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UNITED STATES ENVIRONMENTAL LEGISLATION AND ENERGY RESOURCES: A REVIEW*

DANIEL P. BEARD

IN RECENT years considerable attention has been focused on the relationships between environmental quality and energy supply and demand objectives. Some spokesmen have commented that these two subjects reflect divergent goals and that significant technological and societal changes will be required to reach them.¹ Others have stated that both environmental and energy supply objectives can be achieved without major readjustments.² While this debate has continued, environmental legislation has been implemented: the courts have resolved legislative conflicts; administrative agencies have promulgated standards and regulations; and, as Russell Train, administrator of the Environmental Protection Agency (EPA) recently wrote, "the average citizen is . . . beginning to recognize that there were difficult choices to be made, that some cherished patterns of behavior may have to be modified."³

The Arab oil embargo and other energy supply problems have changed the character of this debate, however. Executive and congressional leaders have acted to delay implementation of environmental objectives in order to improve energy supplies and relieve shortages. Other leaders have called for further changes in environmental requirements because existing legislation has gone "too far."⁴ Environmental spokesmen, on the other hand, have urged restraint

* An earlier version of this paper was presented at the annual meeting of the Middle Atlantic Division, Association of American Geographers, College Park, Maryland, February 2, 1974.

¹ Two eloquent statements on this issue were recently published. See Hans H. Landsberg: *Low-Cost, Abundant Energy: Paradise Lost?* *Science*, Vol. 184, 1974, pp. 247-253; and Kenneth E. Boulding: *The Social System and the Energy Crisis*, *ibid.*, pp. 255-257. Edward S. Mason (*Reconciling Energy Policy Goals, in Energy, Economic Growth, and the Environment* [edited by Sam H. Schurr; Johns Hopkins Univ. Press, Baltimore, 1972], pp. 113-124) has addressed the problem of adjudicating conflicting goals and the implication these conflicts could have for society. A particularly good collection of papers representing the viewpoint of industry groups is found in Robert N. Rickles, edit.: *Energy in the City Environment* (Noyes Press, Park Ridge, N.J., 1973).

² See Michael McCloskey: *The Energy Crisis: The Issues and a Proposed Response*, *Environmental Affairs*, Vol. 1, Nov., 1971, pp. 587-605; Marc J. Roberts: *Is There an Energy Crisis?* *Public Interest*, No. 31, Spring, 1973, pp. 17-37; and Russell E. Train: *Energy Problems and Environmental Concern*, *Science and Public Affairs*, Vol. 29, Nov., 1973, pp. 43-47.

³ Russell E. Train: *In Defense of the Environment*, *Living Wilderness*, Vol. 37, Autumn, 1973, pp. 9-13; reference on p. 10.

⁴ See "Problems Caused by Environmental Protection Laws," *Congr. Record* (daily edit.), June 26, 1973, pp. S12007-S12009; or "Concern for the Environment," *ibid.*, June 21, 1973, pp. E4297-E4300.

► DR. BEARD is a special assistant to the Honorable Sidney R. Yates (Democrat from Illinois), Chairman, Subcommittee on Interior and Related Agencies, Committee on Appropriations, United States House of Representatives.

and caution in amending environmental legislation, fearing unwarranted over-reaction to immediate problems.⁵

The energy-environment debate points up the need for a better understanding of the relationships between environmental legislation and energy supply and demand. To date most researchers have focused on the environmental impact of the production, transportation, and utilization of energy.⁶ Few have dealt with the influence of environmental legislation on our energy economy, an impact that is rapidly approaching critical dimensions.

In the sections that follow, four key environmental statutes which have influenced energy supply and demand are summarized. Eight major interrelationships between this legislation and energy are then analyzed. In the concluding section the manner in which Congress has dealt with these issues is discussed and several possible implications for the distribution of future energy supplies are outlined. Although this review is limited to the United States, identification of the broad interrelationships between environmental legislation and energy supply and demand may be useful to other countries considering or undertaking similar policies.

RECENT ENVIRONMENTAL STATUTES

In the late 1960's and early 1970's, concern for the preservation and enhancement of the environment increased.⁷ Issues in this "movement" included air and water pollution, land-use management, the aesthetic impact of development, and a wide variety of other topics. In Congress, this concern resulted in the enactment of several major laws aimed at attacking environmental problems.⁸

The first significant federal air-pollution legislation was enacted in 1967.⁹

⁵ "Environmentalists Counter Administration Energy Programs," *Congr. Record* (daily edit.), Dec. 7, 1973, pp. E7863-E7864.

⁶ The literature on this subject is voluminous. The best comprehensive sources are: "Environmental Effects of Producing Electric Power" (91st Congr., 1st Sess., Joint Committee on Atomic Energy, Hearings, 1969), Pts. 1 and 2; D. Berkowitz and A. Squires: *Power Generation and Environmental Change* (MIT Press, Cambridge, Mass., 1971); R. Seale and R. Sierka: *Energy Needs and the Environment* (Univ. of Arizona Press, Tucson, Ariz., 1973); and "Exploring Energy Choices: A Preliminary Report" (Ford Foundation, Energy Policy Project, Washington, D.C., 1974), pp. 21-28.

⁷ A good survey of the factors behind, and the elements of, this concern are found in Barry Commoner: *The Closing Circle* (Alfred A. Knopf, New York, 1971); Lynton Caldwell: *Environment: A Challenge for Modern Society* (Natural History Press, Garden City, N.Y., 1970); and H. Jarrett: *Environmental Quality in a Growing Economy* (Johns Hopkins Univ. Press, Baltimore, 1966).

⁸ For a comprehensive review of legislation enacted following the rise of environmental concern, see "Congress and the Nation's Environment: Environmental Affairs of the 91st Congress" (92nd Congr., 1st Sess., Senate Committee on Interior and Insular Affairs, Committee Print, Feb., 1971); and "Congress and the Nation's Environment: Environmental Affairs of the 92d Congress" (93rd Congr., 1st Sess., Senate Committee on Interior and Insular Affairs, Committee Print, Jan., 1973).

⁹ Public Law 90-148; a copy may be found in *United States Statutes at Large*, Vol. 81, p. 485. Hereafter all citations to statutes or sections of laws will be made according to "A Uniform System of Citations" (Harvard Law Rev. Assn., Cambridge, Mass., 1968), pp.

Among other things this legislation required the states to establish air-quality standards for "air sheds," or regions with common air-pollution problems. However, problems in state implementation of the standards, plus other difficulties,¹⁰ resulted in the enactment of more comprehensive legislation, the Clean Air Act Amendments of 1970.¹¹ This act thoroughly reshaped the existing law to provide stronger federal involvement in setting standards, in establishing specific timetables for compliance, and in assuring effective enforcement. The act extended the concept of air-quality standards and authorized the administrator of the EPA to set primary and secondary national air-quality standards to control emissions of certain pollutants. The act also included regulations to require new major industrial facilities, such as power plants, to achieve standards of emission performance based on the latest available control technology, and requirements that the administrator regulate emissions of pollutants found to be hazardous to health or take immediate action to abate pollution that presents an imminent and substantial danger to health.

The federal government enacted water-pollution control legislation as early as 1899,¹² but not until 1965 was comprehensive legislation obtained. The Water Quality Act of 1965¹³ required the states to establish water-quality standards for all interstate waters and left major responsibility for implementation with the states.¹⁴ The states, however, were slow to implement provisions of the act. The Senate Public Works Committee commented, for example, that four years after the deadline for submission of water-quality standards, only half of the states had standards that were fully approved.¹⁵

Major revisions of this act came with passage of the Federal Water Pollution Control Act Amendments of 1972.¹⁶ The new act reflects a significant redirection of pollution-control legislation,¹⁷ for it attempts to eliminate the use of bodies of water for waste disposal: it enunciates a national goal of eliminating all discharges of pollutants into water by 1985. A major focus of the legislation is construction of publicly owned waste-treatment facilities, but it also contains provisions that directly affect energy industries. According to the act, water-pollution effluents are to be limited to levels achievable through the use of "best practicable" technology by 1977 and of "best available" technology by 1983. Each

26-27. All citations from the United States Code (U.S.C.) are from the 1970 edition unless otherwise noted. Thus the citation for the above statute would appear as P.L. 90-148, 81 Stat. 485.

¹⁰ "Clean Air Act Amendments of 1970" (91st Congr., 1st Sess., *Senate Rept. No. 91-1196* on S. 4358, Committee on Public Works, 1970).

¹¹ P.L. 91-604, 84 Stat. 1676, 42 U.S.C. 1857 ff.

¹² 30 Stat. 1152.

¹³ P.L. 89-234, 79 Stat. 903.

¹⁴ For a discussion of the legislative history of the act, see Philip P. Micklin: *Water Quality: A Question of Standards*, in *Congress and the Environment* (edited by Richard A. Cooley and Geoffrey Wandesforde-Smith; Univ. of Washington Press, Seattle, 1970), pp. 130-147.

¹⁵ "Federal Water Pollution Control Act Amendments of 1971" (92nd Congr., 1st Sess., *Senate Rept. No. 92-414* on S. 2770, Committee on Public Works, Oct., 1971), p. 4.

¹⁶ P.L. 92-500, 86 Stat. 816, 33 U.S.C. 1251 ff. (Supp. II, 1972).

¹⁷ F. Rasmussen: *Federal Water Pollution Control Act Amendments of 1972*, *Wisconsin Law Rev.*, Vol. 53, 1973, pp. 893-907.

source of pollution must obtain a permit that specifies the limitation to be achieved and the measures needed to demonstrate that it is being achieved.

Another environmental statute affecting energy supply and demand is the National Environmental Policy Act of 1969 (NEPA).¹⁸ This legislation declares a governmental mandate and responsibility for environmental quality, establishes the Council on Environmental Quality, and provides for administrative procedures that require all federal agencies to prepare an "environmental impact statement" on proposed federal actions which significantly affect the "quality of the human environment." The responsible federal officials are called on to examine: the environmental impact of the proposed action; any adverse environmental effects that cannot be avoided should the proposal be implemented; alternatives to the proposed action; the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented.

Through a succession of court decisions, the scope of NEPA and the requirements of statements have been clearly defined:

First, NEPA has been viewed as a full-disclosure law. Each environmental impact statement must "at a minimum" contain information which will alert the public "to all known *possible* environmental consequences. . . ."

A second constraint has been that statements must reflect a balancing of environmental and other considerations. . . .

A third requirement imposed through court action is the full consideration of alternatives to the proposed action. . . .¹⁹

The Coastal Zone Management Act of 1972²⁰ is a federal grant-in-aid program designed to assist states in developing and managing activities in the "coastal zone," defined as all water seaward to the three-mile territorial limit and all lands inland from the shoreline that are "necessary to control shorelands and which have a direct and significant impact upon the coastal waters."²¹ Under the act, the states will develop comprehensive plans to which future development of the coastal zone must conform.

Several provisions of the act will directly affect the development of energy resources. Section 307(b), for example, requires that the views of federal agencies principally affected by a state plan be "adequately considered" before the plan can be approved by the Secretary of Commerce. Section 307(c)(1) requires that each federal agency undertaking activities in the coastal zone must, "to the maximum extent practicable," conduct them consistent with the approved state plan. More important, Section 307 requires applicants for federal licenses or permits to present certification that the activity will be undertaken in a "manner consistent with the program." Moreover, "no license or permit shall be granted by the Federal agency until the State or its designated agency has concurred with the applicant's certification. . . ."²²

¹⁸ P.L. 91-190, 83 Stat. 852, 42 U.S.C. 4321 ff.

¹⁹ Daniel P. Beard: The National Environmental Policy Act in the Courts and Congress, 1970-1972, *Professional Geogr.*, Vol. 25, 1973, pp. 377-381; reference on p. 378.

²⁰ P.L. 92-583, 86 Stat. 1280, 16 U.S.C. 1451 ff. (Supp. II, 1972).

²¹ 16 U.S.C. 1453(a) (Supp. II, 1972).

²² 16 U.S.C. 1456(c)(3) (Supp. II, 1972).

ENVIRONMENTAL LEGISLATION AND ENERGY

The enactment and implementation of these environmental statutes have resulted in a number of changes in energy industries because, as Bruce Netschert indicated, "every aspect of energy — its production, conversion, and utilization — carries with it either a direct adverse impact on the environment or the threat of it."²³ Eight direct effects that the legislation has had on energy supply and demand can be isolated: increased consumption of fuel; changes in patterns of fuel consumption; investment in pollution-control equipment; delays in construction of energy facilities; changes in production and transportation technology; increased prices and rates; land-use conflicts; and impacts on the international competitiveness of United States products.

INCREASED FUEL CONSUMPTION

The Clean Air Act Amendments of 1970 specifically call for decreased emission of hydrocarbons, carbon monoxide, and nitrogen oxides from automobiles.²⁴ According to tests by the EPA, the fuel penalty caused by these emission controls on 1973 automobiles is 10.1 percent relative to uncontrolled autos.²⁵ In addition to emission controls, several other trends have affected fuel economy. For example, fuel economy has dropped steadily for all automobiles,²⁶ and increasing amounts of crude oil are required to supply the same quantities of unleaded gasoline.²⁷ Since the automobile consumes a larger share of the transportation energy budget than all other modes combined, these developments, if continued unchecked, could significantly affect the consumption of gasoline and the supply of crude oil.

However, it is difficult to identify precisely the fuel penalty caused by the requirements of the Clean Air Act. The EPA reported that the 10 percent fuel penalty, though significant, was not nearly as dramatic when compared with other factors. Their study showed that vehicle weight

is the single most important vehicle design parameter affecting fuel economy. Past and future increases in vehicle weight have had, and will continue to have, a significant adverse effect on fuel usage. Weight is a parame-

²³ Bruce C. Netschert: *Energy vs. Environment*, *Harvard Business Rev.*, Vol. 51, No. 1, Jan.-Feb., 1973, pp. 24-28; reference on p. 24.

²⁴ For a thorough discussion of the history and implementation of this provision, see "Decision of the Administrator of the Environmental Protection Agency Regarding Suspension of the 1975 Auto Emission Standard" (93rd Congr., 1st Sess., Senate Committee on Public Works, Subcommittee on Air and Water Pollution, Hearings, June, 1973), Pts. 1-4.

²⁵ "A Report on Automotive Fuel Economy" (U.S. Environmental Protection Agency, Washington, D.C., Feb., 1974), p. 1.

²⁶ "Gas mileage [for all cars] has dropped from an average of 14.1 m.p.g. in 1970 to 11.6 m.p.g. in 1973" ("The Gasoline Shortage: A National Perspective" [93rd Congr., 1st Sess., Senate Committee on Interior and Insular Affairs, Committee Print, June, 1973], p. 5).

²⁷ "According to some studies, by 1985 at least 2 percent more crude oil will be needed to produce the lead-free gasoline required by the new model vehicles" ("Clean Air Act Oversight — 1973" [93rd Congr., 1st Sess., House Committee on Interstate and Foreign Commerce, Subcommittee on Public Health and Environment, Hearings, 1973], Pt. 2, p. 562.

ter over which the car buyer has direct discretionary control, in terms of the size car he chooses to purchase.

Other aspects of vehicle design (size, tires, axle ratio, engine compression ratio, air conditioning, transmission type, emission controls, and engine size and type) and operation (speed, trip length, acceleration, maintenance, road surface and grade, and elevation) were also examined. Changes in individual vehicle design parameters, including weight, are shown to affect fuel economy from -50% to over +100% of the nationwide average fuel economy. The most important of the operating parameters can individually vary the fuel economy of a given weight vehicle over a -60% to +25% range.²⁸

In addition, although emission standards will decrease gas economy, catalytic converters (the only system presently available to meet the standards) should improve fuel economy.²⁹ Late in 1973, General Motors projected a 13 percent increase in fuel economy for 1975 models compared to 1974 models.³⁰ If catalytic converters are added to all new models, the result should be improved performance to the point that emission standards will cause little or no fuel penalty.

FUEL SWITCHING

The Clean Air Act Amendments have changed fuel-consumption patterns for several energy sources. For example, the sulfur oxide emission standards promulgated under the act³¹ caused many electric utilities and industries to switch from high-sulfur to low-sulfur fuel oil. This change was made because supplies of low-sulfur fuel oil were readily available, because supplies of low-sulfur coal were expensive and not widely available, and because no system was available to remove sulfur oxides from emissions of electric power plants. The impact of the switch on the demand for coal and fuel oil has been significant. Between 1967 and 1972 the rate of increase in coal use by electric utilities decreased, while the demand for residual and distillate fuel oil increased by 200 percent.³² Until the Arab oil embargo, this trend had been expected to continue. The Federal Power Commission (FPC), for example, prepared a study comparing 1971 fuel use with 1975 state air-quality standards. Their results showed that 62.5 percent of the coal and 71.6 percent of the oil burned by electric utilities in 1971 would not have met 1975 emission standards.³³

²⁸ Report on Automotive Fuel Economy [see footnote 25 above], p. 1.

²⁹ David E. Gushee: Energy vs. Environment: A Conflict in Congress, *Chemtech*, Vol. 4, Feb., 1974, pp. 96-98; reference on p. 97.

³⁰ Clean Air Act Oversight — 1973 [see footnote 27 above], Pt. 2, p. 370.

³¹ *Federal Register*, Vol. 36, Apr. 30, 1971, pp. 8185-8201; reference on p. 8186.

³² "Steam-Electric Plant Factors, 1973" (Nat. Coal Assn., Washington, D.C., 1974), p. 55.

³³ Clean Air Act Oversight — 1973 [see footnote 27 above], Pt. 2, p. 564. The Arab oil embargo, of course, reversed this trend. However, it is far too early to predict how many power plants will switch back to coal from fuel oil and whether the switch will be permanent. During the winter of 1973/1974, eleven oil-fired power plants on the East Coast switched to coal, saving 53,142 barrels of residual fuel oil per day. These figures were far below original estimates because the winter was mild and because scarce coal supplies prevented more plants from switching. Another fifteen plants were willing to convert if and when environmental, technical, transportation, and supply problems were solved.

Emission standards have also been a major factor in the increased demand for natural gas, the least polluting of all fossil fuels, as a commercial, residential, and industrial fuel. The increased demand, approximately 7 percent a year, coupled with decreasing supplies, has caused a significant shortage in natural gas for most users and an upward pressure on natural-gas rates.³⁴ An indication of the pressure is the price of imported liquefied natural gas — up to \$3.00 per thousand cubic feet — which is three or four times the price of domestic interstate natural gas.

Although fuel switching as a result of environmental legislation has increased prices and been a factor in shortages of certain fuels, it has decreased air pollution. Indeed, according to the Council on Environmental Quality, most improvements in air quality achieved since 1970 have resulted from fuel switching.³⁵ In addition, the costs imposed by fuel switching must be weighed against the costs of continued high levels of air pollution. According to the Ford Foundation interim report on energy policy,

Air pollution effects are difficult to quantify. However, a 1973 report issued by the U.S. Environmental Protection Agency estimated the costs of air pollution at \$16.1 billion for 1968:

- \$5.2 billion for residential property damage;
- \$4.7 billion for damage to inert materials;
- \$0.1 billion for vegetation damage;
- \$6.1 billion for damage to human health.

It must be understood that these figures are not hard and fast; value judgements are involved. But the estimate is useful in pointing out the tremendous costs associated with air pollution damage. A more recent EPA report indicates that since 1968 these damage costs have dropped, owing both to increased use of air pollution controls and to the switch by power plants from coal to fuel oil and natural gas. If we postpone implementing air quality goals because of energy shortages and go back to greater use of coal, then the 1968 estimates may not be out of line.³⁶

INVESTMENT IN POLLUTION ABATEMENT

Both air- and water-quality legislation have increased the investment costs of private industry for pollution-control equipment; through 1973, more than \$20 billion has been invested.³⁷ These expenditures have also been significant for energy industries. For existing facilities to meet the pollution-control standards

³⁴ "United States Energy: A Summary Review" (U.S. Dept. of the Interior, Washington, D.C., 1972), pp. 20-25; "Fuel and Energy Resources, 1972" (92nd Congr., 2nd Sess., House Committee on Interior and Insular Affairs, Hearings, 1972), pp. 765-776; "Natural Gas Policy Issues" (92nd Congr., 2nd Sess., Senate Committee on Interior and Insular Affairs, Hearings, 1972), Pts. 1 and 2; and Joel Darmstadter: *Energy Consumption: Trends and Patterns*, in *Energy, Economic Growth, and the Environment* [see footnote 1 above], pp. 155-223.

³⁵ "Environmental Quality: The Fourth Annual Report of the Council on Environmental Quality" (Executive Office of the President, Council on Environmental Quality, Washington, D.C., 1973), p. 271.

³⁶ *Exploring Energy Choices* [see footnote 6 above], p. 22.

³⁷ "6th Annual McGraw-Hill Survey of Pollution Control Expenditures" (McGraw-Hill, Economics Dept., New York, May, 1973), p. 1.

of January 1, 1973, for example, electric utilities had to spend approximately \$3.88 billion and the petroleum industry, \$2.74 billion.³⁸ In 1973, investment in pollution-control equipment for these two industries was \$1.1 billion and \$0.5 billion, respectively.³⁹ These costs are expected to increase. The Council on Environmental Quality, for example, estimates that the cost of pollution control to the private sector will total \$175 billion between 1972 and 1981,⁴⁰ without taking into consideration the significant requirements imposed by the Federal Water Pollution Control Act of 1972.

To place these figures in perspective, however, we must compare them with the costs to society of continued pollution. Are the investment costs greater than the total direct and indirect costs of pollution to society? That remains the central question by which to judge investments in pollution-abatement equipment.

DELAYS IN CONSTRUCTION

Many critics claim that environmental legislation has significantly delayed the construction of urgently needed energy facilities. Officials of the electric-utility industry claim that new generating capacity has been postponed by environmentalists through a succession of court actions.⁴¹ Petroleum officials cite the same reason for delays in adding new refining capacity.⁴² These critics cite two particular circumstances behind the delays: the time required to receive approval for projects,⁴³ and, more important, NEPA. As the chairman of the FPC recently declared, for example, "Undoubtedly, NEPA has been responsible for costly, although not crippling, delays in essential projects. . . . [I]n the process of serving important environmental goals, our energy balance has been placed in disequilibrium."⁴⁴

However, the facts fail to support this assertion. At hearings on power-plant-siting legislation, the FPC revealed that environmental litigation was responsible for only 6 percent of all delays in electric generating capacity installed between 1966 and 1970.⁴⁵ Of the 242 plants scheduled for completion between 1969 and 1974, only 37 were delayed because of environmental challenges.⁴⁶

³⁸ *Ibid.*, p. 8.

³⁹ *Ibid.*, p. 9.

⁴⁰ Environmental Quality [see footnote 35 above], p. 93.

⁴¹ "Electricity and the Environment: The Reform of Legal Institutions" (Assn. of the Bar of the City of New York, Special Committee on Electric Power and the Environment, St. Paul, Minn., 1972), pp. 121-128.

⁴² "Factors Affecting U.S. Petroleum Refining: A Summary" (Natl. Petroleum Council, Washington, D.C., 1973), pp. 24-25.

⁴³ Daniel P. Beard: *Electric Power Plant Siting Legislation: A Review* (unpublished Ph.D. dissertation, Dept. of Geography, Univ. of Washington, Seattle, 1973), pp. 101-110.

⁴⁴ John N. Nassikas: *Energy, the Environment and the Administrative Process* (speech given before the section on Administrative Law, Amer. Bar Assn., Washington, D.C., Aug. 6, 1973), p. 8.

⁴⁵ "Powerplant Siting and Environmental Protection" (92nd Congr., 1st Sess., House Committee on Interstate and Foreign Commerce, Subcommittee on Communications and Power, Hearings, 1971), p. 438.

⁴⁶ "Powerplant Siting" (92nd Congr., 2nd Sess., Senate Committee on Commerce, Hearings, 1972), p. 248. Delays in the construction of facilities have been a significant problem for energy industries and have been expensive for consumers. Alvin Kaufman

Regarding petroleum refineries, Train has made the following comment:

Environmentalists have also been charged with hindering the construction of petroleum refineries. Although some companies have been refused sites for new refineries, by and large the oil industry has been most reluctant to commit large sums to new refinery construction because of past uncertainty about government policies, such as oil import policies. . . .⁴⁷

In addition, the availability of less-expensive foreign oil, foreign tax credits, and uncertainty about oil supplies caused oil companies to build new refineries overseas, rather than in the United States.

CHANGES IN PRODUCTION AND TRANSPORTATION TECHNOLOGY

Environmental legislation has had an impact on energy production and transportation technology. The Coal Mine Health and Safety Act of 1969,⁴⁸ for example, has increased the safety requirements of underground mines, but in so doing it has caused a shift away from underground mines to strip mining. Since this act was passed, the proportion of strip-mined coal has increased from 36 percent to 49 percent.⁴⁹

Water-pollution control legislation provides another example. Since the oil spill off the coast of Santa Barbara, California, legislation has imposed added liability requirements for cleanup of oil discharges by owners or operators of vessels or offshore drilling facilities.⁵⁰ The Department of the Interior has also tightened regulations and inspection of offshore oil-drilling rigs, and the Coast Guard has improved its monitoring and investigation of oil spills.⁵¹ These changes have meant increased production and transportation costs for oil companies, as well as changes in technology.

(Beauty and the Beast: The Siting Dilemma in New York State, *Energy Policy*, Vol. 1, No. 3, Dec., 1973, pp. 243-253; reference on p. 252) estimated the cost of delays in construction of electricity facilities in New York State in 1972 at \$260 million; this figure did not include legal costs or the cost of planning for plants that were never built.

⁴⁷ "Russell Train on the Energy Crisis," *Congr. Record* (daily edit.), June 14, 1973, p. E4087. In testimony before the Senate Interior Committee, the Department of the Interior noted that environmental "circumstances" had been a "significant factor in the lack of construction of new refinery capacity." However, their own figures show that only seven proposed refineries were delayed and that all of these delays were due to the opposition of local government, not to the requirements imposed by any federal environmental legislation. See "Oil Refinery Capacity" (93rd Congr., 1st Sess., Senate Committee on Interior and Insular Affairs, Hearings, 1973), pp. 16-19.

⁴⁸ P.L. 91-173, 83 Stat. 742, 30 U.S.C. 801 ff.

⁴⁹ "Bituminous Coal Facts, 1972" (Natl. Coal Assn., Washington, D.C., 1973), p. 80; and "Minerals Yearbook, Vol. I, Metals, Minerals and Fuels" (U.S. Dept. of the Interior, Washington, D.C., 1973).

⁵⁰ 33 U.S.C. 1319 (Supp. II, 1972).

⁵¹ Don E. Kash and Irvin L. White: *Energy Under the Oceans: A Technology Assessment of Outer Continental Shelf Oil and Gas Operations* (Univ. of Oklahoma Press, Norman, 1973), pp. 160-169 and 275-309. For a review of the Santa Barbara case, see Carol E. and John S. Steinhart: *Blowout: A Case Study of the Santa Barbara Oil Spill* (Duxbury Press, North Scituate, Mass., 1972). A good discussion of this problem from an international perspective is found in William Ross: *Oil Pollution as an International Problem*, *Western Geogr. Ser., No. 6*, Univ. of Victoria Press, Victoria, B.C., 1973.

INCREASED PRICES AND RATES

Achieving a goal of environmental quality will cost money. The Council on Environmental Quality's estimate for the total pollution-control costs for both public and private sectors between 1972 and 1981 is \$274 billion.⁵² Funds of this magnitude will require increased prices, rates, and taxes.⁵³ Walter Heller pointed out the magnitude of the problem:

Let me return now to the context of the natural environment, to the growing consensus that we have to stop and reverse the ugly and destructive waste disposal practices of our modern society. To accomplish this, the taxpayer must foot huge bills. . . . Producers and consumers will have to bear the brunt of outright bans on ecologically dangerous materials and to pay rent for the use of the environment's waste assimilation services that they have been enjoying largely free of charge.

A modest estimate of the demands on the Federal budget for an adequate environmental program would raise the present outlay of \$5 billion a year to about \$15 billion, an increase of some \$50 billion over the next five years. Without growth, and given the limits to the congressional will to tax, how could we hope to raise the required revenues?⁵⁴

Recent environmental legislation has increased the costs of energy: residual oil price rises reflect increased demand for low-sulfur oil; gas rate increases and no reduction in demand reflect the willingness of consumers to pay more for a clean fuel; coal price increases reflect the impact of mine safety regulations and restrictions on strip mining; and higher electricity rates reflect all of these factors plus the cost of equipment to abate air and water pollution.⁵⁵ The most difficult problem, however, is to quantify that portion of the final price of energy which results from environmental-quality goals. Few attempts have been made to estimate these costs, largely because it is difficult to identify which costs are "environmental," who is paying them, and how many times they are paid.

LAND-USE CONFLICTS

The passage of environmental legislation, plus increased concern for environmental quality, has contributed to a number of important direct and indirect land-use conflicts. In several cases, environmental legislation has come into *direct* conflict with land-use choices by public or private institutions. The conflict

⁵² Environmental Quality [see footnote 35 above], p. 93.

⁵³ The other alternative is, of course, that funds can be diverted from other investments to meet these commitments. This possibility seems doubtful, however.

⁵⁴ Walter W. Heller: Coming to Terms with Growth and the Environment, in *Energy, Economic Growth, and the Environment* [see footnote 1 above], pp. 3-29; reference on p. 21.

⁵⁵ Accurate assessment of the impact of environmental statutes has been hindered even more by the Arab oil embargo. During and after the embargo many countries imposed unilateral price increases on foreign crude oil. This caused many American energy users to increase prices to reflect the added cost. See Exploring Energy Choices [see footnote 6 above], p. 18; Thomas R. Stauffer: Oil Money and World Money: Conflict or Confluence? *Science*, Vol. 184, Apr. 19, 1974, pp. 321-325; Gerald A. Pollack: The Economic Consequences of the Energy Crisis, *Foreign Affairs*, Vol. 52, 1974, pp. 452-471; or Walter J. Levy: World Oil Cooperation or International Chaos, *ibid.*, Vol. 52, 1974, pp. 690-713.

between Delaware and federal officials over the use of the First State's coastal zone is one example.⁵⁶ The Delaware statute that barred heavy industry from the coastal zone has hindered federal plans for a deepwater supertanker port.⁵⁷ The controversy in the Four Corners area of Arizona and New Mexico is a direct confrontation over strip mining, water pollution and water use, and energy growth, as well as Indian rights.⁵⁸ The Florida Everglades were also a point of controversy between state and federal officials and a source of intragovernmental conflicts at the state and federal levels.⁵⁹

Continued direct land-use conflicts resulting from energy production, transportation, or utilization are probable. The Coastal Zone Management Act, for example, contains a number of provisions that are certain to lead to conflict.⁶⁰ Although passage of national land-use policy legislation is intended to avert such conflicts, they will continue because it takes some time for problems of implementation to be resolved.

Recently, it has become clear that both the water- and air-pollution control acts contain provisions with significant *indirect* land-use dimensions. Section 208 of the 1972 water act amendments, for example, requires each state to set up an agency capable of developing an area-wide plan to manage waste treatment and a program to "regulate the location, modification, and construction of any facilities within such area which may result in any discharge in such area."⁶¹ The Clean Air Act Amendments of 1970 address the problem of land-use control through emission requirements. Under the act, the implementation plans submitted by the states must provide adequate authority to prevent the construction of new facilities and the modification of existing ones that could prevent attainment of air-quality standards within the time allotted.⁶² (The EPA issued regulations covering its land-use authority in mid-1973.⁶³) In addition, transportation

⁵⁶ See Henry S. Marcus: The U.S. Superport Controversy, *Technol. Rev.*, Vol. 75, No. 6, Mar.-Apr., 1973, pp. 49-59.

⁵⁷ Delaware Code Annotated, 1972 Noncumulative Supp., Chap. 70.

⁵⁸ See "Problems of Electric Power Production in the Southwest" (92nd Congr., 1st Sess., Senate Committee on Interior and Insular Affairs, Hearings, 1971); or "Problems of Electric Power Production in the Southwest" (92nd Congr., 2nd Sess., *Senate Rept. No. 92-1015*, June, 1972).

⁵⁹ John Huarte and Robert H. Socolow: The Everglades: Wilderness vs. Rampant Land Development in South Florida, in *Patient Earth* (edited by John Huarte and Robert H. Socolow; Holt, Rinehart and Winston, New York, 1971), pp. 181-202.

⁶⁰ The major conflict should come over implementation of Section 307, where state officials will have a form of veto over the issuance of federal licenses or permits. See footnote 22 above.

⁶¹ 33 U.S.C. 1288(b)(2)(C)(ii).

⁶² 42 U.S.C. 1857c-5(a)(4). An excellent review of the land-use implications of the Clean Air Act is found in Daniel R. Mandelker and Susan B. Rothschild: The Role of Land-Use Controls in Combating Air Pollution Under the Clean Air Act of 1970, *Ecology Law Quart.*, Vol. 3, No. 2, Spring, 1973, pp. 235-275.

⁶³ The regulations are: that state or local agencies must set up procedures to assess the air-quality impact of new facilities that could generate significant automobile traffic; that states must identify areas where projected growth and development could result in violation of the national standards during the next ten years, and they must submit an analysis of such potential problems and plans for dealing with them; and that the analysis must deal

controls can be utilized by the states to achieve national air-quality standards. Transportation control measures are required for any air-quality control region where controls on stationary sources, such as power plants, combined with federal auto-emission standards, are inadequate to insure attainment or maintenance of the air-quality requirements.⁶⁴

An even more significant indirect impact may come from EPA's regulations concerning nondegradation. The preamble to the Clean Air Act Amendments of 1970 states that the purpose of the act is "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population."⁶⁵ The Supreme Court recently upheld a lower-court decision that the phrase "protect and enhance" meant no significant deterioration of air quality in clean-air regions (primarily rural areas).⁶⁶ The lower court found that "the Clean Air Act of 1970 is based in important part on a policy of non-degradation of existing clean air and [EPA regulations] in permitting the States to submit plans which allow pollution levels of clean air to rise to the secondary standard level of pollution is contrary to the legislative policy of the Act and is, therefore, invalid."⁶⁷

The EPA has proposed four methods of defining "significant deterioration."⁶⁸ All of the alternatives now being assessed will have some impact on development and growth in clean-air regions, but none is intended to impose a strict policy of "no growth." Nevertheless, as *Business Week* noted: "the stakes are enormous, for the guidelines will determine what sparsely populated areas of the Nation can be developed and what areas must remain rural."⁶⁹

INTERNATIONAL COMPETITIVE EFFECT

One impact of environmental laws on energy industries that has received little attention is their effect on the growth of domestic energy sources from an international viewpoint. Attention has recently turned to the influence that tax

with all significant air-quality implications of growth and development, including additional air pollution from new commercial, industrial, and residential development, from increased demand for electricity and heat, from motor-vehicle traffic, and from production of solid waste (*Federal Register*, Vol. 38, June 18, 1973, pp. 15834-15839).

⁶⁴ *Ibid.*

⁶⁵ 42 U.S.C. 1857(b)(1).

⁶⁶ *Fri v. Sierra Club*, 412 U.S. 541 (1973).

⁶⁷ *Sierra Club v. Ruckelshaus*, 344 F. Supp. 253 (D. D.C., 1972).

⁶⁸ The four proposed methods of dealing with nondegradation are: the air-quality increment plan, which would establish a maximum allowable increase in sulfur dioxide and particulate air-pollution levels in areas where 1972 levels were below the federal ambient standards; the emission-limitation plan, which would establish a ceiling on emissions in certain air-quality control regions which have sulfur dioxide and particulate levels that are already below the secondary air-quality standards; the local-definition plan, which would amount to a case-by-case determination of whether a new source is causing "significant deterioration"; and the area-classification plan, which would require states to categorize areas as belonging to one of two "zones" of allowable deterioration. In the area-classification plan, one zone would allow no significant development; the other would allow ambient pollution to rise to the limits of the secondary standards in order to accommodate necessary growth. See *Federal Register*, Vol. 38, July 16, 1973, pp. 18986-19000.

⁶⁹ "The EPA Compromise on Clean Air Rules," *Business Week*, Jan. 26, 1974, p. 21.

provisions have had on domestic oil companies, prompting them to develop overseas oil resources.⁷⁰ We might also ask whether environmental statutes have had the same effect. Are environmental statutes so stringent that companies have looked overseas for "easier" conditions?

The EPA has found that pollution-control regulations do tend to put United States exporters at some disadvantage but that over the next five to ten years this disadvantage should disappear as other developed and less-developed countries begin to enact similar legislation.⁷¹ The EPA and the State Department are currently studying the international trade effects of pollution control on several industries. In addition, under the 1972 water-pollution control legislation, the Department of Commerce is required to undertake a study of the probable competitive advantage of goods manufactured abroad over comparable articles made in the United States in cases where foreign pollution-control requirements are less stringent.⁷² The study is incomplete, and it has apparently been hindered by the lack of accurate and consistent data. However, it does indicate that the increased costs associated with pollution-control legislation may not reach the international marketplace in the form of higher prices for several years.⁷³

FEDERAL RESPONSE

The interrelationships of environmental legislation and energy supply and demand have not evoked any major, comprehensive response at the federal level. For the most part, both the executive and legislative branches have allowed environmental statutes to be enacted without major revisions once the programs have been initiated. This "wait-and-see" attitude is common in the implementation of new programs: it is advisable to allow sufficient time for problems to develop so that effective corrective measures can be devised. In addition, there appears to be some reluctance to reverse the direction of environmental improvement now that the basic legislative policies have been enacted. This does not mean, however, that changes in the relationship between environmental statutes and energy have not taken place. On several occasions in the past four years, legislation has been amended to meet specific, and usually emergency, needs.

In early 1972, for example, legislation was enacted to authorize the Atomic Energy Commission (AEC) to issue temporary operating permits for nuclear power plants.⁷⁴ These permits could only be awarded after a determination that environmental requirements would be met during operation and that the plant was essential to the generating capacity of the utility's power system. This legislation was passed to speed licensing of several power plants delayed by court

⁷⁰ For example, see "Profitability of Domestic Energy Company Operations" (93rd Congr., 2nd Sess., Senate Committee on Finance, Hearings, 1974); or Oil Refinery Capacity [see footnote 47 above], pp. 5-36.

⁷¹ Remarks of Robert W. Fri, Acting Administrator, Environmental Protection Agency, EPA-Industry Conference on International Control Activities, Washington, D.C., June 13, 1973, p. 2.

⁷² 33 U.S.C. 1251.

⁷³ "Pollution Control Costs and International Competitiveness," in *U.S. Industrial Outlook*, 1974, With Projections to 1980 (Dept. of Commerce, Washington, D.C., 1974), pp. 7-10.

⁷⁴ P.L. 92-307, 86 Stat. 191, 42 U.S.C. 2242.

cases.⁷⁵ The net effect of the legislation was to overturn the requirements of those court cases that had denied the AEC authority to issue temporary permits to allow operation of plants while time-consuming reviews and hearings proceeded.⁷⁶

Another "emergency" measure was the Energy Supply and Environmental Coordination Act of 1974.⁷⁷ This legislation was enacted to authorize temporary relaxation of air-quality standards during periods of fuel shortages. The primary aim of this act was to authorize conversion of power plants from fuel oil to high-sulfur coal. However, the legislation requires power plants which do convert to add on pollution-abatement equipment by 1979. Other requirements were included to insure that the relaxation of air-quality standards was only temporary.

Recent concern over the development of a national energy policy points up the need for a more comprehensive investigation of the impact of environmental statutes on the United States energy system. The evolutionary development of United States energy policy has been one in which individual policy decisions were made in response to the needs of the time and rarely were concerned exclusively or even significantly with energy supply or demand.⁷⁸ According to one Senate study, "Federal policy has been influenced by the growth of energy industries and has, in turn, influenced their development, but there has been no conscious intent on the part of Federal policy makers to manage the Nation's energy system in a comprehensive sense."⁷⁹

We seem to be duplicating this pattern with respect to the interplay between environmental statutes and energy. The relationship has not been investigated thoroughly, and the changes (such as the legislation cited above) that have been made were in response to specific "emergency" needs. Effective energy policy cannot be implemented unless all the interrelationships between the two areas are understood and treated "in a comprehensive sense." The goals of both policy areas are so interrelated that one cannot be achieved without clearly understanding and considering the other. This complex web of relationships is clearly

⁷⁵ *Calvert Cliffs Coordinating Committee v. Atomic Energy Commission* required the AEC to consider the environmental costs and benefits of its licensing actions. In *Izaak Walton League v. Schlesinger*, issuance of an interim operating permit for a nuclear power plant was enjoined until an environmental-impact statement was completed. For more complete details, consult Beard, National Environmental Policy Act [see footnote 19 above]; or Frederick Anderson: NEPA in the Courts: A Legal Analysis of the National Environmental Policy Act (Johns Hopkins Univ. Press, Baltimore, 1973).

⁷⁶ Beard, Electric Power Plant Siting Legislation [see footnote 43 above], pp. 225-226.

⁷⁷ P.L. 93-319, 88 Stat. 246.

⁷⁸ See J. Cordell Moore: Observations on United States Energy Policy, in "Considerations in the Formulation of National Energy Policy" (92nd Congr., 1st Sess., Senate Committee on Interior and Insular Affairs, Committee Print, 1971), pp. 83-115; "U.S. Energy Policies: An Agenda for Research" (Resources for the Future; Johns Hopkins Univ. Press, Baltimore, 1968); Hans H. Landsberg and Sam H. Schurr: Energy in the United States: Sources, Uses and Policy Issues (Random House, New York, 1968); or Barry J. Smernoff: Energy Policy Interactions in the United States, *Energy Policy*, Vol. 1, Sept., 1973, pp. 136-153.

⁷⁹ "Federal Energy Organization" (93rd Congr., 1st Sess., Senate Committee on Interior and Insular Affairs, Committee Print, 1973), p. 3.

demonstrated when we examine the impact that environmental legislation (as presently enacted) will have on where future energy supplies will come from and on where they will be consumed.

The problem of fuel switching offers one good example. Environmental legislation on sulfur oxides has contributed to a change in demand from "dirty" fuels (such as coal), which are abundant, to "clean" fuels (such as natural gas and fuel oil), which are in short supply. If this trend continues, we can expect a number of important shifts in energy supply. First, low-sulfur coals from the western United States will be in great demand. Since they will be strip-mined, increased adverse environmental effects of another type can be expected.⁸⁰ Second, the number of mine-mouth coal-fired and coal gasification plants in the West will grow. This is sure to increase the conflict over scarce water supplies in the region.⁸¹ Third, if electric utilities continue to switch to fuel oil, they will have to look for foreign sources, which may be unreliable and expensive and which may increase the demand for coastal sites for new facilities. This will also necessitate improved shipping facilities, especially supertanker ports.

Land-use conflicts offer another example of why we must approach the energy-environment interface comprehensively. The Arab oil embargo forced the United States to launch on a course of energy self-sufficiency.⁸² This goal, if it can be achieved, will, however, not be reached for at least ten and possibly fifteen years. In the interim, the United States will have to depend on large amounts of imported oil and gas, increase the supply of low-sulfur coal by strip mining, intensify the development of oil and gas in the outer continental shelf and onshore federal lands, begin the development of oil-shale lands, and continue the conversion to nuclear power. Thus conflicts will arise over the use of land in the coastal zone, where population is most concentrated and where prospective sites for a wide variety of energy facilities will be sought.

Implementation of both the air and water acts will also result in other land-use conflicts. The EPA's nondegradation regulations, for example, will have a direct impact on the overall development of rural areas and on the location of energy facilities in particular. One important impact will be their effect on the location of mine-mouth generating facilities in the West. Transportation control plans and other indirect land-use controls will also have an impact on energy supply and demand. The former are intended to decrease air-pollution levels, but they will also affect urban transportation patterns and thereby the location and level of energy demand and supply.

SUMMARY

Formulation of a comprehensive national energy policy has recently become a major public-policy objective. For that policy to be developed and implemented, a thorough understanding of all the elements involved must be ob-

⁸⁰ See Robert Gillette: Western Coal: Does the Debate Follow Irreversible Commitment? *Science*, Vol. 182, 1973, pp. 456-458; or "The Coal Industry's Controversial Move West," *Business Week*, May 11, 1974, pp. 134-138.

⁸¹ "Rehabilitation Potential of Western Coal Lands" (National Academy of Sciences, Environmental Studies Board; Ballinger Publishing Co., Cambridge, Mass., 1974).

⁸² "Project Independence Blueprint" (Federal Energy Administration, Washington, D.C., 1974).

tained. The relationships between recently enacted environmental statutes and energy supply and demand is one such element. This article has attempted to provide an overview of the relationships and to describe the manner in which governmental institutions have treated the relationships and have speculated about the possible effect they could have on the distribution of future energy supply.

There is a critical need for research on almost every aspect of the environment-energy interface, especially on problems related to land-use conflicts, on the impact of fuel switching, and on problems resulting from changes in production and transportation technology. Energy supplies are deteriorating rapidly, and the need for answers on which to base new public policies is accelerating.