HUDSON BASIN PROJECT

TASK GROUP REPORTS

4 ENERGY SYSTEMS

The Rockefeller Foundation

The Hudson Basin Project was initiated by The Rockefeller Foundation in 1973 to identify and explore significant environmental issues in an area sufficiently large, coherent, and complex to offer a full range of interconnected problems.

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HUDSON BASIN PROJECT

REPORT OF THE
ENERGY SYSTEMS TASK GROUP

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ABOUT THIS REPORT

The Hudson Basin Project was a three-year effort to examine the principal environmental problems and issues of the New York metropolitan area and that part of its hinterland consisting of the Hudson River watershed. Funded by the Rockefeller Foundations's Quality of the Environment Program, and carried out by Mid-Hudson Pattern, Inc., the Project represents an experimental effort to test how such problems can be considered on a regional scale, and whether new perceptions would emerge which, in time, would result in policies and programs beneficial to society.

At the outset, the Project defined the following ten subject areas for the analysis of environmental problems and related public policies: Land Use/Human Settlement; Land Use/Natural Resource Management; Transportation; Environmental Service Systems; Energy Systems; Water Resources; Air Resources; Biological Communities; Human Health; and Leisure Time and Recreation. Each subject area was assigned to a five-man Task Group which worked over a period of approximately five months to provide an initial overview of the region's environment.

Although approaches varied among the Task Groups, they were encouraged to focus on the definition of major issues and their significant relationships, and the examination of institutional capabilities for resolving these issues. The Task Groups were also asked to assess the adequacy of existing information and identify new information needed for environmental management.

The Hudson Basin Project Task Group Reports--ten volumes in all--are a significant part of the Project's research effort. These together with other Project efforts provide the basis for the policy analysis, conclusions and recommendations presented in the Project's final report, "Anatomy of an Environment." Now that the Project is concluded, these Task Group reports are being published to assist those who want further information on specific aspects of the Project's work.

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FOREWORD

This report examines certain aspects of energy systems* as elements of the Hudson Basin that interact with the people and communities of the region, and with its ecosystems and resources. Energy-related issues are complex, not only because of technology and economics but, to an even greater degree, as a consequence of their extensive involvement with many facets of natural and physical environments and societal processes.

This study is an effort to deal pragmatically with important and urgent problems of the Hudson Basin and to point toward productive approaches to their resolution. The limited study does not attempt to be comprehensive, much less definitive or final. Rather, as a prelude to further efforts, the report seeks to identify some of the significant energy-related problems that may be resolved or at least mitigated by actions within the scope of existing or potential institutions of the region. The intent of this effort is to clarify routes along which progress may be made by definitive studies, by public debate, and by action.

The Energy Systems Task-Group was composed of five members invited on the basis of their knowledge and their involvement in energy matters. By conscious intent, the task group membership was diverse in its professional competences, interests, and viewpoints--an architect, an environmentalist, and a sociologist, in addition to energy engineers. That diversity assured debate conducive to balanced judgments.

The study was conducted in the nature of a colloquium held intermittently over the 5 months from December 1973 to May 1974. During the eight

*Energy systems consist of the facilities, resources, and organizations that acquire energy sources (e.g., fossil fuels and nuclear materials), convert them to energy modes suitable for end uses (e.g., electricity and gasoline), and deliver them to end users.

meetings, members or invited specialists made prepared presentations that then were subjects of roundtable discussions. There were meetings with personnel of task groups in other fields and, from time to time, task group members developed their views in working papers. Throughout, the study has focused on Hudson Basin problems; it considers problems that are common to the entire nation only as background for understanding them in the context of the region.

The report reflects task-group consensus and does not necessarily present the position of each member as he would state it himself. It is gratifying, however, that so diverse a group arrived at substantial agreement on so many controversial points.

CONCLUSIONS AND RECOMMENDATIONS

Energy availability greatly increases the work-performance capability of the Hudson Basin. It makes possible a high-quality lifestyle and also leads to extensive degradation of the environment. Those incompatible consequences can be reduced significantly by applying the technical and economic resources of the region. However, modification of present lifestyles also is necessary for attainment of society's quality-of-life objectives.

Continued growth of the region's energy demands is forecast for several decades. Impacts on the environment and on community development are being challenged as excessive costs for meeting energy demands, and demand estimates also are being challenged. Energy systems have lost the confidence of the public.

Per capita energy consumption in the Hudson Basin is lower than the United States average, particularly for industry and transportation uses. For those reasons, and also because of the relative affluence of the region's population, energy stringencies are likely to impact less severely on the Hudson Basin than on the United States as a whole.

For the next 10 to 15 years, although public and private management may abate the adverse impacts of energy stringencies, it is unlikely that energy demand growth will be significantly lower or that supplies will be substantially augmented.*

For the near future, energy stringencies may have some effect on consumer economics, on transportation, and on housing and settlement patterns; however, such effects probably will be limited. For the longer term, population size, affluence, and lifestyle (including transportation) practices will determine the character of Hudson Basin energy systems to greater degree than other factors, with the exception of possible

*See Comment #1. (Comments referred to by number in footnotes will be found in Appendix III, pp. 30-33.)

major technological advances, possible war, or other catastrophes.

Existing and improved technologies will diminish polluting emissions and certain other environmental damage. But for other forms of environmental degradation, ameliorative technologies are less well advanced. Environmental protection costs will be substantial, and the adoption of ameliorative technologies will depend on the readiness of energy users to accept the costs, including reduced energy availability. Government sanctions will have to modulate economic restraints.

Central to decision making in the public interest is strengthening procedures and techniques for the development and expression of public consensus. Current progress encourages expectation that the decisions now emerging in the Hudson Basin will move it toward socially acceptable benefit/cost balances that take proper account of environmental and community-development values.

The functioning of energy industries and the public regulatory agencies in energy management must become both more accessible to the affected public and more responsive to societal objectives--especially regarding protection of the environment and community development. Innovative management procedures must be adopted to mitigate current practices that make massive commitments of environmental and financial resources to energy system development. State agencies, in consultation with cognizant federal agencies, should provide continuing appraisals of the state of the environment, energy requirements, and energy system capability.

The need for a great deal more information and knowledge calls for continuing programs of research, development, and demonstration regarding problems of technology, ecology, public administration, and energy-systems management. While many of the Hudson Basin problems will be dealt with in programs of nationwide sponsorship, regional and local programs are also needed, particularly in adapting and demonstrating the practicability of energy-conservation and environmental measures.

FUNCTIONING AND PROBLEMS OF HUDSON BASIN ENERGY SYSTEMS

THE PRESENT SITUATION

Broadly, the Hudson Basin energy systems are comparable to those of the nation: characterized by continuing increases in requirements coupled with increasing difficulties in providing energy supplies,* now exacerbated by foreign control of major petroleum sources. The emergence of this dilemma has been apparent for a number of years but only recently has it been publicly acknowledged, and the sudden onset of energy stringencies threatens to disrupt individual and societal well-being.

The Hudson Basin energy systems are networks of highly developed physical facilities, management operations, and financial structures. They now provide about 3,500 trillion BTU per year for the 20 million people of the region, thereby increasing their work-performance capability 10,000-fold.

That enhanced work-performance capability makes possible an abundant lifestyle (although it is not equitably shared by everyone), including pleasant homes, high levels of nutrition, health care, and amenities. But it also causes air and water pollution and ugliness in urban and rural environments. More importantly perhaps, it changes the way people live, as witness the automobile-exurbia syndrome, for example.

Regional per capita energy consumption, 175 million BTU per year, is less than three-fourths of the United States average. The relatively low per capita energy consumption in the region is due to lower use for industry (about one-fifth of the national average) and for transportation (about three-fourths of the national average). The latter is

*See Comment #2.

related to the concentration of 90 percent of the region's population in the densely settled metropolitan core where travel distances are short and use of public transit prevails.*

Fuels for heating and cooling, for transportation, and for generation of electricity constitute, in about equal amounts, over three-fourths of regional energy consumption. Over the 1960 to 1970 decade, the growth rate of residential use of energy was only slightly greater than the 11.6-percent population increase.** However, during that period, total net energy consumption in the region grew about 30 percent (40 percent for gross consumption). Commmercial uses grew at about the same rate. Fuels consumed for electricity generation doubled. Transportation energy uses grew by more than 50 percent, with automobiles being the most energy intensive mode of surface travel--6,500 BTU per person-mile in comparison with 3,100 BTU for subways and about 2,500 BTU for trains and buses.

Virtually all energy used in the Hudson Basin is converted from sources that originate outside the region, thus permitting this region to enjoy the benefits of energy availability and to avoid many of the direct social costs. Because of its precarious dependence on low-sulfur crude oil from the Middle East there is strong incentive for nuclear fueled generation.

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*The energy supply and consumption estimates used in this report are crude approximations derived from variety of sources, especially from the Regional Plan Association 1974 study of energy consumption in the New York Urban Region. That region is generally similar to the Metropolitan plus the Middle Hudson areas of the Hudson Basin Project. However, the frailties of these estimates are attributable solely to the Energy Systems Task Group.

**See Comment #3.

The general structure and functioning of the energy systems of the region conform with nationwide patterns. In the Hudson Basin, as elsewhere in the United States, they are private-sector entities organized predominantly by energy mode (electricity, gas, heating oil, gasoline and other highway fuels). They are managed by complex mixes: large corporate producers and suppliers of energy fuels, with various-sized enterprises for distribution to end users.

The profit maximization objectives of energy systems are tempered by government regulation in order to represent public service responsibilities.* However, existing mechanisms are not yet effectively providing for the public interest in this regard, especially for the attainment of the least net-social-cost of supplying energy and of overall efficiency in meeting user requirements.

Impacts on the environment and on community development are being challenged as excessive costs for meeting energy demands,** and the demand estimates are also being challenged.*** There is pervasive loss of confidence and skepticism about the functioning of energy systems as stewards of the public interest.

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*See Comment #4.
**See Comment #5.
***See Comment #6.

TRENDS AND IMPLICATIONS

For the longer term, fundamental and far reaching developments may change the technology, the economics, and the social posture of energy systems. Fundamental technological changes that could affect their functioning include coal gasification and liquefaction; nuclear breeder and fusion electricity generation; tidal, geothermal, and solar energy; and possibly even more radical technologies. There are also potentials in system design and management, such as dispersed conversion facilities, salvage of rejected heat, and district total energy systems. However, long lead times (10 to 15 years and longer) and large expenditures must precede major alterations of existing practices. While there is a national commitment to substantial supply augmentation,* the magnitude, character, and timing of the supplies ultimately available will be strongly influenced by both public and private decisions.** It is unlikely that there will be substantial effects within the next decade from even the massive programs now being mounted to augment energy supplies and to encourange conservation.***

In the near term, management practices will mitigate but not eliminate the hazards of fuel shortages for the automobile operator as well as for the utility company. A large share of recent energy problems resulted from the sudden onset of stringencies, and such adverse impacts on energy users may be alleviated by distribution arrangements, e.g., by improved highway fuel allocation or by rationing.

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*See Comment #7.
**See Comment #8.
***See Comment #1.

Large commercial and residential complexes, like industrial plants, will begin and will continue to adopt fuel conservation measures.* Initially, they will mainly be relatively inefficient retrofit devices. In a somewhat longer time frame, significant energy conservation results should be achieved from site and structure design.

Single-family homes and private passenger autos will be slower in adopting conservation practices because of greater investment costs as well as the persistence of custom.** In time, energy-intensive autos will be replaced with smaller ones having more efficient engines.

Energy stringencies may dampen migration from city cores to exurbia, and population increase may be housed mainly by infilling existing settlements. More fundamental changes in settlement patterns associated with enlarged public transit require greater commitments than may be forthcoming.***

In the near term, substantially increased prices for energy may affect marginal commercial enterprises--especially those associated with recreation and resort development. Low-income workers may also be affected, especially those in rural and exurban areas who have large gasoline requirements. For the larger, more affluent, share of the population, energy prices may have a relatively small effect on consumption, although increased expenditures for energy will exert pressure to curtail other purchases. Higher energy prices, in conjunction with uncertainty of supply, may discourage acquisition of a second home. Increased energy costs in conjunction with increases for labor, materials, and debt service may affect the market for commercial buildings and single-family homes.

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*See Comment #9.
**See Comment #10.
***See Comment #11.

For the next 10 or 15 years, the huge social investment in energy facilities and their interrelationships with other societal systems will be a conservative force resistant to change.* For the longer term, population numbers, affluence, density of settlement, and travel practices will be determinative of energy consumption and thus of the character of energy systems. However, energy stringencies will impact on the Hudson Basin less severely than on the United States as a whole because of the relatively high per capita income of the region and its low use of energy for industry and transportation.**

Existing and improved technologies will diminish the impacts of polluting emissions such as sulfur dioxide, particulates, and rejected condenser heat--but at substantial costs, including reduced energy production. Less readily amenable to present technologies are control of automotive emissions and the visual blight of transmission lines. These too may be subject to technological amelioration in the near future, although at very high costs. In some other areas, ameliorative technologies are less well developed, notably those with aesthetic content, such as site and structure design. There can be confidence, however, that such techological competence will develop.

Crucial to the application of ameliorative technologies will be the readiness of energy users to accept higher costs and/or reduced availability of energy supplies, particularly the latter. Because the provision of energy supplies is subject to the economics of competition, government sanctions are needed for environmental protection. Ongoing experimentation (e.g., variances from air quality standards versus improvement of stack gas scrubbers) will determine the extent to which envirnmental protection will be effective.

It may be possible to provide for future Hudson Basin needs for thermal-

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*See Comment #12.
**See Comment #13.

electric generation capacity without occupying any new sites along watercourses. This may be accomplished by enlarging existing installations, employing various types of cooling systems, and utilizing derelict industrial sites.

THE NEW YORK STATE POWER PLANT SITING ACT

The Legislature of the State of New York has accorded equal importance to environmental protection and electricity supply. It has provided that approval of power plant siting proposals shall be based on the public need for the facility and on the nature of its probable environmental impact through authoritative determination of whether the facility:

--represents the minimum adverse environmental impact, considering the available technology and the economics of alternatives, as well as aesthetic and other environmental values and public health and safety;

--is designed to operate in conformance with applicable laws and regulations;

--is consistent with long-range planning for electric power supply;

--will serve the public need for power, and the public interest in protection of the environment.*

In this regard, the New York statute is consonant with the declaration of the National Environmental Policy Act:

> "It is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures...in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans."**

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*For Excerpts from the New York State Power Plant Siting Act, see Appendix I, p. 24.

**From NEPA, 42 U.S.C.A. 4321.

DECISION MAKING IN THE PUBLIC INTEREST

Government involvement in energy-related decisions is becoming more extensive. Decision making in the public interest should seek a balance of benefits and costs to society. As said in the Calvert Cliffs decision, it must be a finely tuned and systematic balancing of all relevant concerns on a case-by-case basis. Public confidence in, and acceptance of, energy-related decisions requires that they be arrived at through open and consistent procedures exercised by persons with credible public-interest credentials. Societal institutions charged with the performance of these functions must be strengthened and improved.

Federal and state agencies deal with public health and safety aspects, and with engineering and financial feasibility, but they are not well suited to deal with regional and community development. As a consequence, those aspects of energy system development have been slighted until recently.

Progress is being made now in strengthening the mechanisms and in improving the techniques of public consensus on energy-related issues. The strong impetus that has been and continues to be supplied by citizen groups, as in the Cornwall and Indian Point issues, is being transformed into formal procedures for public participation in decision making, notably pursuant to the 1972 amendment of the New York statute regulating electric generating facility siting.

The first stage of public involvement in such decision making is appraisal and evaluation of the social benefits and costs of alternative courses of action--information basic to rational choices. Orderly analytic procedures assure that account is taken of the significant effects of supplying and using energy, of doing so only partially, or of not doing so at all. There are many technical difficulties and much work involved in assembling such information, but the environmental impact statement that the National Environmental Policy Act requires provides such analyses. Federal agencies, notably the Atomic Energy Commission, have adopted procedures for comprehensive accounting. Although impact analysis procedures are still in a developmental phase, there has been enough experience with them to confirm that they are practicable and that they warrant wide application.

The second stage of public involvement is the exercise of choice. It is at the core of decision making and, in many respects, it is not amenable to rigorous procedures. Engineering and economic analysis of all benefits that are quantifiable can select the course of action that is most socially cost-effective, yet it would miss important but unquantifiable societal values. How many cold tenement flats are offset by a lovely landscape? Are 10,000 megawatt hours of pumped-storage energy worth the ruin of a mountain stream?* Questions such as these cannot be answered categorically. Each situation is a unique combination of social, economic, ecological, and amenity values and hazards. Experience suggests the following guidelines for decision making in the public interest:**

--In considering proposed energy system actions, account should be taken of all significant economic, social, and environmental costs and benefits. In addition to demonstrating engineering feasibility, there should be a reasonable showing that: (a) provision of the proposed energy supply is the least net-social-cost means of meeting public needs; (b) the proposed action complies as fully as feasible with responsible expressions of regional and community development objectives; and (c) the proposed action will include all feasible measures for protection of environmental, ecological, aesthetic, and amenity values and for avoidance of irreversible damage to the environment.

--Because the impacts of an energy system action may have significantly different consequences in different environmental situations, and because the differences in the societal value systems of the various regions and communities may affect the acceptability

*See Comment #14

**See Comment #15

of the proposed action, approval of it must be considered on a case-by-case benefit/cost evaluation.

--Because of the diversity of interests affected, and because of public concern about unfamiliar or unknown hazards of indeterminable probabilities, benefit/cost evaluations should be conservative (e.g., for nuclear reactors).

--The functions of intervenors should be embedded in the decision-making process; and although appeal to the courts should not be foreclosed, legislative hearings are better suited than judicial hearings for considering all affected interests. Decisions are best arrived at by discussion and negotiation among members of a board, rather than by a mere tallying of votes.*

Institutions are now functioning for case-by-case decision making on energy-related issues.** However, a major deficiency is that local communities, the impact sites of environmental degradation, generally are inadequately equipped and organized to be effective participants in the decision-making process.*** Creative leadership will have to devise means for remedying this shortcoming.

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*See Comment #16.
**See Comment #17 and #15.
**See "Some Recent Experiences", pages 128-130, for examples of energy-related decision making in the Hudson Basin.

INCREMENTAL COMMITMENTS

While the energy-related issues that arise in some situations can be resolved adequately by reliance on existing knowledge and informed judgment, the consequences of proposed energy-system actions frequently cannot be gauged in this manner. For example, at present (and probably for some decades to come), many energy-related decisions must consider the degree to which they involve irreversible processes. Formerly, construction of an energy facility might have been acceptable because unforeseen adverse consequences could be detected and arrested before irreparable damage to socially important values was done--a low-head log weir for hydropower is an example, another is strip-mining coal in level terrain of low acidity.*

With the increasing size, service life, and cost of facilities, reversiibility considerations have become correspondingly more important. Especially because of attractive economies of scale, new energy facilities are so large, intricate, and costly that their abandonment or substantial modification may be impractical. It is also because of their size and durability that many of their second- and third-order impacts may be difficult to detect, much less foresee. In fact, many of the massive long-term commitments involved in present-day energy-system development plans exceed our knowledge base for appraising their probable impacts on humans and on the environment.

This is not to argue for complete knowledge as a prerequisite for proceeding with energy facilities. In many situations the damaging effects of not having system capability when it is needed may be too high a price for omniscience. However, it is possible to devise prudent decision stategies even in situations whose consequences are of high uncertainty. One such strategy is to subdivide massive long-term commitments into units that can be undertaken incrementally, and to monitor the consequences

*See Comment #18.

of each successive commitment. That strategy permits identification of peril points while there is still an opportunity to modify facility design before incurring massive damage.

Such incremental staging of a facility has a higher first-cost than construction at the most efficient engineering rate. The amount of the additional cost will vary according to the character of the increments and the rate of progress. Conventional methods can be used to calculate those additional costs of various incremental commitments. Conventional incremental steps decrease the risk of damage. Strategies of this sort provide a rational basis for decisions about the costs and hazards of energy facilities and systems.*

While incremental-commitment strategy is compatible with a good deal of the engineering and management of energy systems, its effectiveness could be materially enhanced by suitable changes in design and practice. Innovations for that purpose may be among the greatest opportunities for improving the social efficiency of energy systems. They would also further informed public participation in decision making.

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*See Comment #19.

MONITORING AND APPRAISAL

The importance of energy systems to society requires that decisions affecting them be based on informed perceptions of three societal concerns: the state of the environment, the requirements for energy, and the capability of energy systems. Appraisal of those aspects of energy production must be developed from continuing monitoring and evaluation. New concepts as well as new techniques must be developed for those tasks.

Because such appraisals involve large regions, they should be made by state agencies in consultation with appropriate federal agencies.

Concern over present energy requirements is sharpened by demand forecasts. The projected 3.5-percent annual energy growth rate means that supplies will have to be doubled in the next two decades, and that construction of massive facilities must be initiated now and more facilities added for years to come. Although unending exponential growth is an unrealistic concept, no limit has been adopted, and mounting environmental and financial costs are an alarming prospect.

Somehow society must determine and make explicit the tolerance limits of the environment. The assessment must be broader and more comprehensive than mere compilation of local damage episodes. It must appraise the viability of heterogeneous biomes that inclued man and many other species. The tolerance limit cannot be an absolute that is determined once; rather, it should be a continuing appraisal of the capacity of the environment to sustain development without unacceptable degradation.

At present, energy is provided to anyone willing to pay for it, and energy systems gauge energy requirements by the prospects for marketing at a profit. However, because of the limitations of marketplace economics in taking account of the societal costs of energy supply and utilization, that metric is unsuited to public-interest concerns. For example, conventional marketplace economics is inappropriate for determining the allocation of natural gas as boiler fuel. Public decision making must consider energy requirements under various alternative policy options. Furthermore, by considering energy supplies and requirements in their entirety, rather than on the basis of individual energy companies, needs could be met by the most efficient mix of energy fuels.

Electricity brownouts, long lines at gasoline pumps, and heating oil shortages bear witness to the shortcomings of energy systems. Often those breakdowns of service are alleviated by channeling public support and resources into the energy systems, e.g., by diversion of military petroleum supplies, relaxation of air quality standards, and public subsidy of utility companies. Almost always, the deficiency is revealed suddenly and public assistance is provided inefficiently on an emergency basis. With increasing societal dependence on energy, and increasing stress on energy systems, breakdowns in services could be seriously damaging. Independent periodic examination of energy system would provide timely warnings of facility or financial deficiencies, and should also reveal opportunities for technological and/or managerial improvements.

ENERGY SYSTEMS' NEEDS FOR INFORMATION AND RESEARCH

As is true nationwide and worldwide, the effective performance of energy systems in the Hudson Basin is impeded and curtailed by the phenomena of increasing demand for energy coupled with limited energy supplies. Even for the short term, and emphatically for the longer term, satisfactory management of energy systems requires more information and more knowledge to enlarge the range of technological options, evaluate their probable consequences to human and environmental well-being, and appraise their social acceptability and feasibility. Contemporary studies and reports are identifying the wide range of needs for physical, life, and social-science research, development, and demonstration (RD&D) to provide the required knowledge.

ENERGY TECHNOLOGY

With respect to the physical-science and engineering aspects of energy problems, a national commitment is emerging for RD&D programs whose scope and magnitude will match the problems. Because of the character of those fields, the results of research in them has wide transferability. The knowledge gained can be applied generally throughout the nation with only (but by no means negligible) technological adjustments to regional and local conditions. Thus, the technology problems of the Hudson Basin energy systems will be dealt with largely through national RD&D programs, and they are not treated in this paper. However, as is noted in the following sections, modifications of energy technologies to ameliorate their adverse consequences must be developed jointly by energy engineers and other experts in health sciences, ecology, regional planning, and related fields.*

*See Comment #20.

ENERGY-HEALTH RELATIONSHIPS

Knowledge of energy systems' relationships to human health is of crucial importance in determining energy-related societal actions. Those relationships are both beneficial and adverse: beneficial in making possible a wide range of high-quality nutrition, working and living conditions, medical care, and stress-abating amenities; adverse in creating harmful emissions, safety hazards, and stress-inducing environments. The information and research needs in this field initially are the proper concern of the Human Health Task Group. At later stages, there will be need for interaction with the Energy Systems Task Group to examine opportunites for ameliorative modifications of energy technologies.

ECOLOGICAL IMPACTS OF ENERGY SYSTEMS

The knowledge needed for dealing with the ecological aspects of energy-related problems is amenable to generalization in only a limited degree. Design criteria suited to ecosystem tolerance of heat loadings or heavy metals in Puget Sound may not be applicable to the California Coasts, Narragansett Bay, or Lake Michigan, much less the Mohawk River. For practical purposes, ecological RD&D must be site-specific, at least until the understanding of ecological processes is greatly amplified. Pending the acquisition of such greater knowledge, the composition of Hudson Basin ecosystems, their tolerances, and their recuperative capabilities must be researched within the basin. Ongoing ecological studies, while probably warranting expansion, are believed to be well designed. Although those questions are appropriately treated by other task groups, ecologists must participate with energy engineers in designing modifications of technology that will be compatible with ecological constraints. To be effective in such joint endeavors, both ecologists and engineers must understand the rationales of each other's fields

REGIONAL AND COMMUNITY PLANNING

While the nation engages in formulation of national energy policies and programs to resolve problems of supply inadequacies, demand restraint, resource allocation, energy pricing, cartelization, foreign trade, and international relations, the impact of energy systems on Hudson Basin people can be dealt with only at the local level. By and large, while they want abundant supplies of energy, the people affected are dissatisfied with the energy systems--their impacts on lifestyle, on the environment, and on community and regional development. At the present time, society's institutions for dealing with such dissatisfactions are not functioning effectively, and that deficiency reduces the efficiency of the energy systems as well as their social utility.

The impact of energy systems on community development is a major focus of dissatisfaction and frustration. Intricate advance planning precedes installation of energy supply and delivery facilities such as electric generating plants and transmission lines, natural gas pipelines, and petroleum refineries and depots. Yet, although such planning generally is of a high caliber technically, it rarely, if ever, adequately considers whether the proposed facilities and/or the energy supplies that they will provide are acceptable to the people of the region and of the affected communities. To a considerable degree, the energy industry's planning is inadequate in this regard because of the failure of societal mechanisms for the formulation and expression of public consensus. In fact, societal mechanisms are not effective even in identifying what the issues are. The resulting last-minute contention, losses to the energy industries, and damage to the public interest are well known.

In a number of states, mechanisms exist for public consideration and decision making regarding proposed energy-supply facilities, especially thermal-electric generating plants and transmission lines. Generally, those mechanisms provide for adequate advance disclosure of intention to construct facilities; the public need for them; their probable health, safety, and environmental consequences; and a comparative analysis of alternative courses of action. Such disclosure is followed by public hearings at which intervenors may present dissenting views for consideration by the state regulatory agency. While recourse to judicial processes is not foreclosed, the intent is to obviate it as much as possible through accommodation of the public interest in open administrative procedures.

The limited experience to date with this approach is encouraging, and argues for strengthening and perfecting it. There is need, for example, for better assurance that all relevant information is considered, that analyses are objective, that conclusions are valid, that benefit and cost evaluations are consonant with societal values, and that decisions are in the long-term as well as the short-term public interest. Other needed improvements have to do with assuring adequate public information (including identification of the issues) and with formation of a public consensus. Improvements along these lines can be devised by joint endeavors that involve a diversity of competences ranging from the sciences and engineering to public administration and law. While the effort required will be large, it is warranted by expectations of significant contributions to democratic government.

ENERGY USES AND CONSERVATION

Until the end of this century, and probably longer, the United States will have less energy than it is accustomed to having--less per capita, less per dollar. Stringencies in the physical availability of energy supplies (and higher prices) will affect every sector of the nation: industrial and agricultural production and employment, transportation, homes, and individual lifestyles. The consequences could be deeply damaging--serious unemployment, food shortages, inflation--but perhaps they need not be. Prudent private and governmental management may modulate the transitions to less energy-intensive modes without disruptive strains. Such benign transitions are unlikely to be automatic; the will depend on a long-continuing series of wise private and public decisions based on relevant information.

Energy conservation technology--i.e. the hardware, the engineered processes, and the government regulations to conserve energy--will generally be of nationwide applicability. But energy conserving practices will have many elements that are specific to a region. For example, energy conservation practices in transportation, in architecture, and in recreation may tend to have regional patterns. Private decisions may be significant determinants of those patterns. Basic to wise private and public decisions is information on how individuals, agricultural enterprises, and industrial and commercial firms respond to energy stringencies, and where energy stringencies generate damaging strains. Probably much of the needed information can be derived from data now being routinely secured by the energy industries, especially the electric and gas utilities and petroleum distributors. Acquisition and analysis of such information is a first-priority need for coherent decisions and actions at regional and community levels.

DEMONSTRATION

Improved practices and innovations can be tested and perfected at pilot-study scales, but they will be widely adopted only through demonstration. This is true for energy conserving practices such as those related to transport of persons and goods, building insulation, and industrial and domestic equipment.

The purchase of equipment or the utilization of services is determined mainly in private decisions (although government may be influential through taxes, subsidies, or regulations). Adoption of energy conservation measures generally requires modification of behavior patterns and attitudes, including the calculation of, "is it worth the trouble and expense?" Marketing experience, from industrial machinery to groceries, confirms that demonstration is essential for adoption of a changed process or product.

To be effective, demonstrations must be tailored to the target audience. For most energy conservation practices, the tailoring specifications should be for targets no larger than the Hudson Basin. Involvement of community leadership in planning and designing demonstrations is important for their success.

Demonstrations, perhaps of somewhat different design, are particularly necessary for successful establishment of innovative advances in energy systems management by private enterprises and public regulatory agencies, and in public participation in energy decision making.

APPENDIX I

EXCERPT FROM AN ACT OF THE 1972 SESSION OF THE LEGISLATURE OF THE STATE OF NEW YORK (S-9800 B)

AN ACT to amend the public service law, the public authorities law, the condemnation law and the public health law, in relation to the siting and operation of major steam electric generating facilities

Section 1. The legislature hereby finds and declares that there is at present and may continue to be a growing need for electric power and for the construction of new major steam electric generating facilities. At the same time it is recognized that such facilities cannot be built without in some way affecting the physical environment where such facilities are located, and in some cases the adverse effects may be serious. The legislature further finds that it is essential to the public interest that meeting power demands and protecting the environment be regarded as equally important and that neither be subordinated to the other in any evaluation of the proposed construction of major steam electric generating facilities. Without limiting the generality of the foregoing, the legislature finds and declares that under certain circumstances power demands may be regarded as controlling even though the adverse environmental impact may be substantial, but that under other circumstances, given the nature of the resource involved and the public interest in preserving and enhancing the quality of life, the protection of the environment may be regarded as controlling even though this might result in restrictions on the availability of public utility services.

The legislature further finds that the present practices, proceedings and laws relating to the location of major steam electric generating facilities are inadequate to protect the environmental values and to take into account the total cost to society of such facilities and result in delays in new construction and increases in the cost which are eventually passed on to the people of the state in the form of higher utility rates. interest in creating and preserving a proper environment and in having an adequate supply of electric power, all within the context of the policy objectives heretofore set forth toward which objectives the provisions of this legislation are directed.

* * * *

Section 142. Application for a certificate. 1. An applicant for a certificate shall file with the chairman of the board (of electric generation siting and the environment) an application containing the following information and materials:

(a) a description of the site and a description of the facility to be built thereon, including available site information, including maps and description, present and proposed development, source and volumes of water required for plant operation and cooling, and, as appropriate, geo-

logical, aesthetic, ecological, tsunami, seismic, biological, water supply, population and load center data;
(b) studies, identifying the author and date thereof, which have been made of the expected environmental impact and safety of the project, both during its construction and operation, including a description of (i) the gaseous, liquid and solid wastes to be produced by the facility, including their source, anticipated volumes, composition and temperature, and such other attributes as the commission may specify, and the probable level of noise during construction and operation of the facility; and (ii) the treatment of disposal for wastes retained and measures for noise abatement; (iii) the concentration of wastes to be released to the environment under any operating conditions of the facility, including such meteorological, hydrological and other information needed to support such estimates; (iv) architecural and engineering plans indicating compatibility of the facility with the environment; and (v) how the construction and operation of the facility including transportation and disposal of wastes, would comply with environmental, health and safety standards, requirements, regulations and rules under state and municipal laws;
(c) estimated cost information, including plant costs by account, all expenses by categories, including fuel costs, location, plant service life and capacity factor, and total generating cost per kilowatt-hour, both at the plant and including related transmission and comparative costs of alternatives considered;
(d) a statement explaining the need for the facility including (i) reasons that the facility is necessary or desirable for the public welfare and is not incompatible with health and safety; (ii) the load demands which the facility is designed to meet; (iii) how the facility will contribute to system reliability and safety; (iv) how the facility conforms to a long-range plan for the development of an integrated statewide power system;
(e) a description of any reasonable alternate location or locations for, and alternate practical sources of power to, the propose facility; a description of the comparative advantages and disadvantages of each such location and source; and a statement of the reasons why the primary propoesd location and source is best suited to promote public health and welfare, including the recreational, and other concurrent uses which the site may serve; and
(f) such other information as the applicant may consider relevant or as may be required by the commission or the board....

* * * *

Section 146-2....The board (on electric generation siting and the environ ment) may not grant a certificate for the construction or operation of a major steam electric generating facility, either as proposed or as modified by the board, unless it shall find and determine:
(a) the public need for the facility and the basis thereof;
(b) the nature of the probable environmental impact, including a specification of the predictable adverse effect on the normal environment and ecology, public health and safety, aesthetics, scenic, historic and recreational value, forest and parks, air and water quality, fish and other marine life, and wildlife;

(c) that the facility (i) represents the minimum adverse environmental impact, considering the state of the available technology, the nature and economics of the various alternatives, the interests of the state with respect to aesthetics, preservation of historic sites, forests and parks, fish and wildlife, and other pertinent considerations; (ii) is compatible with the public health and safety; and (iii) will not discharge any effluent that will be in contravention of the standards adopted by the department of environmental conservation or, in case no classification has been made of the receiving waters associated with the facility, will not discharge any effluent that will be unduly injurious to the propagation and protection of fish and wildlife, the industrial development of the state, and public health and public enjoyment of the receiving waters.
(d) that the facility is designed to operate in compliance with applicable state and local laws and regulations issued thereunder concerning, among other matters, the environment, public health and safety, all of which shall be binding on the applicant, except that the board may refuse to apply any local ordinance...or any local standard or requirement which would be other wise applicable if it finds that as applied to the proposed facility such is unreasonably restrictive in view of the existing technology or the needs of or costs to consumers whether located inside or outside of such municipality...
(e) that the facility is consistent with long-range planning objectives for electric power supply in the state, including an economic and reliable electric system, and for protection of the environment.
(f) that the facility will serve the public interest, convenience, and necessity, provided, however, that a determination of necessity for a facility made by the power authority of the state of New York...shall be conclusive on the board; and
(g) that the facility is in the public interest, considering the environmental impact of the facility, the total cost to society as a whole, the possible alternative sites or alternative sources of energy as the case may, both within the state and elsewhere, and the immediacy and totality of the need for public utility services and for protection of the environment.

APPENDIX II

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APPENDIX III

COMMENTS BY TASK GROUP MEMBERS

Robert E. Ford (REF) and Richard G. Stein (RGS) have made the following comments on the text of the report as prepared by the Chairman, E. D. Eaton (EDE):

#1 Page 1, lines 19-21 REF--"I think that there is substantial disagreement on that point. I, for instance, believe that we will be facing substantial energy stringencies within the next five to ten years and perhaps continuing for a couple of decades."

EDE--"The language referred to does not deny the prospect of energy stringencies. Rather, it reflects the view that they are only one element in a complex of factors, e.g. materials, labor, credit, and financing costs and availability, etc., that will affect consumer economics, transportation, housing and settlement patterns."

RGS--"At any moment, there is an identity between energy demand and supply. Demand, the actual requirement of all users, is met by the capacity of the supplier, sometimes without taxing the reserve or cushion in the system, sometimes by calling into play the full potential, sometimes by cutting down the quality of the delivered energy (brownouts, voltage drops), sometimes by deferring the satisfaction of requirements to a time more convenient to the supplier (load profile leveling, off-peak heating of hot water, etc.). Nevertheless, from a longer-range basis, demand cannot continue to grow if supplies fail to be augmented. (We do not consider what people fantasize to increase demand "unless it agrees with the growing capability of the system to supply it.)"

EDE--"The intent of the language referred to is to suggest that growth of energy demands and supplies probably will not change significantly in the next ten to fifteen years."

#2 Page 3, lines 1-3 RGS--"Reliance on imported petroleum is a special problem of the Northeast; growing world competition is increasing the Hudson Basin's difficulties in providing energy supplies."

#3 Page 4, lines 6-8 RGS--"Should be rephrased. Not only did residential rate grow at the same incremental rate as all electrical use, it grew even faster. At the end of the decade, per capita use of electricity increased at a slightly greater rate than all energy increased." EDE--"While residential use of electricity grew faster than all uses of electricity, that was not the case with respect to total energy uses--which include natural gas and highway fuels."

#4 Page 5, second paragraph RGS--"Economic pressures act differently on different sectors of the energy supply market. For the utilities (electricity, natural gas), rate of profit is limited, so profit maximization can be achieved only by expansion of the rate base. New complications --the inability of utilities to raise money to expand base--may become inhibiting factors in the utilities drive to expand. For the other sector of the energy market, the sources of heating oil and transportation fuels, there is an undiluted drive to profit maximization that emerges unmistakably even through the institutional ads that have recently appeared."

#5 Page 5, line 15 RGS--"After the word 'challenged' insert 'by the utilities and fossil fuel industries.'"

#6 Page 5, line 16 RGS--"After the word 'challenged' insert 'by environmentalists, civic groups, and a random set of critics who defy neat classification.'"

#7 Page 6, line 11 RGS--"Before the word 'national' insert 'stated.'"

#8 Page 6, line 13 RGS--"After the word 'decisions' insert 'as well as programmatic realities.'"

#9 Page 7, line 2 RGS--"'early start' is questioned."

#10 Page 7 lines 7-8 RGS--"This might be restated 'With proper incentives, the characteristic pattern of private passenger automobiles could be almost totally transformed in a decade due to the relatively short life of an auto. At the end of the same decade, new homes would only represent a quarter of the housing stock.'"

#11 Page 7, line 13 <u>RGS</u>--"Before the word 'than' insert 'politically and economically.'"

#12 Page 8, line 3 <u>RGS</u>--"At the same time a countervailing set of forces will attack the traditional patterns--inability to raise capital funds, downgraded bonds, depressed prices for stocks, customer resistance to high utility bills, challenges to siting approvals and diminished public confidence."

#13 Page 8, line 9 <u>RGS</u>--"Even this pattern has its modifiers. The largest part of the Hudson Basin's energy and gas is supplied by Con Ed to the New York City-Westchester area. Due to a variety of factors-load pattern, amount of obsolescent equipment, extent of underground distribution in congested streets--it is probably the single utility in greatest trouble in the U.S. today."

#14 Page 12, lines 11-13 <u>RGS</u>--"I believe these comparisons tend to distort the nature of the choices, e.g. How many hours of TV murder serial offset the radiation risks of a runaway reaction of a nuclear plant?"

#15 Pages 12-13 <u>RGS</u>--"This whole section would be more effective if the responsible decision-making parties and beneficiaries were identified. ...The starting point for evaluation of choices is that the major responsibility of public utilities is to the public good. The good of the general public as they see it in their collective political decisions eventually determines energy policy. There are some decisions that must be made at the broad regionwide level--amount of energy to be provided, interlocking utility networks, etc. Others can be made at subregional levels--distribution alignments, substation patterns, etc. Others at the local level--placement of major components and transitional zones to neighboring land use patterns. The process and responsibilities have been distorted by the partial autonomy of the utilities and the local beneficiaries of the tax payments."

#16 Page 13, line 12 RGS--"I don't quite agree with this. It assumes that boards reflect the wide divergence of interests that must be satisfied in making such a decision. The general spectrum represented by boards is much more limited."

EDE--"All of the section, Decision making in the Public Interest, (pages 15-18), is conditioned by the initial paragraph on page 15 regarding the character of publicly acceptable decision-making processes and the qualifications of decision makers."

#17 Page 13, lines 14-17 RGS--"See note on page 12 relating to their proper role."

#18 Page 14, line 11 RGS--"The reservoir of still available land was still considered to be virtually limitless."

#19 Page 15, line 11 RGS--"A variation of incremental planning and one that may actually offset the apparent lowered efficiency of the smaller plants is the heightened possibility of useful reclamation of waste heat, the development of plants that are generally termed total energy plants. Smaller fossil fuel generators that can be located closer to their local centers can operate at higher systems efficiencies than remote large nuclear plants whose waste heat cannot be effectively transferred to areas that can use it. We might term this scatter site incremental planning."

EDE--"See page 6, lines 6-10, for mention of rejected heat salvage, district total energy systems, etc."

#20 Page 18, section on Energy Technology RGS--"The Federal research program has been heavily centered in the supply sector of the supply-demand totality. Without explicit policy statement of their comparative interrelationships, it is an ipso facto commitment to make as much energy as technology will permit."

ANNEXES

WORKING PAPERS OF INDIVIDUAL TASK GROUP MEMBERS

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ENERGY FACILITIES AND THE HUDSON VALLEY LANDSCAPE

by Richard G. Stein, FAIA, and Diane Serber, AIA

The evaluation of the impact of power plant siting on the Hudson River Basin's landscape raises a series of fundamental aesthetic and social questions. While all are interconnected, it may be useful to state some separately and look into their ramifications before attempting to evaluate the problem in toto.

1. Who sets aesthetic criteria?
2. What constitutes aesthetic acceptability?
3. How does scale affect the decision?
4. What is the extent of intervention proposed?
5. What is the nature of the affected landscape?
6. What are the precedents for these constructions?
7. How are local attitudes reconciled with broader ones?
8. What alternates exist for doing what is proposed?
9. What alternates exist if what is proposed is not done?

Our speculation will deal with problems connected with the impact of power stations and transmission lines on the landscape in which they are placed.

The objects we are dealing with are structures enclosing energy-converting devices which direct energy towards generators that produce electricity that is then transmitted by power lines to the eventual users. The converting devices may be high-pressure steam boilers that burn oil, coal, gas, of lignite. Or, they may be nuclear reactors which produce high temperatures in controlled reactions which, in turn, produce steam. Or they may be dams that hold back water, selectively allowing some to drop hundreds of feet. There are great rooms housing turbine generators with huge overhead cranes for maintenance. There are also ancillary structures to hold fuel and maintenance equipment and controls.

The specific locale for our discussion is the Hudson River Basin, the river itself and the lands that drain to it. Since the question of cooling is of great importance, the river itself is constantly eyed as a site for generating plants. The pattern of radiating power transmission lines is the necessary by-product of the placement of large generating plants. The Hudson is one of the great rivers of the world, with beautiful and fragile scenic qualities.

Let us turn to the question of who sets aesthetic criteria. We have given over this responsibility to professional critics who both reflect and shape wider attitudes. The critics generally represent or are acceptable to the dominant political forces. In our complex culture, the divergent critical points of view may echo areas of social conflict. These areas of conflict may express the interests not only of different economic groups, but of different interest with a single group.

There are some schools of aesthetics that see eternal and unchanging truths in aesthetics. Actually, aesthetic criteria refer to certain basic characteristics of objects but are modified by social attitudes and objectives, economic implications, cultural precedents, and, in many cases, symbolic allusions. What a culture considers beautiful or aesthetically satisfactory will be varied by economic relationships, class relationships and the way an object is used (either directly or symbolically). For example, at the time of the French Revolution, the Revolutionists saw the Church and its power (along with the monarchy) as the visible enemy. The saints on the portals of the Gothic cathedrals represented the political repression they fought. The smashing of their faces was simultaneously a political statement and an aesthetic reevaluation.

Present-day critics are based in our periodicals, museums and universities. Their attitudes are generally a delicate balance between their own perceptions as members of the intellectual community and the social and economic commitments of their boards of trustees. Their attitudes are bellwethers of more popular points of view which follow. When they express disenchantment with a large industrial building as an aesthetic contribution to our culture, they may be serving as an early warning system for a situation that is more deep-rooted than their surface comments may imply.

Even in reading the words of critics we remember the successes and forget the failures. The names of the artists and writers who failed to deal with significant problems, even though critically acclaimed by their contemporaries, are often forgotten. The small number of artists whose works are still admired among the many commended by Baudelaire* in his critiques of the Salons of Paris in the 1840s, reminds us that while critics help shape and encourage the art forms and attitudes of their times, they ought not think of themselves as expressing long-term or unchanging judgments.

Our critics today for the most part are unenthusiastic about the heroic themes of the twenties and thirties, and the symbolic role given to industry, transportation and labor in the murals, newspaper headings and stock certificates. For example:

> "The critics of the thirties saw in the industrial object, the factory, a form which possessed intrinsic beauty. As le Corbusier wrote in 1938 in commenting on decorative art: "Art and technique, the amusement of decorators. Decorating life! What stupidity! To make life beautiful, yes, It stimulates the recognition of a healthy and natural phenomenon. The flowering of technique is art....Art is not the specialty of a separate group; art is a society's manner of performing all its actions and production well. This affirmation becomes moving if we decide to admit that present society, a machine-based society is, in its full elaboration, a civilization..."**

*After talking about Delacroix's superb paintings, Baudelaire cites Vernet (not enthusiastically), Haussoullier (enthusiastically), Decamps (mixed), Deveria (true and noble), Chasseriau (ambiguous), Planet (talented), etc., etc. (Baudelaire, The Salon of 1845, The Mirror of Art, Doubleday, 1956).

**Le Corbusier, Des Canons, des Munitions? Merci! Des Logis....S.V.P. Editions de l'Architecture d'Aujourd'hui. Boulogne, 1938.

There is today a skepticism expressed about industry's capability of leading us to a better life, which removes its buildings from their previous niche.

Let us consider the next questions: What constitutes aesthetic acceptability and how does scale affect the decision? For many years, a dominating aesthetic that shaped our buildings and cities derived from the Renaissance principles state by Palladio and Alberti, for example, and was institutionalized in all the formal architectural teaching supported by governments--as the Ecole De Beaux Arts in France, and popular taste in America in the early twentieth century. Aside from the adaptations of the classic order as the underlying vocabulary, there was and is an overriding concern for proportion as the generator of aesthetics. An Ionic column has fixed proportions of height to width and column to entablature, regardless of size. An arcade is a classic promenade. A window on the facade of a Florentine or neo-Florentine palazzo is dimensioned in accordance with the proportions of the facade rather than the dimensions of the room behind the facade or the person served by the window. On the other hand, in the medieval town and city, the detail of buildings and the size of the spaces surrounding buildings were governed by quite different considerations --equally widely held if not as formally recorded. Camillo Sitte has written of these: the set of sequential spatial experiences of a person approaching a building; the hierarchy of spaces served; the kind of detail one sees from a distance and from nearby--the non-axial set of principles. In both schools, however, the dimensions of the projects have been determined by a building craft of trained individuals and the perception has resulted from the time scale of a pedestrian or a horsedrawn passenger. (In Rome, even the formality of the monumental St. Peters was contained within its oval-shaped colonnaded forecourt. It was only under Mussolini that the axis was cut through and extended to and beyond the Tiber).

One consequence of our present scale of buildings and mode of travel is a tendency to diminish the awesomeness and vastness of natural landscape. Examples are abundant. Sardinia is a small island--90 miles wide and 170 miles long, far smaller than New York State. Its terrain is rugged, with towering, jagged, wild mountains. The roads through the mountains thread back and forth, seeking the passes and following the valleys. There are several dozen entirely different cultures in the scattered towns and cities, with different dialects, costumes, crafts and traditions --Alghero and Oliena, Porto Torres and Sassari, Castelsardo and Sedini. Even traveling by car, one is aware of the uniqueness of each, reinforced by the buffer areas of woods, fields and mountains. Eight years ago, a super roadway was built, cutting across its width with huge fills in the valleys and cuts and tunnels through the peaks. The alignment was as nearly straight as engineering could achieve. The travel time now is under two hours and the capacity of the terrain to establish the separateness of each region is sharply reduced.

In approaching Versailles through its grand forecourt, one would have had to allow ten minutes on foot or several minutes by coach to traverse the slightly ramped cobbled pavement possibly 1,500 feet long. In contrast, it takes only a half minute to traverse the uneventful half mile in the deceleration lane of the Thruway leading to Howard Johnson's. The space has been devalued. More is needed to do less because of our speed and the compression of detail. Or in approaching an airfield like Detroit or O'Hare, we learn over the intercom that the last 30 miles serves as the the approach to the airfield. We note that possibly 2,000 acres have been flattened with all detail removed. They isolate the cluster of airport building, making them appear smaller than the miles of interior travel would suggest when one is inside.

These examples indicate something that has happened to scale and to the increasing space demands of large structures in a time of diminishing spatial availability. All structures, even the vast mill structures of the nineteenth century, could be related to the people who worked in them, to the wagons that carried the goods in and out. Without making judgments about the quality of living in the company housing, we must note that the scale transitions from housing to industrial buildings were made easily and without a sense of incongruity.

We can see in these examples that abstract ideas of space, proportion and symmetry give way to judgments tempered by a time component, by evaluations of alternate space uses and by dynamic relationships. Bearing this in mind, we will come back to the particular problems involving power plants and their distribution facilities.

What is the extent of the intervention? The buildings housing the apparatus may be 250 feet high. The stacks that dissipate combustion fumes or hot gases may be 600 feet and higher. The spaces within the buildings may be 100 and more feet in height. The protective shells over the nuclear reactors may be a couple of hundred feet in diameter. The steel towers that support the high voltage cables may be 150 feet high and 400 feet or more on center. There may be two or more lines of these in a right of way 250 feet wide. The right of way will usually be cleared of trees for its width.

An additional large-scale component that must be dealt with is the hyperbolic paraboloid cooling tower--immense structures 500 feet high and almost as wide, with an inside volume of over 50 million cubic feet, more than a World Trade Center tower contains (but windowless and scaleless). The dimensions of all of this construction are related to the equipment. The human beings who operate and oversee these huge pieces of apparatus are lost in the vast chambers that accommodate the machines.

Another fundamental consideration deals with the nature of the terrain. The response to any new construction will be affected by the following considerations. In flat terrain the visual impact of any construction is obvious. A 100-foot-high industrial structure can be clearly seen for distances up to 10 miles. A 150-foot-high transmission line can be the dominant landscape feature. Historically, high structures were located in flat areas. Their ability to serve as historic landmarks may be in part attributable to the fact that their materials are the materials of their settings, rearranged stone by stone to create uniquely identifiable complexes. Pueblo Bonito, the tenth-century Indian United Habitation in New Mexico, is an example, as is the spectacular medieval Mont St. Michel in France.

As terrain becomes hillier and more wooded, the visibility of structures is reduced. Trees play their part, too. A heavy growth of trees can be used to limit and control line of vision. Let us disregard for a moment the question of whether one wants to see or wants to avoid seeing the end object.

Need an axial approach on flat terrain have the terrible boredom of a transmission right of way? At Ankor-Wat an axial path is cut through the jungle. At the end of the arboreal tunnel is a hint of what will eventually be seen. There are occasional widenings of the axial way and raised platforms from which the amount and kind of visual information changes. As the end of the passage is approached, the breadth of what one sees is widened. A cleared space around the mile square temple and ground permits one to see the full scope of the construction. The outer wall, however, obscures most of the inner temple--with the exception of the finial spires. As one climbs stairs to come into the inner court, the full scope of the next inner complex becomes visible, only to have the visibility restricted again as the approaching pilgrim descends to the ground level of the inner court, and so on. In each instance the amount, scale, kind and placement of detail is carefully considered to provide a sequence of visual experiences, leading up to, and culminating at, the innermost shrine.

Another problem of building against rugged landscape relates to foreground dimension and the importance of visibility. The screening capability of woodland is unimportant when a large construction is at the water's edge--either a wide river or body of open water. Visibility is automatically created. This can be somewhat intensified or diminished, but only within a small range. A lighthouse is often painted black and white for even greater visibility and immediate identification. On the other hand, one coastal power plant in Maine is painted dark green with a blue stack in the vain hope that it will disappear. This a good place for another observation, namely, that although the difference in function alone may be the main reason why one of two similar structures is considered visually obnoxious, aesthetic insult can exist quite independent of function.

A new motel can intrude into an area with formerly compatible scales so that its tenants can enjoy the view. Since they are in the jarring structure, they don't have to see it. New apartments on the Palisades have diminished the grandeur of the geologic formation with the same illogic. A nineteenth century water-powered mill sits alongside and over a river. Its dependence on the river is understood and the relationship between the two is clearly stated. Power plant builders place some trees between the plant and water, much as suburban developers place a fringe of foundation planting where the house meets the ground. For many years it has been an aesthetic dictum that the joint where materials meet--where man-made structure meets the natural terrain, for example--be obscured rather than explicitly stated and solved, particularly if the utilitarian nature of the construction was to be obscured or denied.

We must face the fact that a construction on the scale of, say, a refinery or a cooling tower, cannot be obscured; its function cannot be denied.

We have two choices. We can alter the configuration of the plants so that the transition is made from the surrounding people-scaled spaces through people-scaled ancillary function constructions to the monumental dome, stack, and tower. Or, we can choose a terrain appropriate to a megalithic construction. We can then choose to accept the clearly delineated transition and express it or we can attempt to design the man-made as an outgrowth of the natural. It is obvious that the size of the construction affects whether judgment will be favorable or unfavorable. The paradox is that the greatest needs for power plants are close to population centers. Competition for land is keenest near these centers and water frontage is particularly sought after. What are the minimum dimensions for the juxtaposition of two structures with completely different scales and usages, both from a safety point of view and a visual one? Are these dimensions absolute or can they be reduced as alternate demands for land use become more insistent than demands for scenic preservation? For nuclear plants, the zone may be a square mile or greater. What are the precedents for judgments of these generators and transmission line constructions?

Historically, structures of comparable size were the sports arenas, the religious buildings, the castles and palaces and chateaux, all buildings or constructions for human occupation. Only occasionally was there a large-scale utility construction like the Pont du Gard, the Roman aqueduct at Nimes, built shortly before the birth of Christ. It is interesting that this historic and dominating structure is only 180 feet high. The pyramids at Giza El, on the other hand, were 480 feet high but are always pictured as being seen with no structures or other elements that would compete with their isolated monumentality.

Only in the nineteenth century did we see the widespread growth of industrial structures and transportation structures that raised questions about their effects on their neighbors. Bridges and railroad sheds moved into the very centers of our cities and characteristically failed to reconcile their space and scale demands with those of their neighbors or with the requirements of a fragile riverbank.

The turn of the century produced major constructions--the Croton Dam, the large steel mills, the great shipyards. Smaller plants located along the river grew incrementally with small buildings that did not alter the river's edge. In the succeeding decades, the size of factories became greater, the process served became more dominant, the dams became large and the human being became a diminishing measuring stick. With our new factories, airfields and power plants, we find the old solutions are no longer applicable.

In facing the question of how scale affects the decision, we find it is not only scale, as has been outlined above, but degree of repetition as well. One transmission tower may be, in its way, as much of a steel sculpture, as much of a monument, as the Eiffel Tower. Thousands of them, marching in their pathways all over the country, keep their symbolic and abstract quality only in static isolation and for a purpose often irrelevant to their function. The first power plant bringing power to the farmers who have no electricity or to the poeple of Addis Ababa becomes the visible representation of personal liberation from ceaseless work. The tenth plant, offering more of the same but nothing new, and, possibly, some ecological and economic problems, has a very different connotative framework.

At the same time, we must realize that in some locations the problems are assets. Large, scaleless structures suit large scaleless spaces. The pyramids enhance the desert. The oil refinery adjacent to the New Jersey Turnpike is visually exciting, its linearity and orderly repetition of elements suitable to being seen from a high-speed thruway, its scalelessness consonant with its flat meadowland site. Whether it is equally visually exciting to its neighbors and to those working nearby, who do not have the benefit of a 55-mile-an-hour compression of visual effects, emphasizes the many faces of truth.

How are local attitudes reconciled with broader ones? It is quite obvious that there is no single attitude that is univerally held. Nor is a group's attitude toward its own immediate environs necessarily the same attitude that the group holds in regard to a similar problem located elsewhere.

If the implications of decisions relating to power production and transmission applied only to the area immediately adjacent to the facility in question, the resolution of whether to build it or not would be easily resolved. The problem has a series of conflicting effects in ever widening circles starting at the very center of the area involved. If one assumes a site for a nuclear power plant similar to Indian Point, one would have to cope with a series of contradictory but identifiable attitudes. Site selection may require the displacement of a certain number of families. Their aesthetic attitude about the complex that supplants them may well be negative, regardless of the ultimate appearance of the plant. The next wider group, the village, may see it primarily as the means to reduce their taxes and improve their schools. They will tend to find those aspects that are pleasing, or, more simply, to consider that anything so beneficial financially must be beautiful--a slightly restated version of truth is beauty.

Beyond the village, there is a wider circle that is particularly aware of transmission corridors, radioactive hazards, exhaust pollution--all with no offsetting financial inducements. This circle has a mixed reaction, some seeking the availability of the increased power generation, others stressing the negative ecological, physiological or scenic consequences.

And finally, there is a larger community, not immediately affected either by the power generation and its economic consequences or by the immediate secondary results mentioned above. Their attitudes will be conditioned by overall social attitudes, economic positions, or ecological and historical orientation. Since some sites are thought of as of national or international importance--the Grand Canyon, the Columbia River Valley, the Hudson, the Maine Coast--the opinions of this wider group must be given proper consideration.

The final modifier of attitudes is the roster of alternatives. While we tend to believe that all reasonable (and many unreasonable) alternatives have been canvassed, in most cases people are faced with a yes or no decision--if, in fact, any decision is left to them at all. The alternatives range from no acceptance of the project to alternative sites, alternative sizes, alternative fuels, overhead or underground transmission, or modified lifestyles.

CONCLUSIONS

Underlying the question of how landscape considerations affect and are affected by the structures that produce and distribute energy are several interconnected considerations. First, in order to have an affirmative attitude toward the project, there must be a conviction that is both necessary and beneficial.

Before we site a single power plant, there is a series of questions which must be asked:

1. Do we need this plant at all? Commonly used estimates of future demand are based on utility companies' econometric curve projections. These are highly questionable on a number of fronts. While we undoubtedly need some new plants, we just as surely do not need all of them.

2. Must all new plants be as large as we are capable of building? A smaller plant has benefits beyond the aesthetic. Total reliance on plants 1,000 MW or larger forces us to raise our factor for emergency stand-by facilities. Therefore, a series of smaller plants, while less efficient in terms of manpower use or capital investment, would be more efficient in terms of fuel consumption and visual impact. Smaller fossil fuel plants have additional advantages. Assuming the development of adequate pollution control devices, they can be located nearer their load centers, reducing the necessity for the huge acreages devoted to transmission facilities. The heat recovery can be used for district steam systems. A series of other constructive benefits -farming, recreational activities, industrial processes--can be tied in to the generating system, permitting it to attain a higher overall efficiency than the larger isolated plants. It can redirect the pattern of urban growth by necessitating a series of greenways in the urban fabric related to the size served by these smaller packages. If these were the characteristics of the plant--an approachable green belt in the center of the city, with power and steam provided and with the fear of radioactivity and nuclear accidents removed--it seems reasonable to predict that the aesthetic response would be favorable.

3. Do we need a "high profile" configuration? In some locations a lower, linear arrangement is preferable.

4. Finally, in describing appropriate governing criteria for these plants in the Hudson Basin, the following points should be made:

    a. In the locality of dense settlements the plants ought not compete with scenic and recreational alternative land uses. The square mile of land can not easily be given up.

    b. In the facility design itself, the plant should look like what it is. While there are alternative ways in which the components can be grouped, their own logic will produce a more noteworthy quality than a design that atempts to camouflage itself.

    d. Where public facilities are provided, make them of superb design excellence. They can't compete in size with the process buildings but they should be more than a minimal public realations gesture.

e. The buffer zones, the scale-changing zones between heroic-sized generation facilities and human-oriented buildings around them, must be carefully designed for a sequential set of transitional visual experiences.

f. Transmission facilities create more problems. The only visually acceptable corridors are in wooded, mountainous areas with minimal population or settlements. They dominate and destroy flatlands. They devalue the complexity of small dense communities and cut major swathes out of urban groupings. Not only are the towers overwhelming in size, the lines themselves define and are perceived as large volumes in space. The only acceptable mode for the future is underground in most instances.

g. The governing aesthetic of acceptability is still centered on a public belief that the facility is truly necessary and beneficial. The utility companies have not been impressively candid and their presentations have too frequently been self-serving and inaccurate.

h. The problem we face is not impossible, but it is very difficult and requires utmost conviction and sensitivity.

February 22, 1974

THE FUTURE IS NOW--AND IT DOESN'T WORK

by Peter R. Borelli

The present energy picture in the Hudson Basin region is no different than that of other urban regions except for relatively unimportant per capita distribution patterns unique to the area. In a nutshell, many energy resources are running out while at the same time public understanding and concern for the environment is increasing. Despite anticipation of some technological "breakthroughs" and a temporary cooling of environmental fervor, both trends are certain to continue, creating an ever-widening gap between energy consumption and availability as well as the enviromental impact of energy production and public tolerance for environmental deterioration.

Any analysis of the region demonstrates an inherent avarice for energy in the present structure of the region's economy. Any stategy to reduce energy consumption or to mitigate the environmental impact of energy production and use must, therefore, take this into consideration.

Given the present economic and institutional structure of the region, demands for electric energy will begin to exceed the state's generating capacity, despite construction of new power facilities. Likelihood of power shortages will be further advanced by the inability of some producers to raise the high capital costs of new facilities. Power rationing and blackouts would not be uncommon under such circumstances.

There is now no systematic program for developing new patterns of energy consumption with the region or state. Energy conservation measures to date have been primarily a response to emergency restrictions relating to fuel shortages and facility breakdowns. Whatever the rate of future growth, a systems approach to energy planning is required to prevent further environmental deterioration.

State and public utilities can be expected to concentrate on a crash program to develop alternate sources of electricity in the foreseeable future, given present trends. Utility rates will be increased to pay for the new facilities and fuel sources subject to national and international constraints and pressures.

Nuclear reactors of the conventional type will very likely provide increasing amounts of power up to 2000, polluting less air but increasing problems relating to hot-water discharge and site location with the river basin. Nuclear waste handling, shipment and storage will become a major issue.

The automobile will continue to be the dominant mode of transportation beyond the limits of the New York transit system, given the present settlement pattern in the basin. Per capita energy use will therefore be heavily weighted toward this increased dependency. The environmental impact of this energy end-use will in turn be measured in terms of deteriorated air quality and conflict over the location and design of highways and interchanges.

GROWTH AND DEVELOPMENT--A DELICATE BALANCE

It will not be easy to reverse the environmentally and socially destructive energy patterns of the Hudson Basin. But a comprehensive plan for the future conservation and development of the region could achieve a delicate and desirable balance between economic well-being and growth and the quality of life in the region.

Our future ability to guide energy use within the basin depends largely upon our ability to guide settlement--to avoid sprawl and its total reliance on the automobile.

The state must assume responsibility for developing a systmatic program for encouraging new patterns of energy consumption. Such a program should be based upon a realistic appraisal of immediate and long-term requirements and enforced by tax policies aimed at reducing consumption above certain levels. State building requirements must be adjusted so as to (1) eliminate air conditioning, for example, when cross ventilation is adequate, (2) reduce light levels, and (3) reduced heat loss.

The region's heavy reliance on natural gas and residual oil for electric generating capacity must be balanced with environmentally acceptable fuel mixes employing such sources as solid waste combustion.

Insofar as commercial and residential consumption of electricity is proportionally high in the region, conservation measures in construction are essential.

Altering the damaging patterns of energy resource consumption calls for comprehensive energy management. It is equally important within the Hudson Basin to alter the damaging distribution of population which can lead to energy waste and high per capita energy consumption. Growth can be accommodated within the region, but in terms of environmental quality, the key lies in guiding settlement and resource use.

April 26,1974

DISCUSSION NOTES

by Robert E. Ford

INTRODUCTION

The current energy crisis represents more than just a scientific or technological dilemma; it is in equal measure a social problem. The energy dilemma proves a social problem in two senses. First, the interfaces between science, technology, and policy have been, and will probably continue to be, problematic. In the past, scientific and technological information has been underutilized in policy decision making. The emergence of energy shortfalls themselves are a good case study of this phenomenon. A whole series of social blockages (to be discussed in greater detail shortly) impede the flow of quality information into the political decision-making process. The problems appear to be more a function of the communication process itself rather than the quality or direction of scientific research.

Second, and probably more crucial, science and technology are only instruments. They provide methods, not goals. Many aspects of the decision to utilize a particular technology are premised on its fit with a set of social values. Such values may range from aesthetic predispositions to an egalitarian ethic. These values will shape to a considerable extent the societal response to energy shortages. In turn, societal values will be altered to some extent by energy stringencies.

Shortfalls in energy will have far broader consequences for the Hudson Basin than mere inconvenience. Depending, of course, upon the extent and the relative success of the regulatory reaction to energy problems, these difficulties have the potential for dictating a new public consciousness (perhaps a "conservation ethic" or a "depression mentality") and for restructuring institutional arrangements, life style, and human settlement.

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A large proportion of the Hudson Basin's socioeconomic "style" is premised upon readily available and inexpensive energy. Changes in either availability or expense significantly alter patterns within the basin. Land use is a good example. If the 1973 projections of Boris Pushkarev* are correct, energy scarcity over a long period of time could lead to more dense settlement patterns. The exchange of populations between the cental cities and their surrounding suburbs will either stabilize or reverse. Leisure patterns will obviously change as energy intensive recreation, including recreational vehicles, second homes, and Sunday drives (to cite but a few) gradually give way to hiking, cross-country skiing, and spectator sports (patterns similar to those in contemporary Europe). Additionally, such cornerstones of American ideology as faith in progress and the positive nature and invevitability of growth will be sorely tested.

The implications of energy shortages for the region are no doubt a fascinating topic. However, this question of passive response of social structure to shortfalls will be left to another paper. Perhaps equally intriguing is the question of the basin's and society's active response to energy stringency. It is this institutional response that this paper will address.

ENERGY OPTIONS--THE REGULATORY RESPONSE

While it is always dangerous to forecast, it appears fairly certain now that the United States faces a serious energy problem. This shortage will affect life styles for the foreseeable future. The nature of the shortfall will probably shift somewhat from an absolute inability to obtain energy resources, to difficulty in affording available energy. Energy problems will probably increasingly become a function of price rather than availability. Even if major technological breakthroughs are achieved in the next few years, the lead time to get such innovations on line assures tight supplies for at least a decade or two. Sadly enough, it would appear that most Third World and newly emerging

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countries will probably suffer more severely than their industrial counterparts. The Hudson Basin itself will probably (at least relatively) suffer energy stringency less in the long run than many other more recently emerging metropolitan regions. Nonetheless, the United States as a whole and each of its regions will have to deal with the question of how to divide up the shrinking energy pie.

The current energy shortfall provides the society with a series of options on how to distribute the emerging shortages. One of the most simple methods is the Free Market Model. Rising prices would gradually drive many users out of the market until supply matched demand. On the other extreme, there is the option of absolute goverment regulation where every foot-pound of energy is alloted to a specific user on a predetermined schedule. Under this model, prices would be absolutely regulated.

The shape of the future in regard to the response to the energy crisis appears to be outlined to some extent in current regulatory efforts. It appears that future attempts to cope with energy stringencies will tend toward the latter choice of a regulatory response. Pricing, however, will continue to be employed to a lesser extent to reduce demand. The major response will be governmental and regulatory in nature. Regulation is no stranger to the energy industry. Utilities are perhaps the nation's most highly regulated endeavor. Nearly all phases of the energy industry are regulated today, although to varying extents. Such regulation should, in the future, increase in scope and, hopefully, in coordination.

The heavy regulation of the energy industry already indicates an implicit American value relative to energy regulation. This orientation should shape future responses to energy shortages. It can at least be argued that for most Americans, energy is more than just another commodity. It is the keystone, if you will, of the contemporary life style. Given its key significance, it is unlikely that energy will be permitted to fluctuate with the vagaries of the market. For unregulated variation in energy cost has all manner of socially unacceptable consequences.

This would be particularly true in the short run.

A large sector of our industrial base is dependent upon ready access to cheap energy. This can be witnessed in our architecture, our industrial processes, and geographical distributions. Rapid and protracted rises in energy prices would dislocate much of this base--a dislocation leading to near collapse in the economic sphere. Few would be willing to accept such a state of affairs. The pricing mechanism is also extremely regressive. It would offend the egalitarian ethic of many, since the poor would suffer disproportionately. Finally, the decision to allow a rapid rise in energy costs would constitute a highly unpopular and politically untenable decision. Public wrath would be swift and certain. Thus, it appears that regulation will continue to be the response to energy stringency. While a mixed model of price increases and allocation by administration will continue, the mix appears at present to be heavily weighted toward regulation. The nature of these regulatory efforts, however, is likely to alter considerably in the next 5 years.

Stringency implies that margins for error are considerably reduced. This is especially true in a complex industrial state where everyone is heavily interdependent. In such a setting, planning tends to emerge. Hence, we can presently see pressure toward planning in land use and foodstuff distribution as the availability of such commodities decreases. It appears fairly obvious then, that long-range planning will be an important and critical part of future regulatory efforts.

However, at present, public planning is ideologically alien to a large segment of the American public. While considerable "planning" is currently undertaken at public expense, the relationship of such planning to action or implementation is often problematic. Future regulatory efforts will need not only more public planning but also more policy related planning.

In the coming pages, the current regulatory-planning model for energy will be discussed. Its emerging dimensions will be probed. Particular attention will be devoted to current problem areas. A series of solutions and proposals for future patterning of the regulatory apparatus will be presented.

REGULATION BY CRISIS

The regulatory authority over energy facilities is still dispersed among several hundred federal, state, and local agencies. Until the efforts of these bodies are effectively coordinated to implement an agreed-upon national policy, little progress can be expected. If anything is truly characteristic of that diverse enterprise called energy regulation, it is its uncoordinated and short-run orientation. Current energy regulation has been fragmented and piecemeal, without much attention to long-range consequences. To some extent this has been a function of the often uncoordinated and fragmented nature of current enterprise--a problem to be treated shortly. Moreover, the lack of current regulatory efforts--and their piecemeal nature--is a function of a lack of overall direction, and a lack of consistency and coordinated planning.

This need for overall and stable planning is especially crucial in an area haunted by extended lead times. It is probably conservative to observe that 20 years are needed from planning to conclusion for any major new additions to our energy grids. Probably equally as crucial as lead time is the entire question of stability of regulation. The investment demanded by major additions to our energy systems is indeed impressive. Without some certainty that such investments will bring adequate returns at some future date, such investments will not be forthcoming. In a highly regulated endeavor, only stability of regulation assures such investment returns.

Finally, our past is currently probably not a good predictor of our future. As previously developed, the growth of planning in the past decades has in many ways been a function of the growing scarcity of many resources. When margins of safety are wide, one can afford the luxury--or the waste--of short-run reactions. In a restricted market such policies can often be disastrous. We no longer have the wide resources and capital margins that permit rapid and extensive changes in direction.

Husserl once observed, "Everything is in everything." Nowhere is this more true than in the complex industrial state's energy mix. Yet most energy planning is only within a particular fuel class. The FPC regulates the wellhead price of gas. The AEC watches over the uranium market. With few exceptions their plans for their specific charges are not only short-run in nature, but tend as well to function as if their commodity were operating in a vacuum. The problem is that all else is not equal. Price and supply variations in other energy sources obviously affect considerably one fuel's viability. While each independent regulatory apparatus attempts to take into account alternative fuel sources, the inability to control the decision making of other agencies makes much of their long-range planning ineffective. To have effective planning, there will have to be a mechanism to address the entire energy system.

Another dilemma facing current planning is the private/public controversy. Energy planning has an interesting mix of private (utilitties, oil companies, coal companies, etc.) and public regulatory agencies. Traditionally, the private agencies have been more "proactive," that is, presenting proposals and making long-range plans for their particular narrow market. In turn, the regulatory apparatus has been largely reactive, that is, listening to proposals and either accepting, rejecting, or altering such proposals. It appears, however, that the public sector will become increasingly involved in proactive planning. A good example of this is the role that ASDA has undertaken in siting nuclear facilities. At the federal level, AEC's committment to fusion reactors is another example of the growing "planning activism" on the part of the regualtory apparatus. However, the fit of private and public plans with each other may be difficult. A good example of this again is the ASDA role in nuclear power plant siting. While part of ASDA's mandate was to assist in finding sites for the state's nuclear facilities, some of the utilities see such activities as threatening their prerogatives and, in some cases, have considered competing with ASDA for a particular site. A more active public role is bound to lead to even greater difficulties.

In the preceding paragraphs we have spoken only of difficulties in the horizontal integration of planning. Perhaps equally as interesting, and particularly germane to a discussion of the Hudson Basin, is the vertical mix. Nowhere is the complexity of our energy system more obvious than in the vertical mix. Within the basin (and the nation) the energy system is considerably fragmented across levels of operation. Electrical utilities traditionally have been subregional within the basin, serving a particular mandated area. The oil industry is quite complex--an interesting potpourri of national companies, some regional endeavors, and some local independent distributors. Gas distributors are usually subregional in this area, often allied with an electric utility. They purchase their gas from multiregional companies.

The public sector is equally complex. Federal, state, (and recently) regional and local bodies all are involved in energy management. In some cases the public or governmental sector may itself be an energy operator (TVA or PASNY). Coordination between levels of government--my respondents in the utilities tell me--is poor. Coordination within the private sector itself is mixed.

In the preceding paragraphs, the many-faceted nature of the energy system has been outlined. However, it only has to be pointed out that each of the subdivisions within the energy system is presently a separate planning entity. While some of these sectors plan more than others, all are potentially important decision and planning points. Probably equally important, each at present does plan--some long-range (a utility investing in two nuclear facilities), some short-range (how much oil should a distributor buy for next year). By their decisions, premised on certain "visions of the future," each unit in this grid is making plans that affect the fuel mix and the total energy system.

The utilitarian philosophers had a concept called synergy that is perhaps appropriate to today's energy system. Some of these philosophers had a belief that each individual (in this case corporation or agency) operating on the basis of their own self goals would, interacting as a system, lead to a system output--the common good. At least implicitly this appears to be one of the premises under which the current system is operating.

Recent oil shortages have cast doubt on the synergy model, and discussions of the public interest have led to questioning of the argument that the sum total of individual greed is the common good. Several groups, from consumers to environmentalists, would blanch at this proposal.

To a considerable extent, the current planning regimen is based upon individual interests, with regulatory agencies attempting to modify each interest to conform with what they see as the interests of their constituencies. Often, regulatory interests within one state may conflict with the interest of another state or region.

This concept of the definition of "the good" is critical to an understanding of planning. For planning basically is a function of a number of variables --available information, a workable ideology, and social priorities. Planning is simply attempting to match current practices and future activities to a future set of goals. Obviously critical for such an effort is good information. Unhappily for planning today, neither sufficient information on energy uses, nor agreed upon future goals, are available.

The relations among science, technology, and policy are sketchy. At present, information on available energy options is often controversial. It is not often certain that the best information is adequately transferred to policy makers. A good example of this phenomenon can be found in New York State's thermal criteria. These criteria, as presently specified, are probably too stringent to be met by any nuclear facility--even of moderate size.

Yet from a biological perspective, it appears that mechanical stress is far more inhibiting to microorganisms than is the thermal change. Available legal criteria appear to be based on problematic assumptions. Legislation based on best available information would probably specify far different criteria for power plant cooling discharges. The interface between technical information and policy is critical to the entire energy question. The problem with data base is not limited to scientific information. Adequate (valid) information on available energy (storage and distribution systems) is still limited. Before adequate planning can be undertaken, there must be baseline studies on the current energy systems.

The greatest difficulty that long-range planning for energy will face, however, is probably far more severe than any of those previously addressed. In fact, to be frank, it is most likely to be insurmountable. It is most likely that, barring some unforeseen energy "crisis" of impressive proportions, that planning for energy in the foreseeable future will continue to follow a pattern of "mini-policies"--with what one author has described as frequent, unintended, and contradictory side effects.

Political scientists have consistently described contemporary American society as "pluralistic." One of the outgrowths of our fantastically complex industrial development has been an increase in heterogeneity of values and of interests. Contemporary federal or state politics appear to be interest groups in nature. It is only at the local level (and not even in all governments) where one can witness the political process dominated by a particular interest or group.

While there are many series of both common and abstract values that bind American structure together, there is consistent disagreement on the specifics of implementing such values. It will be interesting to see how well the first general goal appied to energy--national self-sufficiency--survives the process of implementation. On the level of actual implementation on which reasonable planning must operate, there are few common values upon which to premise political support. In the past, each of the traditional means of public policy making has had to deal with a plurality of competing interests. It appears that this decision-making model will continue.

Recent scarcities have compounded the problem. With resource limitations threatened, comsumers have banded together into additional interest groups. Thus, at least in political terms, the number of competing claims on the energy domain has grown considerably. Energy shortfalls have made the political decision-making process even less amenable to long-range planning. New interest groups have emerged, such as the independent truckers and gas station dealers. This increased competition for limited energy resources has led to increasing veto power, leading to a reduced potential for positive action. It appears, at the moment, that current interest group configurations will lead to stalemated politics and lessened probability of rational approaches to the current energy dilemma.

As one author has observed (Gilmour, 1973), "A heritage of almost unlimited national abundance of energy and other natural resources and the accustomed free-wheeling entrepreneural use of these resources, abetted by the political system, is not rapidly overcome, even with the tools of modern communications and persuasion. Political barriers of this magnitude are not likely to be broken down until combined energy and environmental problems reach emergency levels."

Perhaps one additional point ought to be stressed. Reactive and proactive strategies have been discussed previously in another context. There is one additional dimension to this dichotomy. Underlying most of contemporary planning is an often unspoken series of assumptions that are particularly salient. In one sense, current planning regimens can be universally seen as reactive. This is particularly true of energy planning. Energy price and availability in its own right is a constraint to development by planners. Most energy planning reacts on other market forces.

The role of energy in fostering and directing growth is often ignored. Future planning will increasingly have to consider its contributions to shaping the economy. Future discussions will have to consider the interplay between growth and energy. Energy will have to be considered as a constraint in its own right. One of the reasons for the current energy problems is the failure of planners, at all levels, to see energy in this light.

Even short-run policy decisions on such a complex subject as energy must be based on a considerable amount of quality information. At present, information on available energy resources is often limited, and probably more important, questionable in quality. Unlike the energy problem, the information shortfall appears to be more a problem of availability and distribution. The problem is essentially that, for the policy maker or the planner, quality information is simply not available. As a result, decisions are often premised upon faulty assumptions. A good example of this process is the decision (in the past decade) of many utilities to switch from coal to gas or oil. Many of these decisions were simply a result of the decision makers' failure to understand oil and gas shortfalls.

Given our complex energy system and the multiple decision points it encompasses, it is critical that information not only exist, but that it should be easily obtained and widely disseminated. Future problems could be easily avoided if the varied decision points currently existing could have access to a broad range of quality information. Such information would have to be collected, assessed, and distributed by some central energy clearinghouse--obviously a federal, or perhaps even an international operation.

It is often difficult, as Sargent (1973) has observed, "to determine policy based on data that came from interests in the decision." Such information would have to be generated by a credible and independent agency. Current data is often seen as self-serving and questionable. Obviously, regulation based on information provided by the regulated is likely to suspect. Both long-range planning (to a considerable extent) and short-run policy decisions (to a lesser extent) are based on technical/scientific opinion.

March 15, 1974

THE SCENARIOS

by Robert E. Ford

INTRODUCTION

All technical and resource alterations are mediated through social structures. Critical to how a society responds to energy shortfalls are it definitions and perceptions of the forces which have shaped these stringencies. Thus, the timing, the events surrounding the immediate shortfall, and the quality of leadership at the time prove crucial to an understanding of the social response. Since such variables are at present ill-defined, any development of energy scenarios will be extremely tentative.

Reflecting the deep disagreements on the Energy Task Group as to the scope and nature of future energy supplies, three alternative energy scenarios will be developed. These scenarios will be premised upon differing definitions of the energy situation over the next several decades. Scenario One is founded upon the assumption that energy stringencies will restrict energy untilization over the next couple of decades to the level experienced in 1973. Scenario Two will speak of more abundant energy resources, but at much higher prices: about four times 1972 levels. Scenario Three will operationalize energy as readily available and only at a slight increase in price.

Our analysis of the implications of these three scenarios for the Hudson begins with a discussion of rather broad-brush themes. Following this broad thematic development, specific implications will be suggested. Our analysis will also be directed to short- and long-run impacts

Before proceeding with the scenarios, perhaps one further set of caveats should be addressed. These discussions are not meant to imply any socio-technical priority to energy as a factor in social change. While no doubt contemporary society is highly energy dependent, energy nonetheless remains but one factor--perhaps first among equals--in a complex matrix of influential variables.

Energy proves especially highly interrelated with many of these other vaiables. However, any change in the weightings of any of a whole series of relevant variable, such as land availability, work force size, and available capital, to cite but a few, has ramifications throughout the system. It is a highly dynamic model. What is being advanced then in these scenarios is that energy is important at this juncture simply because, due either to scarcity or cost, the "weighting" of energy in the current process apparently will change. such a change in an interdependent economy will provoke allied alterations throughout the system.

SCENARIO ONE--THE CONSTRAINED ENERGY SOCIETY

Stringencies in energy supplies have important implications for the entire social order. Energy availability or lack of availability affects, in a dynamic way, land prices, recreational patterns, and fertility behaviors, to cite but a few obvious factors. To cope with an emerging energy limitation, two major changes in the social order are envisioned. The first major alteration will be the average citizen's life style. The second change, perhaps more subtle, will feature a growing role for government in areas now beyond its present scope.

Maintenance of energy consumption at current levels for the next several decades in no way implies a static social model. It does not argue that things will remain as they were. In fact the limits to this energy scenario probably point to more profound social and economic changes than the other two proposed scenarios. Two factors prompt such changes.

The first factor lies in population dynamics. Even with the low levels of reproduction the society has witnessed in the past several years, and even if reproduction falls below replacement with the next decade, the secondary effects of past increases will contiune to expand the population until at least 2050. Additional resources will have to be made available for these new members. Related to the above dynamic, societies with falling birthrates age in a demographic sense. Our population will gradually increase in both mean and median age over the next several decades. Older populations reveal very different consumption patterns than younger populations. These consumption patters will have to be met.

Second, and perhaps more significant, limitations on energy utilization will have important ideological consequences. Fueling the needs of recent years' economic growth has been the idea that economic growth is necessary for a viable social order. It will be interesting to see what themes and orientations will replace this consideration in a society whose growth is constrained by energy limitations. Goals and ideals will remain in a constrained social order. Interest groups will continue to compete for scarce resources. Technological advances will continue, although at a far more restrained rate. All of these factors, in addition to myriad others, will bring pressure toward redistribution of the "stable" energy supply. So while energy supplies may well remain constant, utilization patterns in the energy-constrained society will not.

IMPLICATIONS

Two general themes arise in the analysis of an energy-constricted economy. The first revolves around the considerable changes that this will occasion in the life style of the average citizen. The second argues for a greater role for government at all levels and in a whole series of domains in which government is now none too active.

Energy limitations will strain today's habits considerably. Social energies are likely to be redirected into very different patterns. After a period of initial rapid change--designed to meet the new energy mix--there is likely to emerge an era experiencing a slackening rate of change. Both geographical and social mobility would similarly slow down. The popularly termed "generation gap" would narrow as youth's experiences echoed their parents'. Neighborhoods would once again emerge as important social milieus. Urban centers would probably grow both in significance and "livability." Divorce rates and rates of mental illness, to cite but two concomitants of rapid social change, will probably decline. On the negative side, we are speaking of a far more conservative and rigid social order where the opportunity for social change, social mobility and the introduction of new ideas would be limited. As societies slow in growth, they become more stable (all else being equal, of course). As societies become more stable, they become more conservative.

A free market economy is a very effective mechanism for distributing available commodities. In the light of current ideologies and definitions, however, it is not a very effective mechanism for distributing shortfalls or scarcity. (It is not meant to be argued that the current market operating in energy is, or has been, a free market. It is fairly obviously dominated by monopolistic industries and constrained by government intervention. It is probably the worst of both worlds). The free market, in distributing shortfalls, penalizes the poor and fuels more trivial uses of energy (snowmobiling) before more societally significant endeavors (heating schools or driving to work). As a result, energy shortages often demand government intervention and regulation.

Because energy is so deeply involved in almost all that is done in this society, and because the way we act directly affects energy use, the intervention of government is likely to be extensive and will carry government into areas in which it is now only peripherally involved, such as land use, housing construction, and the like.

Transportation

Energy stringency will probably impact the transportation sector more severely than most other areas. The fuel most in demand and shortest in supply will probably be oil. The implications of energy stringencies upon transportation patterns are particularly interesting for the Hudson River Basin.

Energy constraints will probably not be sufficient to end the American love affair with the car. However, it will probably dull the fervor of this relationship. The price of fuel and shortages will probably act either to decrease or stabilize per capita ownership of cars. This will probably be accomplished by suburban abandonment of second cars and by the decision of many urbanites simply not to own a vehicle. Driving habits will alter. Sunday drives will become less frequent and the peculiarly American habit of vacationing by driving 4,000 miles will cease.

In the Hudson River Basin, reduction of Sunday and vacation driving will impact considerably the tourist industry in both the Catskills and the Adirondacks. Residental patterns will also alter somewhat. while present suburban patterns will not constrict, it is doubtful that future suburban development in the far reaches of Dutchess, Suffolk and New Jersey outer counties will occur. Accessibility, being somewhat a function of price as well as time, will limit their future development.

Automobiles will change. They will become smaller. In the short run, these alterations in car buying habits, as well as competition from foreign imports, could have disastrous implications for Detroit--and since General Motors is so linked to the American economy--could threaten recession for the basin. Government intervention will probably be necessary to convince automobile manufacturers to move to smaller cars and to tide them over the changeover period through massive purchases of buses and other mass-transit equipment. Without such intervention, economic dislocation could be considerable.

In the short run, extensive investment will have to be made in mass transit; subsidies will probably necessary for a period. However, in the long run, mass transit will probably once again become viable as higher load factors result from increased utilization. Investment in further highway and, for that matter, all road development will be extremely limited. Energy will be channeled into extending mass transit systems. The auto, however, will continue to be the prime mode of transportation in less dense suburban districts. Massive traffic jams will be considerably alleviated.

Freight Transportation

Probably the most stiking changes will occur in freight transport.

Railroads once again will become viable as trucking becomes an increasingly expensive alternative. Railroads will probably feature mainly long-haul traffic, while short-haul deliveries will continue to be by truck due to the spread of both sources and destinations over the past few decades. Several patterns of recent vintage will probably be reversed.

Increased transportation costs will militate against the further spread of manufacturing capactiy. The Hudson Basin, a large market with a relatively weak manufacturing base, will probably draw more industries as they attempt to reduce transportation costs by moving close to the markets. The garment industry will probably be a good example of this, as the cost of shipping goods from the South outweighs the advantages of low taxes and wages. While other areas outside the basin will lose manufacturing capacity, the urbanized areas of the Hudson River Basin will probably gain some industry. Rural areas within the basin will witness even greater difficulty in attracting industry.

The Port of New York will also witness increased attention. Allied ports along the Hudson will get more use as the price of transportation by water gains a greater competitive edge. Production for export will show greater interest in port locations for facilities. New York's difficulties in obtaining coal for power generation will probably lead to increased emphasis upon nuclear power--particularly in offshore locations.

Basically, then, the impact of energy shortages upon transportation is that they will constrain the amount of transportation possible. When transportation becomes problematic, one begins to move the process rather than the product. In this dynamic, the urbanized areas of the basin will probably become net gainers. Transportation also probably provides the potential for realizing the greatest reduction in overall per capita energy utilization.

Recreation

Recreational patterns will also be heavily impacted. Several aspects of current recreational patterns are heavily energy dependent. The recreation industry itself is particularly energy related. Perhaps the greatest alteration wrought by energy scarcity will be in American vacation habits. Travel is almost synonymous with a vacation. Motel and other tourist accommodations are heavily dependent upon this recreational pattern. Such habits are likely to be strongly impacted by energy scarcity. The tourist-based economies of the Catskills and the Adirondacks are likely to be impacted considerably by declines in tourism. Day and weekend trips are also likely to become less frequent. Day resorts in the Catskills and the far reaches of New Jersey are also likely to suffer.

On the other hand, camps and resorts featuring a wide range of activities at one location are apt to receive renewed interest. Points of interest and parks along transportation corridors, such as Bear Mountain (Hudson River Day Line) and points of interest along the Hudson rail line are likely to see increased utilization. There will be public pressure toward recreational facility development along major mass transit corridors. Hiking, biking and cross-country skiing will increase in popularity. Demand will also increase for urban-oriented park development such as the Gateway National Park. Neighborhood parks will see additional pressure. Recreational planners will be faced with the need for transportation-related facilities.

Secondly, home development will decline, a function of both rising costs and perhaps government pressure. Mechanical or energy dependent recreation --snowmobiling, power boating, and all-terrain vehicles--will decline; a result probably of both increased cost and governmental regulation.

The economic costs to the tourist-based industry of the region's rural areas is likely to be extensive. Land values are likely to fall and population declines will be considerable.

Residential Patterning

While the greatest energy savings will probably be realized in transportation, probably the most extensive changes will occur in residential patterning. Even now, under current energy regimens and housing costs, pressures toward the projected trends are underway.

As mentioned previously, the spread city appears at about an end. Growth in the far suburbs and exurbs should gradually taper off. The current dimensions of the metropolitan areas seem fixed. Need for additional housing, industrial and commercial development will be achieved by infilling current urban area. Considerable vacant or underutilized land appears both available and sufficient in urban areas to handle such infilling.

Infilling will, of course, have some important economic implications for our cities. Full utilization of vacant lands and increased commercial enterprise will all promise to improve the tax base within urban centers. Larger populations will also present some new dilemmas. Among the more difficult of these dilemmas, perhaps, will be the political conflict such infilling will promote. As younger, more middle-class families are forced to urban residencies, they will confront the minorities and deprived groups which will border their areas. Schools and questions of public safety will come to be of prime import. Political turmoil is certain to result as middle class and lower class confront each other and battle for their own interests. It will be interesting to observe how much middle-class families will be willing to pay to maintain residential segregation from the social problems of the city. For the past couple of decades, it has not been the "draw" of the suburbs but rather the flight from the urban centers that has triggered spread city.

Residence and jobs are also likely to become more closely aligned. Density of development will increasingly become a function of access to mass transportation corridors. In addition, single-family homes will become more and more rare (a process already well underway) as multiple dwellings and planned unit developments gradually replace this material- and energy-expensive residence.

Probably the most telling alteration in residential patterning will lie in a remarkable increase in residential stability. The rapid change in addresses that has been experienced by many American families in the past decade will slow. Similarly, massive population shifts from urban to suburban, and from North to South and West will also slow. Neighborhoods will stabilize and change will be slowed. Given residential stability neighborhoods will once again emerge as important social elements. Neighborhoods will also begin to regain "unique flavors."

Rural areas will continue to lose population. This trend will be particularly pronounced in the north counties and in the hilly terrain of the Catskills, as tourist and second-home development ebb. However, as will be observed shortly, farm populations will probably stabilize and perhaps even increase a little.

Agriculture

Agriculture long ago ceased to be a major economic aspect of the Hudson Basin. However, there is still considerable agricultural enterprise within the basin's confines. While agriculture will never again be a critical enterprise in the region and this region will not be a major national producer of agricultural products, there will probably be a renewed interest in agriculture in the basin. Three factors will prompt this new emphasis.

First, with the decline of land speculation in the basin occasioned both by government pressure and falling rural land values (at least in a relative sense), farming will once again be viable. Second, transportation costs for produce, lettuce, fruits, etc., will become so high as to make regional produce far more competitive. This will become particularly evident on Long Island, parts of Orange and Rockland Counties, and in New Jersey.

Third, and perhaps most provocative, energy is heavily linked to agriculture. Energy scarcity will reduce agricultural production worldwide. World population growth will also demand increased foodstuffs. Fertilizers will become particularly scarce. Waste sludges from sewage plants and organic garbage compounds will become important fertilizer sources for exurban truck farms. Dairy farming, as a relatively low-energy enterprise, will also see renewed interest.

Air and Water Pollution and Solid Waste Disposal.

Predictions of the pollution situation in a fuel-scarce economy model are indeed hazardous. For, in the area of pollution, several complex factors are likely to interact, making outcomes difficult to estimate. Certainly (and probably most obvious), energy scarcity makes environmental programs which expend energy unpopular.

April 15, 1974

THE ENERGY CRISIS: A SOCIAL SCIENCE VANTAGE

by Robert E. Ford

What is a crisis? In a sociological context the concept of crisis bears a distinctly different significance than that suggested by its counterpart terms in psychology and economics. Above all, for the social scientist, a crisis setting is one where the old ground rules, the old ways of doing things are suspended (sometimes permanently, sometimes temporarily). In this suspension of previous norms or mores, change can occur. A new set of appropriate ways of behaving can emerge. the concept of crisis then, is critical to an understanding of the concept of social change.

Truly significant change of a rapid and sustained nature occurs infrequently in any large social order. Societies are inherently conservative creatures, as well they must be. Societies can rarely afford to make rapid changes that may cause them to repent at their leisure. Meaningful change on a societal level occurs most commonly in only two ways.

One of the most common ways in which societal change occurs is simply by generations dying and their children being socialized to new values and new patterns of living. Their parents, on the other hand, find such adaptations very difficult to contemplate. This concept is, of course, crucial to understanding of what Ogburn has termed cultural lag.* The parents' values lag, while their children's orientation adapts to new technologies.

Let's take an example relevant to the energy question--environmental concerns. Probably almost everyone today voices some support for the proposition that the environment ought to be protected to some extent. For some, this is but a superficial commitment; for others, it is a pattern for living. For many, especially those of the older generations, the environment is a lawn in front of a factory, a tree on Arbor Day. To

*William Ogburn, <u>Social Change</u> (New York, Delta Books, 1950) others, environmental concerns are a critical variable to be included in any decision process. The latter view is probably more characteristic of the younger, more recently socialized.

In many respects, environmental values have been incorporated into the socializtion process of the youth. Educational institutions consistently stress concern for the environment, the mass media point to pollution problems, and government stresses (often hypocritically) environmental priorities. Parents also instill their children with concern for the environment--although the intensity of this concern is far greater in the trasmittal than the parents may feel. We tend to socialize children to the ideal rather than the pragmatic.

The result of all this is that we are gradually ushering into our society a generation committed to a certain range of environmental values. However, the change to a higher regard for such concerns in policy decision-making will be a slow one as younger generations only gradually assume the mantle of decision making from the generations preceding them. One can observe this dialectic at work both in government and industry, as younger professionals, much more strongly committed to environmental values, struggle with their older colleagues. This conflict is particularly sharp since enviromentalism has been most pervasive among middle class professionals and those of upper class origin--precisely the background from which most contemporary decision makers are drawn.

However, this dynamic model of change proves a slow and conflict-ridden process. For it takes 20 to 40 years for such change of generations to successfully ensue. Such changes are already underway but it will be a long time before their success is pervasive. The slow rate of such change can be seen in the gradual change in another area--racial attitudes.

The second manner in which a society changes is what might be termed the crisis model. Changes instituted in this manner often prove far more pervasive and rapid than the more traditional approach just discussed. It is not by accident that, as S. David Freeman observed, the Chinese ideograph for crisis combines the characters for two other words: danger and opportunity. For a crisis is more than an impending danger: it is an opportunity for change. In the words of S. David Freeman:

> "However, the public sense of unease over scarcities also offers an excellent opportunity. The so-called energy crisis can be used as a basis for education, information, debate, and change in our seriously outmoded policies and in the wasteful manner in which society uses its very lifeblood."*

Freeman in the above comment bares an important quality of a crisis. A crisis is, most simply, a situation where certain inequities and difficulties are perceived as so glaring that the routine societal prescriptions for coping with the problem must be suspended. A series of search behaviors are then initiated for a new set of rules or values capable of dealing with the particular difficulties. A crisis situation is thus a setting where faith in the current way of doing things is so shaken that new values can emerge. This permits rapid and often sustained change. Witness, for instance, the rapid changes that greeted both China and Cuba in the crisis period closely following their revolutions. The collapse of the stock market preceding the Great Depression likewise initiated a period of crisis which brought considerable change to both government and the economy.

Crises occur when there is a <u>perception</u> that the old ways are not working. There can and often is considerable slippage between fact and fiction. Thus, the communication process is of critical import in understanding the development of a crisis. In this context, both the mass media and societal leaders become important variables in understanding the origins and maintenance of a crisis. However, crisis, whether real or manufactured, must be sustained for the public by empirically observed phenomena. The lines at the gas pumps in the Hudson Basin underscored for its residents the reality of the energy crisis. In Western New

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*From Freeman, 1973; 2.

York, where no such lines greeted motorists (only higher gas prices), the existence of the "energy crisis" as a real, rather than manufactured, phenomenon was severely questioned.

Another example of this phenomena occurred during World War II. Even in a war setting it is difficult to keep a country in a crisis over an extended period of time. (Witness Chairman Mao's difficulties in maintaining a permanent revolution). During World War II, to keep a crisis/wartime atmosphere, the population had to be faced by a series of wartime experiences. Scrap was collected; bandages wrapped; air raids were practiced and spotters climbed roofs. In reality, at least in a production sense, these activities were largely wasteful. The scrap was burned, the bandages burned, and no enemy aircraft were within striking distance. These exercises, however, served to maintain citizen involvement in the wartime crisis. The public needed daily reinforcement. It appears that at least in a sociological sense the current energy crisis is probably over. As the lines shrink at the pump, the perception of crisis will gradually end. Former President Nixon's assessment that the crisis has been replaced by a "problem" is probably an adequate description of current social dynamics.

The energy crisis, and for that matter any crisis, has implications far beyond the immediate factors that trigger it. In the wider consequences of a crisis can be found an explanation of why the concept of "energy crisis" has been embraced with such fervor by a wide range of different groups. There is a considerale spillover effect in any crisis situation. The suspension of current attitudes, brought on by an energy crisis, could well alter attitudes concerning related areas such as land use, residential patterns and the like. A crisis can be an opportunity for a thorough house cleaning. Thus, the existence and the maintenance of a crisis orientation for the Hudson Basin is likely to have impacts far more widespread than changes only in energy regimens.

The extent and length of the crisis perception are also criteria for understanding crisis impacts. Crisis situations must be perceived as severe and they must be of reasonable duration. For if a crisis is but short lived, it is too easy for the population (once the crisis is past) to settle into the old habits again. The recent energy crisis, it now appears, was too brief to succeed in establishing anything but minimal changes. The major change permitted by the energy crisis has been the increases it permitted in gasoline prices. Such rapid price rises probably would never have been politically viable in a non-crisis situation.

Interestingly, severe crisis settings tend to prompt altruistic behavior on the part of individuals and willingness to cooperate in evolving a solution. On the other hand, situations defined as problematic rather than as a crisis tend to lead to conflict between the varied interest groups. In such settings, competition for scarce resources or political favors tends to be the predominant motif.

President Nixon's remark on the demise of the energy crisis, cited earlier, proves to be an important remark. In his distinction between problem and crisis there arose two important points. First, President Nixon was probably correct in the sociological sense when he heralded the end of the energy crisis. His remark was probably contemporaneous with a gradual change in the average American orientation toward the energy situation from one of crisis perception to mild cynicism.

Second, and perhaps more crucial, his comment accentuated a fundamental shift in attitude toward the energy situation. There appears to be growing sentiment that what is necessary to solve the current energy imbalance is not a fundamental change in our attitudes or regulation of energy use but some incremental changes--basically a slight overhauling of the current model for energy generation and use.

Energy Shortfalls--Fact or Fancy.

There is no clear answer to the question of what the energy situation will be in 5, 10, or 20 years. There appears to be extensive disagreement about the future parameters of this problem. In this section, some materials appropriate to the question of the future energy status of this nation will be briefly and rather superficially reviewed. This review will be particularly directed to assessing the relative viability of a crisis or non-crisis approach to the emerging energy situation.

There appears little doubt that given current consumption levels of oil and natural gas and given proven reserves of these commodities, a period of stringencies is fast approaching. Even current levels of production--not taking into account future growth in demand--will quickly exhaust current proven potential. The problem of the above estimates, however, lies in the qualifier "proven reserves." The question remains as to how much oil is undiscovered. Another problem with current estimates is that they are based upon "recoverable" oil. Only between 40 and 70 percent of oil in a field is actually recoverable, given current prices and technologies. Technological improvements and higher prices could considerably increase recovery rates.

With the exception of coal, the fossil fuel situation appears grim. While there are without doubt additional discoverable reserves, they probably will not be as extensive as past discoveries. They will undoubtedly be expensive "to bring in." Oil geologists generally do not believe that such new finds will be sufficient to keep up with current demand, never mind the machinations of growth. Alernatives to oil and gas will be necessary if current energy demand is to be met.

In many ways the United States is the Middle East of coal. Approximately 35 to 50 percent of the world's coal reserves are found in the United States. There appears to be an ample supply of coal. However, there are problems with coal reserve forecasts very different from oil. Coal reserves are based on "hunches" and estimates of how much coal is in the ground. Unlike oil reserves, they are not calculated on the basis of recoverability. Nonetheless, it does appear that there are considerable coal reserves.

The difficulty with coal, however, is twofold. First, coal, especially eastern coal, is a dirty fuel. Clean air standards make the burning of coal difficult in many areas given present technology. The second problem is far more difficult. At present, coal is not directly interchangeable in a large part of the energy mix with oil or gas. Transportation and home heating are areas where coal in its present state would find difficulty replacing current fuels. Technological advance in recent years has been sufficient to lend credence to the belief that coal gasification and coal liquefaction may overcome these difficulties. Then there is always the problem of strip-mining, which will account in the future for a considerable proportion of coal production.

Nuclear plants provide an altenative to fossil fuels in the production of electricity. Such plants, however, prove quite expensive with associated transmission costs, etc. They can run close to a billion dollars apiece. Uranium, which currently powers such plants, now appears at least relatively as rare as its fossil counterparts. Alternative types of reactors will have to replace current techniques as uranium becomes more scarce.

Given the above considerations, forestalling serious energy stringencies appears dependent upon two variables: investment and technological advance. Energy is all around us; the problem is making it a viable servant.

Technological advance--a knowledge factor--is a function itself of three subphenomena: investment, time, and serendipity. Certainly, to some extent, as energy comes to be higher priced, the rewards for realizing new energy sources become greater. One can expect, given higher expected payoffs, a greater investment in energy-related research. However, it appears that the private market simply does not possess either the will or the ability to finance and direct the crash program necessary to realize such a breakthrough. Government will have to assume the costs of such research and development. (Although it appears that serendipity is random, it has been observed that it often occurs more frequently to the committed and desperate). The time frame is short; for many of these alternatives should be ready to come on line in 5 to 10 years.

It appears, given the actions of the last 6 months, that the research and development commitment necessary to achieve breakthroughs in the relatively short time necessary is simply not forthcoming from the government. It also appears that research commitments of $20 to $50 billion per year would be more appropriate to the task faced. Putting all the eggs in one basket--the breeder reactor--is also a somewhat chancy procedure.

A sobering note is realized in the observation that many previous societies have been willing to exhaust their resources and simply wilt rather than cope. The sustained population growths of many third world nations seems to argue that they may well be taking this course.

Achieving technological breakthroughs, however, does not appear to be the main difficulty. It appears that the problem of attaining energy sufficiency is going to be largely an economic dilemma. The relatively short-term switchover costs are going to be considerable, up to a quarter or a third of the Gross National Product. Between research and development, nuclear plant siting, coal gasification, shale oil recovery, and other alternative developments, a sizeable investment is called for. These funds must come from somewhare. It appears that the private capital market will have difficulty sustaining such demand. Government intervention in capital generation will be necessary for at least the short run.

The problems of the United States in this regard are minimal when contrasted with many other nations. For, in essence, we have fat economy. Rearranging our economy, at least theoretically, to handle such investment demands would not be difficult. Transfer resources and investment from the cosmetic industry, recreational vehicles, and from a hundred other "trivial" enterprises and one has realized sufficient capital and resources. Unhappily, in a political economy, theory and practice diverge considerably. Such reshuffling of priorities, capital, labor, and other resources would severely strain our political structure. In fact, it will be argued that without a crisis definition such a rapid reordering of priorities will not be possible.

In many ways, the American political scene is fast becoming a veto-group structure. Politics today is a function of interest-group coalitions. It is becoming increasingly easy in this interest-group structure to veto positive proposals. Given the type and scope of political decisions nesessary to reorder priorities, it is difficult to see how such changes can be faced and coped with--without the crisis definition. The energy problem, then, from this perspective is more likely to be a social difficulty rather than a problem of physical proportions. Every interest group would simply be arguing that everyone else's priorities should be reordered, but not their own. In this context, then, it is obvious why an energy crisis is necessary.

One further postscript is perhaps appropriate. If the energy situation looks somewhat unhappy here in the United States, the world outlook is indeed grim. Two revolutions are currently being experienced throughout the world. One is the revolution of rising expectations. Simply spoken, the rest of the world now believes thay should live as Americans do. The implications of the success of this goal for the world energy bank are obvious. Second, and probably in the long run most critical, there are the skyrocketing populations whose simple geometric progression gobbles up increased resources--energy being related to all.

The widely heralded and recently faltering green revolution is a highly energy dependent phenomena. We have, in the United States in particular and more recently in the world in general, been increasing food supplies by simply trading off oil calories for food calories. The future prospects for such continuing tradeoffs do not appear bright. Yet populations continue to increase.

What is important to realize from this impending international dilemma is that we are no longer fortress-isolationist America. As the world depends on us, we depend on the world. We also compete with the rest of the world for scarce resources. Capital is becoming perhaps the world's most scarce resource. The question also arises whether the world will demand in turn from the United States some of our resources, coal, etc., to meet their energy needs. What also will be our response to the major famines that will shortly stalk India, Bangladesh, and the Philippines? These will be but future considerations which will narrow our energy options.

One further comment is perhaps appropriate concerning the Middle East. It is frightening to realize that nearly all of the major oil producing countries are basically feudal political states. They are rapidly being transferred from the 12th to the 20th century. This is likely to be a most traumatic trip, politically and socially. Upheavals are most certain. Yet the disruption of oil service from but one of these major oil producers for just a couple of weeks will badly scramble the world's oil markets again. Such disruptions are bound to occur in the turmoil that will probably ensue. Finally, there has been no mention yet of the increased balance of trade difficulties which are going to greet our growing dependence on Arab crude. Hopefully, some of this outflow of dollars will return as investment. However, it is doubtful that the outflow and the return investments will be matched. Some net loss will probably be realized here. A further burden will be added to the investment problems that will be soon plaguing the nation.

These preceding discussions have set the stage for the final comment of this section. What has been argued here is that while our energy dilemmas will probably be manageable on a technological level, there is far more argument whether such shortfalls can be socio-politically managed. Societies, however, cannot afford to make mistakes. The consequences of such mistakes are often catastrophic. It appears that the practical way to deal with the socio-political dilemmas is to declare a crisis and use the opportunity provided by the crisis atmosphere to restructure our current energy formats and investment patterns to ways more consistent with our future needs for viable energy sources.

June 19, 1974

HUDSON BASIN ENERGY SYSTEMS

by E. D. Eaton

INTRODUCTION

> The social function of energy systems is to facilitate performance of work required for attainment of individual and societal desires.

This study seeks to appraise the positive and negative social effects of energy systems, to identify deficiencies of the systems, and to suggest possible remedies.

Energy systems provide work performance capability derived from inanimate processes. They consist of the facilities, resources, and organizations that acquire energy sources (e.g., fossil fuel and nuclear materials), convert them to energy modes suitable for end uses (e.g., electricity, gasoline), and deliver them to end users.

Technical and managerial competence to make the system function effectively is the principal asset of an energy system. Energy technology consists of that competence codified for transfer to others. It is the information resource of the system. The efficiency of energy systems is gauged by the net social cost of the energy they provide.

While there may be unique regional and local relationships, the energy systems of the Hudson Basin and their interactions with other systems conform with nationwide patterns.

CERTAIN SYSTEM CHARACTERISTICS

> Stability is the property of a system that induces development of forces to restore system equilibrium after disturbance.

One view of the Hudson Basin energy systems is that they are in disorder:

sources of supply are uncoordinated, prices do not reflect costs, service to end users is unrelated to societal values, damaging side effects are excessive, regulation is faulty, accumulating deficiencies are cascading, systems do not have self-correcting capability, failure is imminent. According to this view, deterioration of the systems occurs because they do not adjust to changes in society's needs and values. Effective functioning of the energy systems requires public intervention to bring about drastic alteration of their management and technology.

Another view is that the maturity of the Hudson Basin is evidenced in continuance of patterns and trends. The vast social investments in existing development and the complex webs of physical and social interrelationships produce system inertia resistant to change in direction or rate. Occupancy of the land, resource uses, the economy, and the technology of the Hudson Basin will continue to interact generally as they do now. Although there will be changes responsive to societal trends, barring profound upheavals such as catastrophic warfare or fundamental technological emergents, changes will come about by gradual increments. According to this view, effective feedback keeps the energy systems tuned to efficient performance; response lag time causes only transitory perturbations.

Each of these views is extreme but, to some extent, each is valid. Because of the many interdependencies of energy and societal activities, energy-related institutions are conservative. Drastic innovations that might be widely disruptive are avoided and obsolete patterns may remain after their usefulness is ended.

Innovations in energy technology are adopted more readily than institutional innovations. Yet, although there were attractive financial incentives, it took more than 20 years after feasibility demonstration to establish commercial scale practice of supercritical boilers for steam-electric plants, nuclear fueled electricity generation, and extra-high-voltage transmission. Up to the present, lead time for comparable technological innovations has not been shortened.

Even if gradually, important institutional innovations appear in response to new needs. Regional electric power pools, for example, are a highly successful institution for strengthening system reliability and for minimizing generation-capacity increases. Some of the other needed innovations are discussed in a following section.

An important social purpose of energy system management is to induce innovations that will heighten system sensitivity and response to society's needs and values. However, because of the extremely complex interrelationships with many other societal activities, there is great hazard of unintended secondary consequences of radical changes in energy systems.

One objective of planning must be to devise incremental innovations to be adopted progressively at rates which afford opportunities for adjustment of interrelationships without disruptions damaging to societal well-being.

INTERACTIONS WITH OTHER SYSTEMS

Technology frames the range of available choices.

Energy systems are a major logistic element supporting the quality of human life. Energy derived from inanimate processes replaces human labor and permits relief from physical and mental drudgery. Energy technologies enhance health and safety; they make homes pleasant; they facilitate communication and travel. The availability of abundant energy supplies makes possible wider perceptions and wider choices of lifestyle. Continuing improvement of the technology of energy systems promises increasing benefit to societal well-being.

The benefits of energy availability are not cost-free. Provision and utilization of energy degrades the environment: there are landscapes scarred by coal and uranium mining, waters polluted by acid mine drainage, oil spills, and condenser heat; air is polluted by sulphur dioxide, nitrous oxides, particulates--the list of environmental insults is almost endless.

Because virtually all of the energy used in the Hudson Basin is derived from outside sources, it is able to enjoy the benefits of energy availability and to avoid many of the direct social costs. Additionally, petroleum conversion to end-use products takes place mainly outside the Basin. However, one consequence is that the Hudson Basin must produce goods and services for regional export to offset the costs of imported energy materials, and that requirement impresses demands on the people and resources of the Hudson Basin. Energy supplies are acquired by the region at the expense of other benefits.

In the Hudson Basin, preponderent energy utilization is to condition the intimate environment--to heat, cool, and illuminate buildings and adjacent space. There are many opportunities to greatly improve these uses of energy through systems other than the energy systems, and such improvements might significantly diminish growth of energy demand.

Transportation of persons, material, and information is another major use of energy that can be greatly improved by operation of other systems with like consequences for energy demands.

ENERGY-RELATED ISSUES

> Decisions on public interest matters should be consistent and rational, they should be arrived at through open procedures that take account of all valid interests. So structured, reasonable persons can be expected to make socially acceptable decisions.

Production and distribution of energy supplies now are private sector functions subject to private decisions whose pervasive effects on the public interest give rise to many public issues. A fundamental issue is the extent and character of public decision making on whether to permit construction and operation of energy supply facilities and, if so, under what terms and conditions:

--What determines "public health and safety, environmental quality"?

--What are the boundaries of concern--Appalachia, the Gulf Southeast, the Continental Shelf, the Mediterranean?

--What are the criteria for aesthetic compatibility?

--What should be the extent and character of public participation in the decision?

--To what extent and how will energy system planning by the energy industries be integrated with overall regional planning by public agencies?

--To what extent and how may energy demand growth be limited by public regulation--what factors of demand are controllable?

--How will energy shortages be allocated--by price only, or by social utility?

--How will costs be allocated--will there be compensation for environmental damages in addition to value of real estate taken?

There has not been unambiguous resolution of these and like public issues; no public consensus has emerged regarding their significance in particular situations. This is as it should be because, in fact, each situation is a unique combination of social, economic, ecological, and amenity values and hazards. For that reason, decisions in the public interest must be made on a case-by-case basis.

There now are functioning, although rudimentary and imperfect, institutions for case-by-case public evaluation and decision making on energy-related issues. The environmental impact statement process, if further perfected, could greatly strengthen federal and state regulatory agencies, although they too need improvement. A major institutional deficiency is in the decision-making process at the local community level; remedying that deficiency is a crucial challenge to the democratic system.

Many of the issues that arise in particular situations can be resolved by reliance on existing knowledge and the informed judgment of persons whose technical and public-interest credentials justify public confidence. Institutions exist for utilization of informed judgment applied to available knowledge, and there are opportunities for wider employment of them.

There also are situations in which the consequences of proposed energy system developments cannot be gauged with confidence on the basis of available information. Some such cases are opportunities for technological innovations of incremental development that permits monitoring for progressive evaluation of the consequences before irrevocable commitments are made.

SOME RECENT EXPERIENCES

> Successful utility management requires creative engineering, perceptive response to the public, and luck.

Examples drawn from the Consolidated Edison Company system illustrate some of the kinds of problems involved in balancing requirements for energy and for environmental protection.

At estimated load-growth rates lower than the averages for the United States as a whole, Con Ed's generation capacity requirements will double between now and 1990.

In June 1965 when Big Allis, the million-watt generator, went into operation at the Ravenswood plant, its fuel efficiency seemed to be a technological fix to mitigate the energy-environment crunch. But repeated malfunctions for several years were topped by a breakdown in July 1970 that kept the machine out of service for 10 months. One consequence was that inefficient, high-pollution standby plants were kept in service instead of being retired.

The Ramapo-Coopers Corners 500-KV transmission line was proposed for construction in 1964 to reduce additional generation capacity requirements by substitution of an intertie with the strong PJM system--but it would slash a 52-mile scar across the lovely Catskill country and it was vigorously opposed by environmentalists. In 1971, the State Public Service Commission approved construction of the initial 26 miles, Ramapo to Rock Tavern, for connection with the Roseton generation station; no decision has been reached on the second 26-mile link with the PJM system.

This incremental approach has amply demonstrated the value of the intertie in preventing brownouts, and it also affords opportunity to monitor the environmental impact of the transmission line and to improve the aesthetics of right-of-way design and management before committment of the most scenic sections.

In 1969, Con Ed proposed to add 1,600 megawatts to the capacity of its fossil-fueled Astoria plant in Queens, but strong opposition developed because of the air pollution consequences. After year-long hearings, New York environmental agencies sanctioned a compromise that permits an 800-MW enlargement at Astoria conditioned on (a) use of natural gas and low-sulfur oil, (b) retirement of in-city coal-fired generation, and (c) development of nuclear generation alternatives at Indian Point and/or other sites.

Indian Point No. 2 and No. 3 (1,000 megawatts each) near Peekskill, Con Ed's initial nuclear generators, have experienced many difficulties since authorization in 1966 and 1967. Among these is opposition by environmentalists and environmental agencies because of potential damage to aquatic ecosystems, particularly the anadromous striped bass and shad populations. After extensive hearings and studies, the project has been redesigned to minimize fishery damage by entrainment and by elevated water temperature due to condenser cooling. The redesign process involved environmentalists, and by 1971 it resulted in endorsement of the project by the Environmental Defense Fund and in federal/state approval, although of a much more expensive plan.

Seeking to protect the magnificent Hudson River scenery, environmentalists have opposed construction of the 2,000-megawatt Cornwall pumped-storage project which would reduce in-city pollution by retiring obsolete fossil-fueled steam-electric boilers. After 10 years of arduous and expensive contention, although the Cornwall project was relicensed by the Federal Power Commission in 1971 in aesthetically improved design, it still is not under construction and the issues are still unresolved.

By 1971, the energy supply situation had become alarming enough for the Interior Department to consider possible development of the oil and gas resources of the Georges Bank on the Outer Continental Shelf off New England--although at best production would be a decade or more away. Apprehension over oil spillage and other environmental damage is now matched by apprehension over curtailment of Middle Eastern petroleum supplies.

The Save-a-Watt energy conservation program, initiated by Con Ed in 1970, was credited with reduction of summer peaks by 200 MW, but still user demands continued to exceed environmentally acceptable means for meeting them. Nevertheless, relatively modest proposals considered by the State Public Service Commission for a moratorium on new nonresidential loads or a requirement that they be the first ones to be interrupted in shortage periods were defeated by the combined opposition of the New York City government, Con Ed, and the newspapers on the grounds that economic growth would be impaired.

April 4, 1974

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