that the ideal point to set the fee would be somewhat lower than the marginal cost of control for capturing the last ton of emissions reduction desired. In theory, sources that could reduce their emissions relatively cheaply would do so to avoid paying the fee. Other sources facing relatively large control costs generally would choose to pay the fee.[60]

While attractive to economists, the emissions fee concept is not devoid of drawbacks. Those disadvantages primarily involve its implementation and its economic impact on domestic coal markets. As noted above, an SO_2 fee would be difficult to administer. Environmental authorities generally can estimate an individual power plant's maximum emissions rate. But determining its total emissions is difficult, if not impossible, without continuous emission monitoring. Thus, it would be necessary to invest in either a widespread CEM effort or an "emission auditing program." The SO_2 emissions fee imposes costs in a pattern very similar, but not

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[58] *See* E.S. MILLS, THE ECONOMICS OF ENVIRONMENTAL QUALITY (1978).

[59] A $120/ton SO_2 emissions fee, imposed on major sources, would raise roughly as much money as a one mill/kwh generation fee. It would also induce a few sources to reduce their emissions but it concentrates the revenue burden on those areas that will later be expected to incur the costs of controls. On the other hand, these areas will presumably receive much of the benefits when those revenues are disbursed. *See The Acid Rain Lobby Picks Up Steam,* 107 FORTUNE 33-36 (1983).

[60] A variation on this theme would be to establish allowable emissions in a particular area and then sell or give the right to produce a portion of that total to current polluters. They could then resell those rights if desired.

quite as focused, as an efficient allocation system coupled with the normal rate-making process. As a result, unless fuel switching were constrained, coal markets would be impacted. Under an emissions fee approach, Table 4 indicates that the costs of achieving SO_2 emissions reductions remain concentrated on a few states. Some individual utility systems would still have to pass through large expenditures to their ratepayers as a consequence. The SO_2 emissions fee, like the normal rate-making process, therefore would create pressure for large amounts of fuel switching. Moreover, it might not produce the level of geographical distribution of SO_2 emissions reductions desired. An SO_2 fee used to allocate the reduction would prevent pollution sources from having to pay extremely high costs per ton of SO_2 removed. Instead, polluters could choose to pay the fee rather than make the investment in pollution abatement. As a result, the emissions fee approach provides an obvious mechanism for revenue generation. But it does not necessarily force an actual emissions reduction.

Sulfur-Content-in-Fuel-Tax. A sulfur-content-in-fuel tax is essentially comparable to an SO_2 emissions fee. However, the two approaches do differ in one important way; the tax is based on sulfur input instead of output. As a result, a sulfur-content-in-fuel tax would be imposed on the sulfur content of fossil fuel purchases rather than on SO_2 emissions. It probably would have to be based on SO_2 emissions/mmBtu nevertheless in order to standardize among fuels. Once again, unless constrained by law, most sources probably would prefer to shift to lower sulfur fuels to avoid the tax. Like some of the other options, unless some type of credit is provided, the tax also would penalize FGD-equipped sources. These power plants would still be subject to the tax. Yet they already have made substantial investments in air pollution control equipment which reduces emissions but carries with it an energy penalty. FGD systems require fuel to operate, thereby increasing fuel consumption but not electricity generation. With the credit, a sulfur-content-in-fuel tax's impacts would be virtually identical to those of an SO_2 emission fee. Without the credit, however, FGD systems are not likely to be installed on a retrofit basis for utility air pollution control purposes. In theory, such a credit could be set at a level to leave decisionmakers indifferent between scrubbing and fuel switching, or could function as a positive incentive to encourage scrubbing or high-sulfur coals. Finally, while it might be administratively less complex to implement a sulfur-content-in-fuel tax than a SO_2 emissions fee,[61] such a differential has not been demonstrated empirically on a widespread basis. Like an emissions fee, the sulfur-content-in-fuel-tax approach to revenue generation does not guarantee that SO_2 emissions

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[61] This is the case because sulfur inputs measured in terms of liquid and solid fossil fuels can be established in physical units in a more straightforward fashion than can outputs measured as emissions from a variety of geographically dispersed point and mobile sources.

reductions will accrue in an environmentally as opposed to economically optimal fashion.

Federal Budget Outlays. Each of the above alternatives, including the normal utility rate-making process, ties the mechanism for revenue generation to some aspect of energy use and its residual air pollution effects. It is possible, at least conceptually, to sever totally or partially the linkage between acid deposition control costs and raising the revenues necessary to fund those controls. The costs of acid rain controls could be paid for directly by the national government as an item in the federal budget. Approaching the financing question in this way spreads control costs over the largest possible base, thereby minimizing individual liability. It also does not require a significant expansion of existing administrative structures. The revenue generation process is administratively simple since the existing mechanism for raising federal funds would be used.

Yet turning to general revenues not only implies that acid deposition control is an important national concern but that consensus exists which ranks it as a major priority. At this time, we simply do not have enough evidence to conclude that such a consensus exists. In fact, some aspects of reliance on the federal budget to subsidize controls call into question the option's political feasibility. The use of direct federal budget outlays represents a clear departure from the polluter pays principle. Otherwise the polluter pays concept must be construed so broadly that it loses any analytical meaning, since relying on general revenues is completely indifferent to prior abatement efforts. Unlike some of the other alternatives which can be justified on the basis of energy policy objectives, financing controls with general revenues also fails to change relative fossil fuel prices, thereby promoting conservation or efficient end use management. Finally, in a period marked by substantial concern over taxes and deficits, the approach forces a clear choice between increasing one or the other. These drawbacks seem sufficient to mobilize significant political opposition if not to preclude using direct federal budget outlays to finance all or some part of the costs of acid rain controls.

POLITICAL IMPLICATIONS

Each of the financing alternatives outlined above as well as our summary of the science and economics of acid rain forces policy-makers to confront the reality that control costs are high. There is simply no cheap way to achieve substantial reductions in SO_2 emissions. Because each of the options can be set at a level sufficient to have essentially equivalent revenue generation capability relative to the other options, the selection of an option ultimately becomes a function of distributional considerations. A recent analysis succinctly states the obvious conclusion: "Acid rain is an environmental crisis with sweeping financial implications, but its solution is political."[62] In other words, classic equity issues—who gains the benefits and who bears the burden of the costs and risks—are likely to drive the decision to embark upon any particular financial path. Steven Rhodes and Paulette Middleton, both at the National Center for Atmospheric Research, have made this point as follows:

> As acid rain control measures are proposed and debated, an important observation must be taken into account in the formulation of regulatory policy; namely, that the current unregulated acid rain situation produces *certain benefits* to some and *uncertain costs* to others. Proposed regulation of acid-causing emissions, however, promises *certain costs* for those who presently enjoy the certain benefits but *uncertain benefits* for those who presently incur the uncertain costs.[63]

In such circumstances, the economic efficiency of any financial strategy may be of only marginal importance. The very different patterns of interest group mobilization and interaction which are likely to occur as a function of the allocation of acid rain control benefits and costs are probably more significant. Professor James Q. Wilson provides a useful typology for anticipating these patterns: (1) Majoritarian politics, when both costs and benefits of policy are widely distributed; (2) Interest group politics, when both costs and benefits are narrowly concentrated; (3) Client politics, when benefits are concentrated, but costs are widely distributed; and (4) Entrepreneurial politics, when benefits are broadly spread, but costs are narrowly concentrated.[64] Each of these categories appears to have some relevance for characterizing the debate over financing acid rain controls.

The Limits of Client Politics

The current situation in acid rain politics demonstrates the limits of client politics.[65] Restricting acid rain policy to a research and development (R&D) strategy, the consistent position of President Ronald Reagan's administration, has become increasingly less defensible as studies of the phenomenon proliferate. For some time, environmentalists and other parties-at-interest have been critical of the administration's policy of re-

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[62] R. HOWARD & M. PERLEY, ACID RAIN: THE DEVASTATING IMPACT ON NORTH AMERICA (1980).

[63] Rhodes & Middleton, *The Complex Challenge of Controlling Acid Rain*, 25 ENV'T 6-9 (1983).

[64] J.Q. WILSON, THE POLITICS OF REGULATION (1980).

[65] Client politics are characterized by a situation in which:

> Some small, easily organized group will benefit and thus has a powerful incentive to organize and lobby; the costs of the benefit are distributed at a lower per capita rate over a large number of people, and hence they have little incentive to organize in opposition—if, indeed, they even hear of the policy . . . client politics produces regulatory legislation that most nearly approximates the producer-dominated model.

Id. at 369.

quiring more scientific research before taking action, terming such a stance "stalling tactics" in the face of what they perceived to be sufficient empirical evidence that a hazard exists.[66] As important as the growth of scientific knowledge has been in giving credence to this criticism,[67] even more significant has been the emerging perception that unacceptable inequities in the distribution of costs, damages, and benefits underpins existing policy. This perception has been more significant in reinforcing calls for reductions as well as research now. Advocates of the status quo in the acid rain arena have tried to reduce their waste disposal costs by externalizing that burden to the environment and thus to the society as a whole through client politics. As noted above, those utility systems, primarily located in the Midwest, which generate electricity from high sulfur fuels are one of the more significant actors in this process. Electric utilities are not the only clients supporting the status quo, however. High sulfur coal producers and miners, some railroads, chemical manufacturers, and Midwestern public officials also are influential on that side of the policy debate.[68] Each of these groups, especially high sulfur coal interests, has a vested interest in opposing acid rain control measures. This opposition is especially the case to the degree that controls would result in a significant redistribution of the current cost-benefit configuration.

On the other side of the political fence, a coalition has formed to press for modifications in the existing situation. This "acid rain lobby" is composed of environmentalists, land owners and small businessmen in areas impacted by acid rain such as Ontario and New York resort communities, Canadian power interests, and the Canadian government itself.[69] In fact, the Canadian interests have expanded the definition of client politics to include the actions of the American government. As a recent report of the Canadian House of Commons declared:

> Acid rain is produced because firms, operating in their own best interests, function within an institutional framework which cannot effectively manage the environment. Under some circumstances, the same agument can be made with respect to the political jurisdictions. Since acid rain is associated with the long-range transport of air pollutants, emissions originating in one political jurisdiction can be deposited in another jurisdiction. Thus any government which operates in the best interests of its own citizens will tend to do little about controlling emissions which fall in, and cause damage to, other

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[66] J.R. LOUMA, TROUBLED SKIES, TROUBLED WATERS: THE STORY OF ACID RAIN (1980); and R.H. BOYLE & R.A. BOYLE, ACID RAIN (1983).

[67] Mosher, *Administration Loses its Umbrella Against Steadfast Acid Rain Policy,* 15 Nat'l J. 1590-91 (1983).

[68] FORTUNE, *supra* note 59.

[69] *Id.*

> provinces, states, or countries. Just as acid rain allows firms to impose external costs on third parties, acid rain allows one political jurisdiction to impose such costs on other jurisdictions. In this respect governments behave like private firms.[70]

To date, the acid rain lobby has focused largely on attempts to keep the issue visible and on efforts to influence legislative and executive initiatives. But, as is typical of client politics, they have had limited success in organizing broader coalitions among the parties-at-interest who might benefit from a change in the status quo. This limited success is a direct result of the fact that the benefits from changes in the existing system are highly uncertain and widely diffused while the costs of change are highly concentrated and more certain.

Nevertheless, the acid rain lobby has had some success in its effort to mandate additional SO_2 emissions reductions. It now appears that the stalemate which has existed since the late 1970s is breaking up, and that some modifications in the status quo are likely. The question is when further controls may be mandated, the timetable for achieving those reductions, and how those costs are amortized. Two possible scenarios under which an answer may unfold are suggested by the range of financing alternatives available: abandoning client politics in favor of either entrepreneurial or majoritarian political arrangements.

Polluter Pays or Cleanup Subsidies?

Entrepreneurial Politics. On the surface, the most obvious way to restructure acid rain policy would seem to involve following the trend of environmental politics in recent years by implementing entrepreneurial arrangements. Wilson characterizes this option as follows:

> . . . a policy may be proposed that will confer general (though perhaps small) benefits at a cost to be borne chiefly by a small segment of society. . . . Since the incentive to organize is strong for opponents of the policy but weak for the beneficiaries, and since the political system provides many points at which opposition can be registered, it may seem astonishing that regulatory legislation of this sort is ever passed. It is, and with growing frequency in recent years—but it requires the efforts of a skilled entrepreneur who can mobilize latent public sentiment (by revealing a scandal or capitalizing on a crisis), put the opponents of the plan publicly on the defensive (by accusing them of deforming babies or killing motorists), and associate the legislation with widely shared values (clean air, pure water, health and safety).[71]

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[70] SUBCOMM. ON ACID RAIN OF THE CAN. HOUSE STANDING COMM. ON FISHERIES AND FORESTRY, STILL WATERS: THE CHILLING REALITY OF ACID RAIN, REPORT TO THE CANADIAN HOUSE OF COMMONS (1981).

[71] WILSON, *supra* note 64.

While environmentalists point to the dying spruce trees on Camel's Hump Mountain in Vermont as an example of ecological crisis, the current scientific uncertainties surrounding the pervasiveness of the effects of acid deposition make it difficult to create widespread public perception of a crisis. Similarly, while individual scientists have legitimated acid deposition as a R&D topic, no dominant policy entrepreneur has emerged in the U.S. political context. Therefore,the political feasibility of entrepreneurial politics appears to be very low.

Abandoning client linkages in favor of entrepreneurial politics involves dramatic changes in the ways costs and benefits are distributed. Most importantly, it involves the implementation of the economic philosophy of polluter pays. As a result, entrepreneurial politics are compatible with the use of the normal electric utility rate-making process as well as with several alternatives to that process such as emissions fees or sulfur-content-in-fuel-taxes. Each of those alternatives would have the effect of imposing control costs at the primary source of SO_2 emissions. But while placing the entire burden on the electric utility companies, and leaving it to them to allocate the costs among their customers and shareholders, may appear theoretically attractive for both efficiency and equity reasons, it is also highly controversial. From the point of view of the Midwestern states, it is simply too big a financial burden to bear. As a result, interests in those states have pressed for various spread-the-cost schemes. Moreover, the utility industry points to the fact that none of the responses currently under consideration mandates NO_x reductions. This lack of a requirement for further NO_x reductions essentially is because additional regulation of mobile sources, the primary emitters of NO_x, would mobilize other powerful political interests.

Nevertheless, some variant of the polluter pays principle has dominated the United States' environmental politics to date. Regional conflict certainly would be exacerbated by any scheme to subsidize cleanup efforts in the Midwest. Heightened regional conflict is especially likely given the widespread perception in other regions that Midwestern interests have not been aggressive enough in reducing their emissions. As Edwin Rothschild of the Citizen/Labor Energy Coalition has argued: "There is no question that these Midwestern utilities have been lax in complying with the Clean Air Act. They have been stalling for years in avoiding the costs of installing scrubbers."[72] Moreover, some participants in the acid rain debate are concerned that continuing down the technology-forcing path (i.e., forced scrubbing) represents a bailout of the high sulfur coal producers. And, as lawyers Bruce Ackerman and William Hassler have asserted, there is the possibility that FGD-forcing measures may have the

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[72] Mosher, *supra* note 45.

perverse result of selectively increasing emissions in the East.[73] Yet, to achive a reduction of 40 to 50 percent within ten years which is the magnitude proposed by control advocates, it becomes impossible not to rely on a FGD retrofit strategy.

Certainly a continuation of the decade-long emphasis on engineering mechanisms to ensure implementation of the polluter pays philosophy is likely to lead to entrepreneurial politics linking such unlikely interests as the clean air and the dirty coal groups.[74] We know from experience that the polluter pays approach can lead to some very strange, yet very powerful, coalitions of energy, environmental, and economic actors. In fact, this highly volatile and somewhat unpredictable dimension of entrepreneurial politics is a major reason that various spread-the-cost subsidies have appeal.

Majoritarian Politics. The most widely suggested departure from the entrepreneurial politics path is the establishment of some majoritarian political framework. Wilson says of this orientation:

> All or most of society expects to gain; all or most of society expects to pay. Interest groups have little incentive to form around such issues because no small, definable segment of society (an industry, an occupation, a locality) can expect to capture a disproportionate share of the benefits or avoid a proportionate share of the burdens.[75]

Distributive politics, in a nutshell, is the great appeal of majoritarian policy. In the acid rain arena, the use of such financing options as generation fees, Btu taxes, or direct federal budget outlays promises to spread the costs of mitigation across the broadest possible segment of the society. Each reflects the classic majoritarian strategy for formulating a policy response to a public problem. In an abstract sense, spreading the burden means that the political feasibility of such option may be greater than more punitive variants based on the polluter pays approach. But majoritarian options are neither as economically efficient nor equitable as entrepreneurial ones. Thus, while client politics may be fast approaching its limits in the acid deposition case, neither entrepreneurial nor majoritarian politics guarantees consensus.

THE MISSING INGREDIENT: INTEREST GROUP POLITICS

The political attractiveness of an acid rain "trust fund" or some other alternative to reliance on the normal electric utility rate-making process

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[73] B.A. ACKERMAN & W.T. HASSLER, CLEAN COAL/DIRTY AIR (1981).

[74] *Id.*

[75] WILSON, *supra* note 64.

is illustrated in this quote from a recent FORTUNE article assessing the possible impact of legislative initiatives on the stock market:

> For now, the stock market seems untroubled by the specter of acid rain legislation. "There are psychological issues that haven't moved the stocks yet," says Margery Obrentz, a security analyst at Kidder Peabody & Co., "but as Congress gets more serious about this, we expect the stocks to move a little." Perhaps the market is so untroubled because no one really expects Congress to slap an unproductive $10-billion or $20-billion capital expense on the utility industry. Not that acid rain legislation won't pass; it probably will. But sentiment is strong against saddling one industry or region with the whole cost, especially since smelters, steel mills, auto plants, and home furnaces all contribute to the acid brew. So it may well be that one of several spread-the-cost schemes under consideration will shift the burden at least partially off utility shoulders.[76]

Attempts to expand the political framework to include some sort of international cost sharing appear less promising in the near-term. At the multilateral level, discussions of transboundary pollution have led to calls for more R&D and monitoring. But, with the exception of the recently announced "30% Club," the international community has had limited success in developing control goals or timetables. And bilateral negotiations between the United States and Canada have been limited largely to R&D agreements and symbolic acknowledgment that acid rain is a problem.[77]

Significantly, only interest group politics does not seem compatible with the acid rain financing debate. Like most environmental issues, the acid rain problem does not fit easily into a framework characterized by concentrated costs and benefits. We know substantially less about the value of damages prevented or mitigated than we do about costs. But we can anticipate that benefits will accrue to different parties-at-interest, at different points in time, and at different magnitudes than will be the case with costs.[78] And we also know that a strong case can be made that the U.S. political system and the international system function best when the various parties-at-interest do have an understanding of distributional consequences. Environmental policy-making is no exception to this rule. Professor Walter Rosenbaum has made this point a central part of his analysis:

> . . . public policy-makers are very likely to weigh the costs and

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[76] Magnet, *How Acid Rain Might Dampen the Utilities*, 108 FORTUNE 60 (1983).

[77] Yanarella, *The Foundations of Policy Immobilization over Acid Rain Control*, THE ACID RAIN DEBATE 39-56 (E.J. Yanarella & R.H. Ihara eds. 1985); and R. GOULD, GOING SOUR: SCIENCE AND POLITICS OF ACID RAIN (1985).

[78] Regens & Crocker, *supra* note 29.

> consequences of environmental policy decisions in group terms. This is not to suggest that various groups are the only components in the public official's subjective map of the political world, but almost all studies of official decision-making emphasize that group viewpoints and the group consequences of policy choices do weigh heavily in official thinking much of the time. It is a matter of fundamental political intelligence for officials to discover, in any case, where important interests stand on policy questions, environmental or otherwise. All this underscores the fact that what groups do in the political arena—how they represent their interests, to which officials they speak—is likely to have substantial consequences in shaping public policy.[79]

This is conventional wisdom, yet none of the financial alternatives currently being considered in the acid rain debate reflects the interest group politics framework. This fact alone may go a long way toward explaining our inability to develop agreement on a control program as well as on a financing strategy that is acceptable to the diverse range of participants in the acid rain arena.

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[79] W.A. ROSENBAUM, THE POLITICS OF ENVIRONMENTAL CONCERN 21 (2d ed. 1977).