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Our question is not so much whether the United States needs a policy for energy as whether an effective policy is possible without corresponding changes in the national economy, in prevailing popular values and in the structure of public administration. Other questions logically follow. If a national policy is necessary, what alternatives are available? What constraints and conditions are attached to each choice? And ultimately of greatest interest, what are the implications of the available choices for the futures of the American nation and people? These are the primary questions. The arithmetic of energy supply and demand is an important but secondary consideration.[1] Current debate on energy issues tends to be focused on relatively short-range and technical considerations and too seldom considers the broader implication of alternative decisions. Our concern, however, is with what it means to have a national policy for energy and with the implications of available choices.

WHY A POLICY?

A national decision regarding the uses of energy is overdue. Both a message from the President of the United States[2] and testimony before the Senate Committee on Interior and Insular Affairs[3] have revealed widespread agreement that a crisis in energy supply is impending. Demands upon energy resources have been increasing more rapidly than the supplies. Shortages of both natural gas and electricity have already been experienced. Controversies over the environmental effects of oil extraction, burning of fossil fuels, surface mining and nuclear reactors have complicated efforts to increase the output of energy. The "energy gap" thus created is expected to widen in the years ahead if present trends continue and no countervailing measures are adopted.

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1. On the technical aspects of the energy crisis, see Weinberg, *The Energy Crisis: A Look at Short and Long-run Solutions*, NEW ENGINEER, Feb., 1972, at 4-6, 54, 57 [hereinafter cited as Weinberg]; *The Energy Crisis*, SCIENCE & PUB. AFFAIRS, Sept., Oct., Nov., 1971, pts. I-III.

2. *Clean Energy: Message from the President of the United States Transmitting a Program to Insure an Adequate Supply of Clean Energy in the Future*, 7 WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS 855-66 (1971).

3. *Hearings on National Fuels & Energy Policy Before the Senate Comm. on Interior & Insular Affairs*, 92d Cong., 1st Sess. (1971) [hereinafter cited as *Energy Policy Hearings*].

The causes of the present crisis arise primarily on the demand rather than on the supply side of energy transformation. To deal with these causal factors is, therefore, primarily a task of politics and economics rather than of science and technology. The crisis may be postponed by increases in the supply of energy, but it cannot be indefinitely avoided if demand continues to grow. In our present state of knowledge, the availability of energy and the capacity of the earth to absorb its effects appear to be limited. To the extent that these limitations cannot be surmounted, society's demands cannot be fulfilled. When demands for energy exceed the available supplies, questions arise as to which demands will be served and in what order of priority.

Until recently, the energy demands of the American people were easily answered by an abundant supply of energy-producing resources in coal, oil, natural gas and water power. But the exponential increase in population and affluence and even greater advances in energy-consuming technologies have removed the comfortable margin that the nation once enjoyed. Uncomfortable stresses are being felt, and possibilities of breaks in the energy system are increasing. For example, 32.3 per cent of the energy consumed in the United States in 1970 was derived from crude oil.[4] By 1980, as much as one-third of the nation's oil demand may have to be met through imports;[5] and this assumes the addition of Alaskan oil to present levels of domestic production. In view of the political uncertainties in the overseas oil producing areas, it would seem unwarranted to expect that imports can be relied upon to supplement domestic supplies, especially within the present structure of prices.[6] The nation has become so dependent upon an uninterrupted flow of oil products that any prolonged cessation of imports, regardless of cause, would have severe economic and political repercussions.

Government, therefore, cannot indefinitely evade the issue; its own security and ability to function are at stake. And regardless of whether the political leaders are prepared to cope with the energy crisis and its implications, the Government will be held accountable for any massive failure of energy supply. This crisis, therefore, presents political leadership with an uncomfortable dilemma. If the public official evades the crisis for a time, power failures may ultimately catch up with him and expose him to the recriminations of an angry public. If he acts forth-

4. *Hearings on S. 77, S. 630, S. 993, S. 1160, S. 1240, S. 1498, S. 2455 & S. 2777 Before the Subcomm. on Minerials, Materials & Fuels of the Senate Comm. on Interior & Insular Affairs*, 92d Cong., 1st Sess., ser. 92-13, pt. 1, at 435 (1971).

5. *Energy Policy Hearings, supra* note 3.

6. *Oil: Under the Gun*, FORBES, Mar. 15, 1972, at 28-30, 36-37 (interview with spokesman for the Organization of Petroleum Exporting Countries).

rightly to resolve the problem, he finds that every solution alienates some sector of society.

Even if the supply of energy could be indefinitely expanded, it is not certain that the utilization of energy could continue unabated or that the American people would be willing to tolerate the environmental and other social costs of unlimited energy production. Unlimited energy-consuming activities could pre-empt large areas of the human environment, rendering it unavailable for other needs. For example, inadequately controlled surface mining has scarred large areas of the earth, leaving much of the land valueless for further human purposes. Acid drainage from subsurface mines and discharges from oil wells have polluted surface waters over extensive areas.[7] Thermal discharges from a greatly expanded electrical generating system could significantly degrade the nation's supply of fresh water.[8] And to extract nuclear fuels residual in granite could require disposal of 220 million tons of rock per year on the basis of projected user demand.[9]

Moreover, the supply of available energy does not appear to be indefinitely expansible by any technology now in prospect. Sources of energy, practically unlimited for human purposes, are theoretically available from solar radiation or from geophysical forces latent in the mass of the earth. But no practicable means of utilizing these resources in relation to existing needs are in prospect. Atomic fusion might provide a greatly expanded supply of power, but fusion technology is still in an experimental stage and no certain remedy for its thermal and radioactive hazards has been found. In addition, the siting of fusion reactors and the transmission of vastly increased amounts of electricity would pose major technical, environmental and economic problems that would not be easily resolved. The theoretical ultimate necessity for controlling energy demand appears to be unavoidable, and a future-oriented policy for energy thus becomes a present practical necessity.[10]

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7. DEP'T OF THE INTERIOR, SURFACE MINING AND OUR ENVIRONMENT: A SPECIAL REPORT TO THE NATION (1967).

8. Comment, *Thermal Electric Power and Water Pollution: A Siting Approach,* 46 IND. L.J. 61 (1970).

9. Weinberg, *supra* note 1, at 6.

10. For a comprehensive review of these issues, see COMM. ON POWER PLANT SITING, NAT'L ACADEMY OF ENGINEERING, ENGINEERING FOR THE RESOLUTION OF THE ENERGY-ENVIRONMENT DILEMMA: A SUMMARY (1971); OFFICE OF SCIENCE & TECHNOLOGY, ELECTRIC POWER AND THE ENVIRONMENT (1970); SCIENTIFIC AMERICAN, Sept., 1971, (issue devoted to "Energy and Power"). For a discussion of the environmental institutional implications of energy policy, see Katz, *Decision-making in the Production of Power, id.* at 191-200.

The following four points summarize the need for a national policy for energy:

(1) The amount of all energy resources now available is limited. Sources of coal, oil, natural gas, water power, uranium and combustible cellulose are finite. For the near future, some of these resources may be sufficient for many purposes. Ultimately, however, all fossil fuels are exhaustible and the yield of renewable resources may diminish or even disappear in the face of growing demands.

(2) The ability of our present technologies to capture and utilize energy is limited. The most abundant sources of energy in solar radiation and geophysical forces are not attainable in significant amounts by technologies now present or in prospect. The full effects and potentialities of breeder reactors and atomic fusion are as yet conjectural.

(3) The capacity of the environment to absorb the residual products of energy without ecological damage is limited. All present forms of energy produce pollutants in the form of heat, particulate matter, toxic substances or radioactive emissions. Moreover, the extraction and transmission of energy scar the environment with strip mines, slag heaps, high-voltage electric lines and electrical generating plants. The polluting effects of energy production and consumption may be more intractable barriers to the expansion of energy than the finite nature of available energy resources.

(4) The social and economic costs of obtaining energy would remain limiting factors even if resources and technology could satisfy all power demands. When men find the exploitation of energy sources more expensive or hazardous than they are willing to support, an effective limitation is placed on the total energy demand of society.

The practical necessity for limiting energy demands lies in the future, but action to implement this necessity and also to maintain or improve the quality of life for people must begin in the present. Qualities of foresight, commitment, planning and innovation are now required. Unfortunately, principles and values which in the past have helped the American people to accept policies that they disliked do not appear to avail in this case. Under the stress of war, free societies have accepted the rationing

of energy; they are much less likely to accept restrictions or to develop new industrial processes or lifestyles in anticipation of some hypothetical future need. Thus, the makings of confrontation are present between the ultimate necessity for limiting energy demands and the commitment of the American people to an ever more abundant economy.

When all needs cannot be freely met, questions of choice and priorities arise and necessitate the formulation of a policy. There are now no built-in limitations on the demand for energy in our society. The citizenry assumes both that all energy demands will somehow be met and that it is the responsibility of government to insure that the flow of energy meets all expectations. These assumptions, joined to the growth of population, affluence and industrial activity, are pushing energy demand toward the limits of supply. A critical situation thus arises to which government must respond, and that response, whether fundamental or expedient, becomes the energy policy.

Alternatives and Dilemmas

The simplest alternatives for resolving the energy crisis are to increase supply or to reduce demand. The control of demand, however, interferes with the behavior of individuals and organizations, an alternative that democratic governments generally try to avoid. The commonly preferred alternative has therefore been to push the supply of energy as far as possible, leaving the satisfaction of demand to the market economy and personal choice. This involves locating new sources of energy (*e.g.*, exploitable oil, gas, coal or water power) and improving technologies for the more efficient use of energy resources now available.

It is erroneous to assume that an increase in supply will entail no interference with levels of economic activity or with individual consumer preferences. Experience demonstrates that any major technological advance brings with it effects that may be widely felt throughout society. For example, discovery of a cheap and practically inexhaustible supply of nonpolluting energy from the sun or the depths of the earth could have a profound impact on present fuel producing industries, with chain reactions affecting employment, transportation, national budgets, international relations and basic manufacturing processes. More plausibly, shifts in availability among present energy sources would favor some sectors of the economy while disadvantaging others. For example, recourse to atomic fusion reactors could favor off-shore locations around the coastal perimeters of the United States, accentuating the tendency for economic growth to concentrate in these areas. Gaseous diffusion technology for coal might favor economic development in the Southern Ap-

palachian region. In the absence of a practical alternative to the gasoline-fueled automobile, decreased availability of crude oil products from choice or necessity could force greater reliance upon public transportation, indirectly affecting land values, housing locations, forms of recreation and the structure of local government. No national policy for energy will be complete that fails to provide means for identifying and ameliorating, so far as feasible, such social dislocations.

Merely to push exploitation of existing energy sources, with roughly the present allocation among fuels, would also eventually affect consumer alternatives. As physical access to fuel supplies becomes more difficult, real costs increase unless offset by new technological efficiencies. The direct dollar costs of energy consumption go up, pressing upward the prices consumers pay for energy-dependent products or activities. Quality of life preferences impose costs upon extractive processes for purposs of health, safety, aesthetics and ecological values. If these costs are not met in the energy production process, they will be "paid for" in the costs of illness, accidents and loss of environmental amenities and viability. The oil, coal and electric power industries have increasingly found their activities challenged by environmental protection groups.[11] To increase energy supplies at the cost of environmental quality involves interference with the preferences of a substantial number of people.

Even if present energy sources could indefinitely be expanded, it might not prove feasible to rely exclusively, or even primarily, upon a policy of indeterminate growth. This strategy does not avoid all disagreeable socioeconomic consequences and, as we have noted, the capacity of the natural environment to absorb the residual effects of energy production without ecological damage is limited. Because all present major sources of energy are limited or threatened with ultimate decline, the search for new sources that are indefinitly renewable and relatively non-polluting should be given high priority. In the long run, however, the energy crisis is not resolvable merely by increasing the amount of available energy. Attack upon the problems of energy use and misuse must be incorporated in any effective national or international energy policy.

If demands for energy exceed all feasible means of supply, the demands cannot be met, and a strategy of limitations is implied. Several alternatives are available for the control of demand. These range from relatively mild and indirect restraints through taxation and pricing, through intermediate controls, such as priority allocation and rationing,

11. *See, e.g.,* Calvert Cliffs' Coordinating Comm., Inc. v. AEC, 449 F.2d 1109 (D.C. Cir. 1971); Scenic Hudson Preservation Conference v. FPC, 354 F.2d 608 (2d Cir.), *cert. denied,* 384 U.S. 941 (1965).

to direct public administration of the production and use of energy. All of these alternatives have been employed in various contexts, although not necessarily for the express purpose of conserving energy. For example, the price of natural gas at the well-head has been regulated by federal action,[12] electrical energy is priced by state public utility agencies,[13] gasoline is taxed by both state and federal governments[14] and the production of crude oil has been prorated among oil-producing states.[15] Except under emergency conditions, usually associated with the exigencies of war, severe restrictions or prohibitions of energy use have not been involved. But whenever economies continue to grow and energy supplies cannot be increased, restrictions on the use of energy may have to be considered.

The simplest, but not necessarily the most satisfactory, control over demand would be to limit the amount of energy that might safely be taken from each of the existing sources and to allow the market economy (prices) to allocate supplies among the demands in accordance with ability and willingness to pay. At least in principle, sports cars and snowmobiles would "compete" with ambulances and fire engines for available motor fuel. But moderate and indirect restrictions may not be sufficient. If demand continues beyond a point at which public convenience or necessity is jeopardized, some form of selective priority, allocation or rationing becomes probable.

Rationing implies distribution based upon political decisions regarding estimated supplies in relation to public needs and preferences. Differing forms of energy entail differing problems of distribution. Energy in flow systems (*e.g.*, electricity or natural gas) is not as easily rationed in accordance with a detailed subdivision of priorities as solid or liquid fuels that may be containerized. In some cases, therefore, rationing according to priorities almost inevitably results in an absolute denial of fuel for certain purposes, there being no other workable way to insure that priorities are observed.

The disagreeable consequence of limiting the uses of energy by amount, or by purpose, is that preferred choices of some people are to some extent thereby limited. Thus, to hold energy constant to the extent of resisting popular demand for more energy denies the wishes of would-

12. Phillips Petroleum Co. v. Wisconsin, 347 U.S. 672 (1954). For a discussion of the consequences of well-head regulation, see Kitch, *The Permian Basin Area Rate Cases and the Regulatory Determination of Price*, 116 U. PA. L. REV. 191 (1967).

13. *See, e.g.*, IND. CODE § 8-1-2-4 (1971), IND. ANN. STAT. § 54-201 (1951).

14. INT. REV. CODE of 1954, § 4081; *see, e.g.*, IND. CODE § 6-6-1-4 (1971), IND. ANN. STAT. § 47-1535 (Supp. 1971).

15. Presidential Proclamation No. 3279, 73 Stat. 25, 19 U.S.C. § 1862, note (1970).

be consumers. In addition, selective restriction of energy supplies without regard to uses could, nevertheless, favor some preferences over others. For example, a preference for household usage of natural gas could be disappointed if natural gas were not made available to would-be new users even though no priorities or rationing were established among existing users. This denial might, in some cases, be in the public interest; but it would require a widely convincing rationale to make it politically defensible.

Any major change in the amounts or sources of energy or techniques of generation could affect people's choices and preferences, if only indirectly. Unlimited availability of energy, for example, could result in an accelerated degradation of the natural environment. These deprivations, however, would often be experienced as impersonal changes rather than as deliberate political decisions. In fact, deliberate decisions are involved in both strategies—to increase supply and to limit demand. But the former—to push energy generation regardless of consequences—does not impinge as obviously on personal choices and, in the short run, is a politically more comfortable course to follow.

Two other methods might limit the per capita demand latent in society. The most simple would be to limit the "capita"—in other words, to stabilize or reduce the human population. If the population of the United States, or indeed of the world, were reduced by two-thirds, the long-range energy problem would remain, but short-range urgencies would be alleviated. A second method would be to limit the disposable income in society. This latter course would limit economic growth and would either maintain existing income distribution or would seek to redistribute income in a manner calculated to limit overall energy consumption. Per capita energy demands might be reduced by limiting the disposable income of people, causing them to reduce costly energy-demanding activities. But alternatives to energy-expensive demands would have to be provided. An example would be to meet public transportation needs through public transit systems that would conserve both indivdual income and energy reserves. Neither of these two methods is congenial to open democratic political systems, at least as exemplified by contemporary American society. However, the least interference with standards of living and the widest range of personal preferences would be gained through population control, which is necessary for other major reasons and cannot be avoided in any long-range strategy for energy that can be expected to succeed.

Implications of Choices

If limited energy resource availability precludes the extension of

high energy consumption to the world generally, questions of national and international policies arise that have not yet been faced. Is it possible that optimistic and liberal development planners have been promising mankind a future abundance that can never be realized? Denial of human dreams and ambitions may be imposed not so much by the injustice or ineptitude of man as by the finite character of the real world and the irreversible character of evolutionary processes. But men will compete for the resources that are available, and as availability diminishes demands for energy will greatly complicate domestic politics and international relattions.

Unless an almost inexhaustible source of energy becomes generally available throughout the world, increasing competition among national states for existing supplies seems inevitable. It is difficult to imagine any rational allocation of energy that all nations would accept as equitable. And if the development of energy technology results in the concentration of large power-generation complexes at the edge of the oceans or (for gas diffusion techniques) at the site of coal deposits, some major reallocations of population and of industrial and political power seem probable.

The prospect is not unavoidably grim, although the human reluctance to face reality may make it so. The alternatives among policy choices at this point in time are still open and are not mutually exclusive. Some combination of alternatives may present the most feasible course toward bringing energy supplies, needs and demands into some optimal relationship consistent with the full range of human values, especially those pertaining to the quality of the environment. Among alternatives, the following might be combined to form a rational and effective policy:

(1) Stop population growth.
(2) Invest heavily in research and development toward indefinitely renewable energy technologies with minimal damaging side-effects.
(3) Adopt strategies toward less wasteful and redundant uses of existing energy supplies.
(4) Incorporate energy policy within a broader context of planning for economic well-being and environmental quality, with special attention to the total range of values sought in uses of land and water and in the building of more healthful and humane urban settlements.

To the extent that public policy calls for increasing (or perhaps even maintaining) present levels of energy, increased emphasis on research and development is implied. Ways must be found to make more efficient

uses of existing resources if the social and environmental costs of increasing the total amount of energy generated are to be avoided. But because all present methods of generating energy in some measure degrade the environment, the expansion of supplies conflicts to some extent with national environmental policy objectives. Most obvious clashes occur over the siting of power plants, the extension of overhead transmission lines and the polluting effects of mining and burning of fuel supplies. Research and development for energy expansion should, therefore, include investigation of ways to minimize adverse impacts upon the environment. In addition, the costs of environmental protection and of human health and welfare (as in mining) should be fully accounted for in budgeting the real costs of increasing the supplies of energy.

Pressures of demand may be expected to increase in the foreseeable future, and governments are certain to be blamed if supplies fail to satisfy at least the larger and more essential needs. The interdependence and mechanization of modern industrial societies make them especially vulnerable to interruptions or shortages in the flow of energy and, as we have seen, public policy must provide for the control of demand. Yet, except under great public crises, it is difficult to persuade people voluntarily to limit their demand upon material resources. It would be especially difficult to do so in a society dedicated to mass consumption and full employment. Advertising and politics have contributed to an ideology of mass self-indulgence in the more affluent and productive modern societies. "Every man a king and every woman a queen" may be an appealing political slogan, but it affords a poor point of departure for considering a national policy calling for restraint in patterns of mass consumption. Looking to the future, it appears that if the great American consumer is to be "king," he must be no more than a limited monarch, whatever his affluence. A political economy based upon the assumption of ever-rising levels of consumption does not seem to be indefinitely sustainable. An economy cannot be indefinitely expanding if it cannot be indefinitely energized. Therefore, if economic (purchasing) power is to be subordinated to political or social decision, the political ideology must necessarily reinforce the decision.

American political doctrines are already being affected by considerations involving the quality of life and the quality of the environment.[16] For example, the tacit "right" of persons to treat the air and water as freely available for commercial production and waste disposal is being

16. Marx, *American Institutions and Ecological Ideals: Scientific and Literary Views of Our Expansionary Life-Style are Converging,* SCIENCE, Nov. 27, 1970, at 945-52.

modified by a more explicit right of individuals and society to protection against the uncontrolled degradation of their environments. New rights are being added and old rights are being taken away. Free use of the automobile is being curbed in many ways, but the practical right of citizens to question the environmental impact of public works projects has been added. As yet, however, popular political ideology in America, and in the modern world generally, has not developed a formulation that is consistent with our knowledge of the natural world and what we think we know about the nature of man.

To institute an effective policy for energy before it is forced upon the nation by irremediable shortages requires a major effort of public education and foresighted, candid and courageous political leadership. To recognize the need for a policy for energy is to open the way to a more creative analysis of needs and values in society than has characterized our traditional political dialogues. Such analysis could hardly avoid inquiry into that ill-defined and semantically abused concept, "the standard of living." A national policy for energy may require more public planning and control and less freedom for enterprise and consumption than Americans generally like to contemplate. But this, in part, is deferred payment for having produced too many energy-consuming Americans. It is too late to do more than regret the lack of foresight on the part of past generations. It is not too late, however, to prevent a progressive tightening of the fit between man and his environment in the future.

No practical consideration of policy is complete that does not answer the question of implementation. In the United States today, promotion of energy supply and consumption is divided among administrative agencies largely on the basis of the type of energy source. Fossil fuels are administered through the Department of the Interior, hydropower through the Federal Power Commission and nuclear power through the Atomic Energy Commission. All of these agencies, their programs and their priorities are structurally and substantively separated from those agencies promoting environmental quality. The energy agencies are subject to the requirements of the National Environmental Policy Act of 1969.[17] However, the impact of the Act is upon the character of specific projects, not upon the major goals of the agencies or upon policies not directly relating to environmental issues. Efforts to police environmental side-effects through the energy agencies have not had generally satisfactory results. At the very least, an agency vigorously promoting unbiased administration of energy technology standards which would restrain its

17. 42 U.S.C. § 4321 *et seq.* (1970).

primary mission will find it hard to establish public credibility. This "credibility gap" appears to have been a factor in the transference of the function of setting standards for nuclear radiation from the AEC to the Environmental Protection Agency.[18]

If major energy-environment conflicts are to be avoided, or wisely resolved, the American people must give much more thought and attention to the character of their common future. The generation of energy, as an aspect of national policy, is not an isolated end in itself. It is an integral aspect of national goals and economic and environmental well-being. A comprehensive national agency for energy might assist in a more effective utilization of present energy resources, but it should not be established as a Cabinet-level department. Such a body should have safeguards against an overly strong tie-in with client groups or special interests in the Congress. A national energy agency should be effectively subordinated by law and organization to the authority that determines the broader goals of American society. An adequate policy for energy cannot be formulated by thinking solely about energy or even about the direct uses of energy. The purposes for which energy is used in relation to all other major goals of public life must also be considered. A national energy agency should, therefore, be integrated effectively into a national department for the environment and natural resources. It should not become a promoter of energy as an end in itself.

If timely action is taken on an energy policy, the material cost to individuals and economic groups most directly affected will be less than if action is deferred until some not-too-distant day of reckoning. The immediate temptation, however, will be to substitute short-range expediencies for genuine solutions. Improvisations sold as "practical" and "realistic" are likely to be neither. Their painlessness is a temporary illusion. It would be dishonest to pretend that any energy policy can be put into effect without contention and economic damage to the prospects of some investors and entrepreneurs. The choice is analogous to war—no victory is likely without some losses. Therefore, the best strategy for a national energy policy is to act with a degree of timeliness and effectiveness to minimize so far as possible the dislocations and disappointments that ensue.

Tomorrow's circumstances will be largely determined by what is done today. An energy crisis in the future cannot be lessened or prevented in the future. The remedy must be provided before the event.

18. Reorg. Plan. No. 3 of 1970, § 2(a)(5), 84 Stat. ——, 5 U.S.C. App. (1970).