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REGIONAL ENERGY STUDIES PROGRAM

The Interdependence of Water, Energy and Economic Development
in New England's Future: A Synopsis of the Workshop, Oct. 27-28, 1977

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BROOKHAVEN NATIONAL LABORATORY REGIONAL ENERGY STUDIES PROGRAM

The Interdependence of Water, Energy and
Economic Development in New England's Future:
A Synopsis of the Workshop, Oct. 27-28, 1977

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August 1978

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ABSTRACT

A workshop entitled The Impact of Water Availability on Electric Energy Production in New England: Implications for Economic Development, was conducted on October 27-28, 1977 under the joint sponsorship of the Brookhaven National Laboratory and the New England Council of Water Center Directors. The workshop was the first step in developing a systematic and coherent research strategy for analyzing the technological, economic and institutional factors governing the dynamic relationships between water use, electric power generation and economic development patterns in New England.

This report is the synopsis of the results of the workshop as interpreted by the authors and is to serve as a point of departure for drawing up the details and carrying out a subsequent research strategy.

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MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

1. A comprehensive methodology for assessing the relationship between water availability, energy and economic development on a sub-national level is needed to both counteract the fragmentation and improve the quality of decision making. No such methodology is presently available.
2. Water resources, energy and economic development form an inseparable group for policy analysis. Rational decisionmaking can only be formulated based on an integrated analysis of all three elements. Any analytical methodology for planning and management which omits one or more of these interacting components of reality will produce misleading results.
3. An analysis of the relationship between these three major problem areas must begin with an evaluation of the term "region." The term varies with the context in which it is used. New England lends itself to such a research effort because of the existence of region-wide multistate institutions, a substantial data base and the variety of conditions displayed within a geographically small portion of the country.
4. Multistate regions such as New England should be evaluated in terms of their internal similarities, differences, and the ways in which these complement each other. The results of such analysis will differ if water resources, energy and economic development are treated separately. A common perception of a region's dynamics is needed because of the close interactions of all these facets.
5. New England, like all geographic and politically definable regions, has strong external interdependencies. The strength and character of these relationships as they apply to the separate primary components of water, energy and economic development, must be well understood first before the internal interactions are evaluated.
6. Institutional issues are at the heart of many of the energy/water/economic development conflicts. They must be incorporated in any comprehensive regional analysis and assessment methodology.

7. The implications of alternative new and existing energy technology for water use and regional development need to be analyzed from a long term comprehensive perspective. At the same time an evaluation of water conservation technologies in energy production and use should be incorporated within this wider framework to counteract the tendencies by some to look only for site specific impacts.
8. The development of a regional assessment methodology of water/energy/economic development relationships should encompass consideration of quantitative as well as non-quantitative techniques and data evaluation.
9. Factors that should be assessed from a multi-state regional, as well as, sub-regional perspective are:
 - centralization versus decentralization
 - the implications of scale
 - conservation and rapid industrialization
 - institutional implications
 - public attitudes
 - accountability
 - evaluation techniques
 - data base
 - technological implications

It is almost impossible to make rational management and policy decisions without a methodology which is based on a thorough understanding of how water, energy and economic development interact.

10. The conference concluded that the New England Council of Water Center Directors, together with the Brookhaven National Laboratory, develop a research program guided by these findings and conclusions.

1.0 INTRODUCTION

Dependable supplies of water and energy are major underpinnings of New England's economic development. Growing opposition to the introduction of additional steam electric power sources and the development of major new water supply projects represents a challenge to further industrialization in New England, described by many as a "mature" economy. Environmental concerns, health impacts, unjustified economics, aesthetics and changes in the local quality of life are factors cited in opposition to these new projects. The fact that the conventional production of electric energy requires large amounts of water compounds the problems, because water as a natural resource is already of great concern to New England users, even without considering energy.

Moreover, despite growing populations, industrial expansion and the serious potential of drought, no major new sources of fresh water have been developed in the New England region for at least the past decade, nor are any such projects planned for the future. Will New England continue along its recent path towards high labor - low energy intensive industrial development, or will this trend be reversed? How will the relationship between water and energy influence the future course for New England as a whole, and what will be the geographic distribution of this development?

This workshop was designed to face such issues. It originated with a proposal submitted in May 1976 by the New England Council of Water Center Directors (NECWCD) to the U.S. Energy Research and Development Administration. ERDA suggested that Brookhaven National Laboratory (BNL) act in an advisory and cooperative role with NECWCD. Subsequently, BNL staff met with members of the NECWCD and associated researchers to discuss the nature of the proposed project as well as the preparation of issue papers in support of a workshop included in the original proposal.

Seven issue papers were prepared and presented at the workshop.¹ These were intended to provide basic information and a framework upon which a future research program could be undertaken. The workshop was to become the first step in the development of a systematic methodology and coherent research strategy which could:

¹More detail about the workshop is presented in Appendices A, B and C of this report.

- use New England data and information to describe how water availability, electric energy production and economic development are linked in multistate regions.
- identify the specific factors and processes which determine, directly or indirectly, the nature of the interactions; and
- assess how different water, energy and economic development strategies and institutions, laws, policy and programs can complement or conflict with each other and thereby alter the pattern of development.

Specific objectives of the workshop were first, to identify the key issues inherent in the relationship between energy production (particularly electric energy), economic development patterns, and the availability of water resources; second, to identify research methodologies capable of answering some of the problems associated with these issues, and third, to help develop an appropriate regional research strategy.

This report is based in part on the issue papers and on the discussions of the workshop as interpreted by the authors. It delineates and highlights the relationship between five themes which kept reemerging during the proceedings:

- The nature of multistate regions as exemplified by New England;
- The impacts of alternative water, energy and development policies and associated institutional systems on efficiency, the degree of centralization-decentralization of decision-making, and on life styles;
- Public-private planning, regulation, programs management: individual choice and the public interest;
- The nature and value of resource conservation measures whether carried out by the application of technological hardware or non-structural measures;
- The value and limits of quantification; availability of data, reliability and validity, comparability.

These issues also represent research questions and common denominators through which the relationships among the three elements--water, energy, and economic development - can be identified and understood. They will serve as the focal points for the development of the multistate research agenda.

2.0 THE NATURE OF MULTISTATE REGIONS

The specific geographic focus of this report, as it was during the conference, is New England. There are several reasons for this choice. For historical and political reasons a number of multistate institutions, both public and private, concerned with economic development, water resources and energy have evolved. An abundance of quantitative and qualitative data is therefore available. New England, as perhaps the most mature economic region in the United States, displays and foreshadows most, if not all, the contradictions, conflicts and complementarities found elsewhere but does so in a geographically more confined area. From a research point of view, New England as a geographically limited microcosm of the United States, illuminates problems and allows manageable analyses of very complex problems.

2.1. Intra-regional dimensions

To effectively deal with these relationships an important first question must be asked: Is New England a region? The answer requires a definition of the term "multistate region." Of necessity any choice of definition must be somewhat arbitrary but the crucial question remains whether New England be treated as a single region for purposes of analyzing the stated problem. Can one really talk about New England when in fact there are six very different individual states with some glaring distinctions between the northern tier states of Vermont, New Hampshire and Maine, and the southern states of Massachusetts, Connecticut and Rhode Island.

From the perspective of this analysis and to define the region it is essential to weigh the significance of similarities found throughout the area, as well as the importance of complementary relationships among characteristics found in different parts of the region. The dairy and poultry industries of rural areas, as suppliers of goods to metropolitan centers of population, are examples of urban-rural complementarity. The issues can then be redefined in terms of the following question subject to analysis: Should the relationships existing between energy, economic development and water availability be examined on the geopolitical scale of (a) all six states, (b) differences between northern and southern states, (c) individual states, or (d) sub-state regions? An answer will reflect not so much choice among alternatives

but rather where to place the emphasis. An indepth analysis of New England, or for that matter of any other multistate region, will have to take account of internal similarities as well as differences which, when taken together, complement each other. A geographical or political subdivision of the region will therefore be required.

The different geographic patterns of New England should be analyzed not only in terms of political boundaries but also in terms of population density patterns, types of economic activity and geological features. The significance of these similarities, differences and complementarities must be evaluated for each of the three functions to be analyzed: 'economic development' taken by itself will require a different structure of regional analysis than 'water availability' or 'electric energy production'. Since the principal objective of the research is to explicitly identify the inter-actions and the nature of the interdependencies among the three, one major research effort should be directed towards first understanding the basic differences on an intra-regional scale between energy, economic development and water availability in terms of:

1. political and institutional structure including law;
2. socio-economic characteristics; and
3. technological and physical characteristics.

For example, the public and private institutions that make decisions about energy production, particularly electric energy, are likely to be far more integrated throughout New England than those making decisions about water. Moreover, the private/public mix will differ. It is these distinctions that must be identified first, before similarities or complementarities or inter-actions can be found. This analysis in turn will be necessary in order to assess the economic, technical and resource use, political and social implications of large and small scale electric energy production, water resource management and industrial development. Public and private decisions about scale of energy production limits will be made. If they are to be objective and in the public interest, it is essential to understand how the scale of power plant operation makes a difference from the perspective of the energy, water and economic development linkages and the associated social-institutional fabric.

2.2 New England Institutions

Table 1 shows which regional institutions have on-going planning, program management, policy formulation, program coordination and legislative overview functions. Each of the New England institutions represents a different perspective or performs a different function in the sphere of the subjects of this report. Moreover, each is dependent on different constituencies, some with their own influence on energy, water or economic development decisions. Where is the real focus of decision making? To what extent do the different constituencies avail themselves of regional institutions? For example, decisions made by state agencies about water resource management are likely to influence the water - energy - economic development relationship more than those made by a multistate planning agency such as NERBC. Equally, decisions made by U.S. Department of Energy or the individual utilities may affect the shape and future of these interactions far more than those made by NEPLAN, the planning coordinator for the investor-owned electric utility companies.

Nevertheless, recognition of a regional New England reality has prompted numerous powerful decision groups to establish regional institutions as a necessary part of shaping the future of the region, some to collaborate and coordinate, others simply as a forum for negotiations. Thus, an examination of regional institutions and their current role with respect to water availability, energy and economic development will be a necessary component of a research strategy.²

2.3. Extra-regional dimensions

If complementarities and similarities exist inside New England, they also exist across its regional and international borders. Again, New England as a multistate region can be understood not only from the perspective of its internal structure, but also in terms of its relationships to the "outside world".

In terms of electric power production, one must include the potential imports from Canada, either in the form of fuels such as coal from

² Brief descriptions of these institutions will be found in Appendix D, which provides a setting for understanding the region as part of a national and international configuration.

TABLE 1: Applicable New England Institutions
(as of November, 1977)

<u>Public Institutions</u>	<u>Water Availability</u>	<u>Energy</u>	<u>Economic Development</u>
New England Governors Conference	X	X	X
New England Interstate Water Pollution Control Commission	X		
New England Regional Commission		X	X
Environmental Protection Agency (N.E. Region)	X		
New England River Basins Commission	X	X	
Federal Regional Council		X	X
New England Staff for Coordinated Air Use Management		X	
New England Radiological Health Compact		X	
New England Congressional Caucus	X	X	X
New England Caucus of State Legislatures		X	X
Massachusetts Siting Council		X	
Federal Reserve Bank of Boston		X	X
U.S. Army Corps of Engineers (North Atlantic Division)	X	X	
<u>Private Institutions</u>			
New England Council for Economic Development		X	X
New England Energy Policy Council		X	
New England Power Pool/NEPLAN		X	

Brief descriptions of these institutions will be found in Appendix D, which provides a setting for understanding the region as part of a national and international configuration.

Nova Scotia or directly as electric energy from Quebec. On a world-wide scale, New England, more than any other area of the country has been relying heavily on foreign oil for electric energy production though current plans call for increasing use of atomic power and, to a lesser extent, for additional hydropower.

An examination of fuels and fuel substitution in terms of price and availability will have an effect on the configuration of electric power production, on the total quantity of regional production, and on the scale of both discrete and pooled production facilities. For example, a recent study makes the point in discussing these relationships in terms of water consumption and withdrawal: "...heavily polluted water that is discharged from a coal gasification plant is consumed water for many competing uses, although not, perhaps, for mine floor wetting. Water evaporated from a wet cooling tower or an artificial lake, or from surface-mined land under reclamation, is consumed water from the viewpoint of other uses in the region, because the evaporated water cannot be expected to fall as rain on the same region."³

In the same article estimates are made for different levels of future energy development on electricity production. The estimated future fresh water consumption for electric power plant cooling in New England, given national assumptions, could range from 0.029 km³/yr. to 0.80 km³/yr. compared with estimated 1975 New England level of 0.13 km³. These ranges, though admittedly extreme, indicate how much difference alternative technologies and different total national energy production levels could make. In addition, if one were to evaluate differences for smaller areas within New England, water demand and availability levels could vary even more in responses to extra-regional influences.

Furthermore, if small scale hydropower production units were again to become widely used because of national policy, factors in other sub-national regions outside New England in the world at large, or simply because of socio-political choice, the scale of electric power generation could become far less concentrated and far more geographically decentralized. The impact on water resource use may equally be less concentrated. In turn, the

³Harte, J. and El-Gasseir, M., "Energy and Water," Science, 199:4329, (February 1978), pp. 623-634.

geographic pattern and location of economic development, the mix of power dependent industry, and indeed the aggregate use of electric energy would be affected. How such external factors affect energy production, economic development and water resource availability inside the region should be part of any analysis.

A similar rationale, though different in its specifics, can be traced for economic development. As might be expected in a national economy, New England's economic development is subject to an enormous variety of outside factors. The key distinguishing features which link New England most closely to the national and world economies are specialized technological products and services. In relation to other regions of the country, the absence of major deposits of raw materials and the national shift away from water power and coal as energy producing fuels resulted in a comparative advantage for labor intensive service industries. This comparative advantage is based on New England's physical characteristics, location and social history. New England entered the post-industrial development phase earlier than most other regions. This is true for both northern and southern tier states, even though the northern areas never appeared to reach a fully industrialized stage. Most important, the cross currents of development continue to grow in strength and New England's economic development is far more inter-dependent now than ever before. This internal interdependence of regional development has strong and sometimes conflicting social, environmental and economic facets. The regional institutions referred to earlier are symptoms of the demand for integration, while at the same time efforts are made to revert to a more decentralized economy with widespread local autonomy.

Rapid regional integration generates resistance by some to the associated larger scale, just as greater external integration between the national economy and New England's economic activities can stimulate already latent regional parochialism. An improved understanding of how the internal and external links of the region operate in water, energy and development today and are likely to operate in the future, is necessary to plan for an adequate regional water and energy supply consistent with desired life styles. What is adequate, what is enough, what can be done and what are the consequences of different planning strategies are central questions to be addressed

by the scientific community. The scientific community, particularly at universities, can, through its research, clarify actions and reactions as well as trace the chain of likely consequences flowing from the availability of water to electric energy production to economic development at a multi-state level.

3.0 INSTITUTIONAL ISSUES AND PROBLEMS

3.1. Locus of Decision Making for Electric Power Production Facilities

Among the major conflicts arising time and again from energy development proposals are inter-agency disputes over the "right" and the "ability" to take significant regulatory responsibility in evaluating and approving both development and operating proposals. The Seabrook Nuclear Power Plant proposal and the ESECA⁴ conversion activities are examples of how such disputes prolong the decision process and oftentimes stalemate specific development activities. While some regulatory intervention is usually required and the initiative for agency intervention sometimes laudable, the interaction of participating agencies has not been governed by any formal procedural requirements, requirements which might serve to shorten and facilitate the regulatory process.

The sources of inter-agency disputes or issues in regulating specific development proposals are not always clear. Two major factors have, however, contributed to these disputes: excessive compartmentalization and fragmentation. While the factors to be considered in any major development proposal (such as the siting and development of nuclear or fossil fueled electric generating facilities, or of hydroelectric power plants and their contingent impoundment facilities, or of water diversion and storage facilities) are many and broad, the powers accruing to any given state or federal regulatory agencies are relatively narrow and specific. Thus each development proposal usually requires the evaluation of many agencies, each on comparable narrow grounds.

For example, in Maine, the following agencies are participants in facility siting decisions through their authority to issue permits, licenses or other authorizations:⁵

⁴Energy Supply and Environmental Coordination Act of 1974, as ammended, 15 USC 791-798.

⁵Central Maine Power Company, personal letter from Donald C. Vique to James S. Munson, June 23, 1977.

Coal Facility

Local

Selectmen
Planning Board

State

Public Utilities Commission (PUC)⁶
Department of Environment Protection (DEP)

Bureau of Public Lands (BPL)
Department of Public Safety
Department of Transportation

Federal

Army Corps of Engineers
Environmental Protection Agency
Coast Guard
Federal Aviation Administration

Nuclear Facility

Selectmen
Planning Board

Public Utilities Commission (PUC)⁶
Department of Environment
Protection (DEP)

Bureau of Public Lands (BPL)
Department of Public Safety
Department of Transportation

Army Corps of Engineers
Environmental Protection Agency
Coast Guard
Federal Aviation Administration
Nuclear Regulatory Commission

Each of these organizations may approve or deny a permit independent of the decisions of the other permitting organizations. Each may thus be considered the site of a crucial decision. If such powers are exercised independently without consulting other interested parties compartmentalization may result in a sub-optimal decision.

Fragmentation may exist either in the process of reaching a decision or in the allocation of regulatory authority among participating agencies. In the case of wetlands development for a coal/electric facility proposed in Maine, there are a number of permits which, though overlapping, require duplicate hearings and independent approval. These permits include:

Local

-wetlands permit (if authorized by the DEP), Selectmen

State

-wetlands alteration permit, DEP (the DEP may review and intervene even if they have ceded permit authority to a locality),

-permit for facilities in tidal waters and subtidal lands, DEP/BPL

-lease of submerged lands, BPL

Federal

-permit for discharge of dredged or fill material in navigable waters,
Corps of Engineers

⁶This type of agency is also referred to as a Public Service Commission (PSC) or Public Service Board in other states of the region.

- permit for power transmission lines crossing navigable waters, Corps of Engineers
- permits for structures or works in navigable waters, Corps of Engineers

In the absence of any statutory requirements to the contrary each permitting organization may hold independent hearings (if they are required to hold hearings at all.)

Fragmentation and compartmentalization in the facility siting process has resulted in state initiatives along two directions: the creation of a "one-stop" siting process at the state level and the creation of special agencies (such as the Energy Facilities Siting Council of Massachusetts) which have substantial authority for site selection and evaluation. Whether such initiatives will be effective is debatable. The decision to approve or disapprove a permit still rests with independent agencies. In addition, these state initiatives do not require federal participation. Further, while they represent a step forward in coordinating the participation of state agencies in facility siting matters, such initiatives do not establish a formal mechanism for balancing conflicting goals or objectives among independent agencies.

3.2 Factors in Decision Making

In evaluating a project an agency considers the effect of that project on its objectives or goals as spelled out in its enabling legislation and subsequent statutory refinements. Where such goals differ as, for example, in the mission of the PSC's to ensure safe, adequate and reliable electric supply and the DEP's goals of protecting against environmental damage, the evaluation criteria and methodology as well as the ultimate decision may differ. In the absence of any formal balancing or consensus mechanism each proposed project is judged relative to those pieces requiring permits. Any one piece which fails to satisfy an independent permitting agency may block the project. Thus, the overall benefits or costs of a project are often neglected in favor of the specific benefits or costs of each of those components which require a permit.

Though the conference focused primarily on energy related institutional problems, parallel but different sets of problems were also recognized in the

field of water resources management. These two sets influence each other and therefore must be analyzed in a more comprehensive decision making framework.

A large part of the balancing or consensus problem is a failure to establish criteria for a comprehensive evaluation. There are two considerations here: policy priorities and the evaluation of seemingly incomparable criteria. Energy development and environmental protection often conflict. In the absence of a comprehensive and specific executive policy which considers energy development, environmental protection, economic development and associated social/institutional factors, the benefit of each proposed project will be considered only as good as the worst of its parts. In the recent past only executive and judicial intervention has resulted in any balance among these factors. Yet these actions have been sporadic and piecemeal. It is questionable whether such intervention was based on the relationship of each project to short and long term policy objectives instead of the narrower bases of specific benefits at a specific place and moment in time.

Even if such policy priorities or a balancing mechanism were in place it would still be difficult to evaluate specific projects. Methods of evaluation used in the past, such as cost/benefit approaches, are biased in favor of readily quantifiable values and costs. Thus, calculations of water availability (based on lengthy meteorologic and streamflow data), capital and construction costs, projected employment and income and tax benefits assume greater importance than less quantifiable and more subjective estimates of environmental impacts, regional demographic changes and the like. Such latter considerations, viewed as externalities in the past, today assume increased importance today; however, little has been done to put them into a framework which allows them more weight in comparison to quantifiable criteria. This problem will assume even greater importance in the near future as the opportunities for alternative energy and economic development patterns expand and policy analyses rely increasingly on environmental and socioeconomic concerns. For example, only with improved comparison of subjective and quantifiable values can a realistic evaluation of the regional benefits of centralized vs. decentralized energy alternatives be made.

Similarly, the benefits of developing indigenous, renewable energy sources are almost completely dependent on policy priorities. For example, increased

use of wood for energy in New England reduces the region's dependence on foreign fuel and creates job opportunities for a high unemployment region. Yet, if the increase is large it also creates environmental problems (such as increased runoff and nutrient loss) and the potential for conflict with existing wood industries (with, perhaps, a dramatic increase in the cost of wood or wood products). Furthermore, if recreational industries and water conservation for domestic use are to be promoted, opportunities for energy related water use and the associated low labor - high energy intensive economic development are diminished. At the same time new labor intensive economic opportunities would be created.

In addition to the issues discussed above, participants at the workshop outlined a subset of research questions and issues whose resolution would lead to an improved understanding of the institutions and conflicts which characterize the relationship between water availability, energy production and economic development.

3.2.1 State Legislatures

The role of state legislatures in multi-policy development is not clear. It is true that they define executive agency goals through enabling legislation and subsequent refinements. In addition they may define policy in specific development areas (for example, the ten year quasi-moratorium on nuclear power development in Vermont). Yet, it is not clear how they view and define their roles, how they interact to evaluate and legislate on multi-policy area development decisions (such as electrical generating facilities in relationship to water resource management), how they affect or are affected by public attitudes and how governmental credibility in solving linked issues is established.

3.2.2 Public Service Commission

The behavior of the Public Service Commissions (PSC) defines the type of intervention and frames the roles of public participants in hearings revolving around the need for additional generating facilities. In justifying the need for additional power and facilities the PSCs are essentially the first point of contact in energy facility development proceedings, and several major points of contention appear to typify PSC actions. Some PSCs are not explaining the need for more power and, just as important, the consequences of not supplying additional power. Whether true or not,

many public participants in utility proceedings feel that the PSCs (and other agencies such as the Corps of Engineers), through their long association with utility companies, represent captured interests. Further, in evaluating the economic justification of power development proposals the PSCs do not appear to recognize the difference between utility economics and public economics. In an era of change, where many individuals are seeking alternatives to large, centralized facilities, dependence on the rote economics of utility proposals has become a controversial and festering issue.

3.3 Legal Issues and the Courts

Both executive agencies and private interest groups attempt to use the courts as a protective instrument in multi-policy development issues. Based on recent experience the courts have tried to resist this role, preferring instead to rule on procedural rather than substantive issues. Where they have ruled on substantive issues the courts major actions have been to develop decisions based on legislative intent as defined through reviews of legislative proceedings and executive rules and regulations. A circular process appears to have developed as both the executive and legislative branches use court rulings to further refine specific programs or policies. Whether courts can be considered as major policy instruments is dependent to a large extent on how they rule on substantive issues, and in turn how executive agencies and legislatures interpret these findings.

As a result of legislative gaps the courts may, however, be faced with contentions issues. For example, no federal, regional or state institution exists to allocate water in New England, and competition for conflicting uses of water (energy production-vs.-industrial uses-vs.-domestic consumption -vs.-recreation) may require court decisions on priorities. Such rulings would have to consider the differences among the states in water related laws. The regional implications of different state water laws are not clear. The fact that they may affect the manner in which future development takes place under water availability constraints is a major issue. Other potential legal issues should also be considered. For example, private property rights may become an issue in the move to decentralization. The decision to use the power of eminent domain has been based in part on the role of energy facilities to supply power to a large body of users (thus the public need criteria). Whether such powers can

be so readily justified for smaller facilities is unclear. Similarly, the effect of smaller decentralized facilities on private property values and uses has become an issue in the case of several small hydroelectric proposals.

3.4 Public Participation

Of all institutional factors in energy development and environmental protection the role of public participants is the most contentious and the least tractable. In many large energy development proposals, public participants have been vociferous and outspoken, often stepping outside the bounds of formal procedure to ensure that their considerations are heard. Yet the focus of public concerns is difficult to identify. Recent conflicts over nuclear power have not served to clarify the situation. It may be that the emphasis on water related issues in the Seabrook Nuclear proposal is tangential to other, generic, issues which are exempt from hearings. Even though the real public concern may be over safety and waste disposal aspects of nuclear power, dependence on environmental issues typify almost all facility development hearings. As most public participants do not possess the technical facts to participate in generic hearings they may seek alternative points of weakness in site specific hearings, which frequently turn out to be based upon environmental, economic and procedural issues.

There are many concerns on the part of public participants. While legislation over the past ten years has increased their right to be heard at evaluation hearings, means for exercising this legal right may not have increased at the same rate. Private citizens and interest groups still lack the technical and financial ability to participate in decision making. Citizens may feel they have a voice but they know they have no vote; decisions are still preempted by executive agencies.

The appropriate roles of public participants are not clear. The issue of local -vs.- external participants is important in analysis of facilities with regional benefits and local impacts. This issue may also cut both ways when, for example, the tax benefits of a certain facility accrue to a locality while the impacts are more widespread. The evaluation of benefits against impacts in an arbitration process takes place among both executive agencies and public participants. The arbitration mechanism is unclear, and it is questionable whether the process

used in one specific development proposal can serve as a model for other similar proposals. Before a model for arbitration would be possible several considerations need to be addressed. First, the real issues need to be separated from the sham issues. Second, the role of benefits, and particularly their proper evaluation, needs to be defined. Third, the issue of minority rule -vs.- majority rights must be addressed (for example, a pro development decision may be implemented even in the face of local referendum against that development). Fourth, the equity and efficiency of public participation must be evaluated in light of the contribution of public participants to any specific development decision. And, fifth, the relationship between both perceived and actual citizen needs, on the one hand, and public policies as defined by legislation and executive action on the other, must be examined.

3.5 Regional Value Conflicts

As discussed previously, despite its historical regional context, New England cannot be considered as an entirely homogenous region in any political, demographic, social or natural sense. It is a composite of many distinct parts. Perhaps the greatest recognized disparities are those between the three northern tier states (Vermont, New Hampshire and Maine) and those in the southern tier (Massachusetts, Rhode Island and Connecticut), and those between the highly urbanized coastal corridors and the rural inland areas. The importance of these distinctions lies with a variety of factors. First, the economies of the rural/urban areas and north/south tiers differ. One is focused on industrial and commercial pursuits while the other is on recreation, forestry and agriculture. Thus the uses to which they would put their natural resources differ. In the urbanized case resource demands are essentially large, consumptive and/or detrimental to the environment. In the rural case resource demands, while large and potentially detrimental, are often passive and diffuse, and dependent on resource availability and quality.

Rural residents often object to a transfer of damage rights but frequently expect to reap recreational benefits originating in urban areas. This may occur in two ways. Highly populated areas with their consequently large demand

for energy are poor sites for energy facilities. In the case of nuclear facilities there are explicit regulations which make urban areas unacceptable for facility siting. There is, therefore, a predilection to locate facilities in rural areas and thereby consume rural resources, while the electricity produced is supplied to largely urban populations. This is typified by the Dickey-Lincoln hydroelectric project which will preempt large amounts of land to supply power to areas far beyond the boundaries of its greatest environmental impacts.

It does not require a comprehensive understanding of hydrology or demography to understand that the areas of greatest fresh water availability in New England are also the areas with the smallest demand for energy and the least consumptive demand for this water. Yet these are areas which will be most directly affected by water diversions resulting from increased water demands in the more highly populated areas. Such points were at issue in the Quabbin Reservoir project and resulted in rulings to the effect that consumptive (human) uses of water were the highest priority uses, and in lieu of any higher priority the needs were such that the project should proceed. These rulings did not extend to uses for industrial or commercial purposes; however a test case is not unreasonable. Such a case might revolve around the following question: Given the demand for fresh water resources for industrial and commercial purposes (perhaps including energy generation) in the southern tier is it not acceptable to divert water for consumption uses from the northern tier? Such a question is essentially at issue every time a large rural generating facility is proposed whose product is destined for urban consumers. Even though differences must be accounted for, they also represent symptoms of intraregional specialization. For example, northerners may depend on the commercial base of the south, whereas the south may depend on the north for satisfying its recreational needs. In this way specialization can forge regional interdependence and cohesiveness just as well as foster separatist tendencies. Such issues are often settled on site specific criteria rather than on a regional balancing of issues.

3.6 Major Institutional Issues

Institutional issues are at the heart of many of the major energy/water/economic conflicts prevalent in New England. The actions of federal, state and

local agencies are poorly coordinated and are distinguished primarily by fragmentation and compartmentalization. This results from many factors but among them are conflicts between agency goals and objectives and problems in the reconciliation and comparison of different sets of criteria such as employment opportunities versus environmental impacts.

The roles of participants in facility siting hearings and decisions are poorly understood. Specifically the roles of state legislatures and courts need to be further defined. The actions of public participants need to be reviewed and analyzed to determine whether alternative methods of intervention will result in improved and more efficient participation.

Regional differences within New England, particularly in terms of population, resources and economics, are such that continuing internal conflicts over energy development and water use are likely. These conflicts are unlikely to be resolved without a broad, yet specific, regional policy one that recognizes the importance of internal differences to both local areas and the region as a whole.

4.0 CONSERVATION

Conserving energy and water relates both to technology and perceptual values. For example, New Englanders have had a tradition of utilizing alternative sources of energy such as wood and hydroelectric power. In fact, it was not too long ago that numerous hydroelectric units relying on relatively small hydraulic heads provided power to local industries. Increasing demands for energy, higher oil prices and a history of environmental awareness have brought New England residents to seek conservation alternatives to their water and energy problems.

Workshop participants viewed conservation as applicable to both water and energy, suggesting that further studies be made along technological, economic and sociological avenues of research.

Most of the water required for steam electric energy production is used for cooling purposes. Technologies exist to minimize consumptive water use although it is not known how efficient these will be for use in the New England region (primarily because of climatological conditions). Data exists to perform critical assessments of the feasibility of various cooling systems such as natural and mechanical draft towers using either fresh or salt water. Alternatives such as using a mix of wet and dry cooling towers should be considered. An analysis of conservation strategies for steam electric power generation, as well as for competing water uses, can and should be performed using existing data and a variety of demand forecasts for the New England region.

Both residential district heating and industrial co-generation are in limited use in northern New England. A feasibility study of their widespread applicability to New England is needed with emphasis on their needs for cooling water.

It has been estimated that over one thousand abandoned dams exist in New England which are suitable for power development.⁷ Several towns in Vermont and Massachusetts, for example, have already gone ahead with plans to either build or rebuild local dam sites for hydropower. Such energy production is a non-consumptive user of water and may simultaneously provide local solutions to projected water supply deficits. Factors such as small scale, state of disrepair and historical features may increase capital investment requirements per unit of energy output and may thus limit this particular option at many sites. Another limiting factor is the potential for conflict among competitive users of water at

⁷"Estimate of National Hydroelectric Power Potential at Existing Dams," Institute for Water Resources, U.S. Army Corps of Engineers, (July 1977).

many of these sites, where reservoir storage is also used for other important purposes (e.g. water supply and flood protection). An analysis of this alternative form of energy production which would incorporate both existing data and local practices is required.⁸

Several knotty aspects of a large scale analysis of conservation were emphasized at the conference. It was concluded that sufficient information exists on technological and economic aspects of many facets of the problem. However, the nature of conservation per se is not at all clear. What is its primary impetus: money, fuel, resource conservation, or is it more a question of state or individual rights? How are these factors combined or weighed? Further studies are required to understand and explain behavioral patterns and their capacity to prevent or adapt to change. This relates to the question of reality versus perception: are preceived needs for energy and water in the United States large, in comparison to those of other industrialized nations, even if one accounts for differences in standards of living? Clearly the answer is yes, though further information is required before any large scale attempt is made to change existing patterns. Such factors as distance between industrial areas, and the related need to spend more energy for the movement of people and goods, may create difficulties in quickly changing energy consumption patterns.

Another serious problem will be to describe market forces and institutional arrangements which may affect alternative energy scenarios. Residents of New England have a tradition for inventiveness (one immediately thinks of Eli Whitney and Samuel Slater), for adapting to a harsh environment (viz. the traditional saltbox house design and historic use of wood as fuel), for decentralized energy production (e.g. the large number of small hydroelectric facilities) and for resource conservation (viz. resistance to large projects such as Seabrook which would affect water quality and quantity as well as the biota therein). These attitudes would seem to favor conservation measures as an alternative to increased development of energy production and water use. On the other hand, New England contains a particularly large number of local governments each historically protective of its own perceived interests. Situations exist where towns within the same state and river basin aggressively compete for the same water supply irrespective of the common good. The degree to which such behavior and institutional arrangements would affect conservation strategies is largely unknown.

⁸ Such a study by the New England River Basins Commission has recently been initiated.

Courts have forced the use of specific control technologies in litigation relating to various powerplant sites. The extent to which they could use existing or proposed legislation to intervene in conservation issues is largely unknown. In this regard some light may be shed by two recent D. C. Circuit Court decisions on the availability of injunctive relief for a defendant who discovers violations of NEPA (National Environmental Policy Act). "The rulings suggest that courts may be unwilling to enjoin important public projects, such as components of the national energy supply program, where less than gross violations of NEPA have occurred."⁹ The extent to which conservation becomes important to the national interest may thus provide the entree to bypass traditional environmental objections to large scale energy and water resources development projects.

Interpreting the effectiveness of conservation presents its own set of difficulties. Consumer and industrial demands for both energy and water are difficult to estimate accurately. The cost of substituting various forms of energy and the elasticity of water supply and demands are not well understood. Measures will have to be developed to evaluate more precisely the regional responses to various strategies for energy and water conservation.

⁹"NEPA Meets the Energy Crisis: D.C. Circuit Finds Statutory Violations but Refuses to Enjoin Ongoing Energy Projects," Environmental Law Reporter, VIII:8, page 8 ELR 10062 (April 1978).

5.0 QUANTIFICATION AND OTHER EVALUATION TECHNIQUES

A systems study of New England water, energy and economic development futures has to be multi-disciplinary and will therefore draw upon data and methodologies from diverse fields. Potential problems exist relating to quantification as evidenced by conference papers and discussions. What analytical techniques will be utilized, what types of quantitative and nonquantitative data will be sought, and what incompatibilities, if any, between data and methodologies will be encountered as obstacles to integrating results from different fields?

Four generic categories were identified at the workshop to group both data and analyses: energy, water, economics and sociopolitics. Researching each issue will often require different data and analytical techniques. The methodologies which are employed all determine both the kinds and detail of data required which, in turn, will affect the quantitative significance of impact assessment. Qualitative significance may have to be substituted. A serious question of compatibility arises: can data of a given type be used by each of the methodologies and, importantly, are the methodologies themselves sufficiently compatible for use in multi-disciplinary impact assessments?

5.1 The Energy Picture

Numerous studies and models exist in both public and private sectors which are used to evaluate the present and future energy situation in the Northeast. These are traditional in that they project energy and economic demand based solely upon historical growth and use patterns. Usually disregarded are factors such as a user's perceived energy requirements, how these relate to conservation, and how both are influenced by regional differences. Smaller scale facilities producing energy from varied sources (e.g. wind, solar, wood, hydroelectric) are again being considered. Therein lies one reason for the public skepticism towards rationales for energy development put forth by utilities, PSC's and other government institutions.

What is needed are reliable projections of electrical demand in New England based more on likely futures and less on past realities. The question of reliability may explain why many workshop participants were skeptical about the projections.

of increased demand made by utilities. Insufficient emphasis has been placed upon geopolitical and institutional differences that characterize New England or for that matter on differences among regions that complement each other. While sufficient data exists to describe past and present energy use throughout the region, the models for projections, planning and siting are suspect, especially if they neglect important issues such as the advantages and disadvantages of centralization versus decentralization.

A question remains: What types of information should be collected to provide the requisite reliability of energy projections? An in-depth study is suggested in order to understand the "energy situation". It should include perceptions by individuals and impacts of alternative institutional arrangements on energy development. Whether such information can be gathered remains to be explored, as does the development of scientifically quantifiable projections and descriptive scenarios of what energy demand would be by type (e.g. fossil, nuclear, solar, wood, etc.) and place (e.g. Vermont vs. Connecticut).

5.2 Economic Development

Geopolitical and institutional considerations again lead to uncertainty as to how to project economic growth accurately. While much requisite data already exists, disagreement abounds as to methods of quantifying regional or sub-regional economic development. The economic structure of New England, closely tied to energy, cannot be adequately described on a gross regional level alone. While numerous studies continue to show the New England economy as growing more slowly than the U.S. economy as a whole, the question of whether one can characterize the region as "postindustrial" or not continues to play an important role in attempts to assess where the New England economy will be twenty or more years hence. More to the point, in fact, is the capability to characterize the region solely in terms of a homogenous unit, given the proliferation of local institutions and social values.

The question of what to measure becomes less important than how to create a framework within which existing data can be evaluated and new data collected. How to evaluate the impacts of institutional factors upon economic growth, as well as the apparently large and growing sentiment against accelerating both economic and energy growth are closely related methodological questions.

5.3 Water Resources

Of all the generic categories of data and assessment techniques discussed at the conference, water data appears to present both the best and worst aspects of quantification for the researcher. Many studies exist that provide information on existing water quantities in New England and the amount used by various energy technologies. A hydrological data base for New England river basins is already well developed using data from state and federal agencies. However, uncertainty in estimates of water availability, particularly groundwater, as well as inadequate projections of future water requirements present numerous problems. For example, what minimum flow statistic (e.g. seven-day ten-year low flow) should be used in siting considerations? Water availability for energy production has been treated as a site specific problem (e.g. the Montague situation) although this may change as larger projects are considered and as regional agencies become more involved with water resources management in the future.

It is relatively easy to quantify the amount of water used consumptively and nonconsumptively by various types of powerplants under numerous cooling system options. Data describing the availability of water in the various river basin exists, and computer models have been developed to integrate this information. Determining whether this water can be used for energy production, however, remains a difficult task. For example, the question might arise as to whether decentralization would change demands for water. This is not immediately apparent from available literature. Additionally, non-scientific considerations such as institutional factors again introduce difficulties with problem resolution.

Increasing numbers of competing uses also present difficult obstacles to the assessment of water supply and demand for energy purposes. New England (and in fact most of the Northeast) has consistently resisted the development of large water storage projects, relying instead on smaller scale reservoirs. Conflicts between states continue to defy solutions to interbasin transfers (viz. the Northfield project with attendant difficulties). Local disputes within states further complicate this issue. A study is required to evaluate the competing uses for water in New England, and to compare this evaluation with water availability and the applicability of court decisions relating to priority of use.

Very little is known about public attitudes toward water use impacts. Elasticities of supply and demand are poorly understood throughout the field of water resources management. Knowledge of the differential impacts upon water use by energy production is a key element in an evaluation of potential constraints of water on New England energy and economic growth and the distribution of that growth. Much more information is required about the extent to which various sectors of the community will be affected by decreased availability of water because of increased energy production.

While various technological options exist to reduce the consumptive use of water by powerplants, questions also arise about the impacts on water quality (e.g. the thermal effluent problem at Seabrook), economics, aesthetics (e.g. large and unattractive cooling towers with problems of drift and fog) and ecological impacts (e.g. land use, fish entrainment, entrapment and impingement). The coastal zone has played an important role in the New England economy. Despite the availability of unlimited amounts of salt water along an extensive shoreline, it is not certain whether this vast resource will be made available for energy production by the states in view of competing recreational values and demand. Equally, whether the northern tier of states will allow development of their extensive freshwater resources to produce energy for use by an industrialized southern tier of states introduces both social and political aspects which again add uncertainties to the relationship of water and energy and their interdependent impacts on New England future.

5.4 Additional Considerations

Some workshop participants pointed to the difficulty, if not impossibility, of quantifying various aspects of the New England energy/economic/water situation; others questioned the dependence on quantification in decision making. For example, properly accounting for the benefits of water resource of energy development projects continues to plague impact analysis. Benefits from sharing revenues derived by communities surrounding powerplants must be included in socioeconomic analyses. The concept of differential assessment¹⁰ may provide a method for better establishing the value of a given resource. This

¹⁰Lapping, M.B., et. al., "Differential Assessment and Other Techniques to Preserve Missouri Farmlands," Missouri Law Review, 42:3, pages 369-408 (1977).

technique considers assessing the resources (e.g. land) at its value in a particular use (e.g. farming) instead of an assessment based on its fair market value. It was generally concluded, however, that qualitative procedures were the best available techniques at present for use in understanding institutional constraints to development of energy and water resources for the purposes of economic development.

In terms of impact assessment, a formidable problem is to adequately distinguish between "demand" and "need". How does the researcher identify an individual's real or perceived need for energy or water or economic development? Are there any reliable techniques whereby one may evaluate the degree to which energy of one kind or another is preferred by the user? What is the elasticity in demand for water? These questions require resolution before beginning an integrated assessment of the New England water and energy future.

Each discipline has its own recognized sets of difficulties concerning types of data to collect and methodologies to employ. Water availability is but one of a number of crucial issues in New England's energy and economic future. Were this not the case the problem of evaluating the issues and coming up with simple answers might not be so difficult. Unfortunately, issues such as institutional differences lead to difficulties, not only because they are hard to define, but also because they involve evaluation methodologies which are at best fragmented and purely qualitative. Thus a team of researchers may easily use modern hydrological forecasts and models, couple these with options for various types of energy development and water use at a number of sites, and include realistic factors such as construction costs and discount rates to account for inflation and interest. The resulting calculations may be for naught, however, when the engineering and economic models are found to provide output incompatible with the needs of institutional social impact assessment methodologies. In engineering one calculates with measurable physical dimensions and monetarizes for economic tradeoff analyses, attempting to communicate measurement in terms of those things people understand. Yet even translations into monetary terms are often composite estimates of different reliability. Moreover they are by their very nature mere analogs of qualitative values. The question of an appropriate measure to use for sociopolitical factors remains unanswered.

APPENDICES

- Appendix A. Summaries of Workshop Papers
- Appendix B. Workshop Program
- Appendix C. List of Participants
- Appendix D. Selected Major Regional Institutions

APPENDIX A

SUMMARIES OF WORKSHOP PAPERS

1. "Public Attitudes Toward Water Related Energy Issues: The Case of Nuclear Power in New England," Madge O. Ertel, University of Massachusetts.

A discussion of public attitudes on public issues, addressing questions such as which public? what is the salience of the issue? and, what is the potential impact of public opinion on the decision making process? Examples are used to highlight each of these areas: diversion of Connecticut River waters via the Northfield Pumped-Storage Project, the Seabrook, New Hampshire and Montague, Massachusetts nuclear power facilities. Election data and survey research are used to illustrate the ways in which public perception and information may be measured.

2. "Regionalism and Economic Development in New England," Riad G. Mahayni, University of Rhode Island.

An overview of the activities of some regional agencies operating in New England. Section one summarizes the debate focusing on the need for regional cooperation and coordination. Section two provides a macro view of the New England regional economy. The last section focuses on a set of regional agencies operating in the region. Four different types of these agencies are distinguished, and one or two of the active agencies from each type are selected for further analysis of their institutional arrangement, activities and views on regional economic development.

3. "Institutional Factors in Case Studies of Power Production in New England," Richard O. Brooks, University of Rhode Island.

An identification, using case studies, of important institutional and government factors seen to be of special significance or applicable for New England. Also discussed are the nature of the decision-making process and interactions of the participants in their institutions. Primary focus is on site related issues. A distinction is made between institutional factors unique to New England and those which are important in the region (and often elsewhere). Also discussed are citizen participation, private interest groups, value conflicts, the adequacy of treatment given scientific issues, as well as various models of decision making.

4. "Water Resources as an Element of Siting Decision-Making in New England," Lewis D. Conta, University of Rhode Island.

This paper sets forth the degree to which water resource questions have historically acted as siting determinants. The extents to which water resource considerations enter into NEPOOL and NEPEX economic planning are examined. Information is provided on the current water use of major electric generating facilities in New England. Also discussed is the degree to which locational dependence on water may increase or decrease in the future as a function of the introduction of new technologies. (This paper supplements "Technology Characterization" which follows).

5. "Technology Characterization," Enrique J. LaMotta, University of Massachusetts.

Together with "Water Resources as an Element of Siting Decision-Making in New England," this paper summarizes current information on competition for fresh water from other uses, water quality regulation, development of new technologies for fossil fuel conversion, water allocation and cooling options.

6. "Impact Evaluation Problems," Paul Weiner, The University of Connecticut.

This paper concerns itself with measuring the sacrifices which society must make to benefit from the production of energy. Four classes of measurement are briefly reviewed: benefit/cost, community structure index, a matrix of community goals, and system analysis. Two approaches are compared: goals and objectives to impacts ("top-to-bottom") and impacts to goals on objectives ("bottom-to-top"). An initial model of dealing with tradeoffs is presented.

7. "Alternative Approaches to the Modeling of Regional Economies, With Emphasis on the Role of Water and Energy Resources," Barry C. Field, David A. Storey and Cleve E. Willis, University of Massachusetts.

This paper describes alternative models used in regional water/energy/economic policy decision-making. In addition to a general discussion of systems analysis and simulation, a brief discussion is also provided of basic modeling processes and concepts. Models are related to the policy process and a list of policy questions is presented which might be used to judge the effectiveness of

alternative models. Also discussed are various studies which have utilized these models and the paper concludes with some judgements regarding promising directions in modeling regional economies with particular focus on water and energy.

APPENDIX B

WORKSHOP PROGRAM

PROGRAM

Thursday, October 27, 1977

DEFINING CONTEXT, ISSUES AND STRUCTURE OF RESEARCH STRATEGY

9:00-9:30 Registration

9:30-10:15

SESSION I

Purpose of Objectives of the Conference

Welcome: E. Alan Cassell, Chairman
New England Council of Water Center Directors
University of Vermont

Introductory Remarks: Peter M. Meier (Moderator)
Manager, Regional Energy Studies
Department of Applied Science
Brookhaven National Laboratory

Keynote Remarks: Raymond D. Cooper, Acting Assistant
Director for Integrated Assessment
Division of Technical Overview
Department of Energy

Purpose of Workshop: Rudolph W. Hardy, NECWCD
Regional Research Coordinator

Objectives and Groundrules of Workshop: Edward Kaplan
Associate Scientist
Biomedical and Environmental
Assessment Division
Department of Applied Science
Brookhaven National Laboratory

Background Reading
Workshop Section 1,4

10:15-10:30 Coffee Break

Thursday, October 27, 1977

10:30-12:30

SESSION II
PUBLIC PERCEPTIONS AND INSTITUTIONS

Edward Kaplan (Moderator)

Brookhaven National Laboratory

Public Attitudes Toward Water Related Issues:

The Case of Nuclear Power in New England

Madge O. Ertel

University of Massachusetts

Regionalism and Economic Development in New England:

Riad J. Mahayni

University of Rhode Island

Institutional Factors in Case Studies of Power
Production in New England:

Richard O. Brooks

University of Rhode Island

DISCUSSANTS: Mark Lapping - University of Vermont

David Morell - Princeton University

William Shipman - Bowdoin College

GENERAL DISCUSSION

Background Reading

Workshop Section 3

12:30-1:00

Cash Bar (Independence Room - Center)

1:00-2:00

LUNCHEON SESSION (Independence Room - Center)

Speaker - R. Frank Gregg, Chairman

New England River Basins Commission

"Regional Water-Energy Planning: Contribution of
University Research"

Thursday, October 27, 1977

2:00-5:00

SESSION III
PROBLEMS AND METHODOLOGIES
Moderator - E. Kaplan, BNL

Water Resources as an Element in Siting Decision Making
in New England: Lewis D. Conta
University of Rhode Island

Technology Characterization: Enrique J. LaMotta
University of Massachusetts

Impact Evaluation Problems: Paul Weiner
University of Connecticut

Alternative Approaches to the Modeling of Regional Economics
with Emphasis on the Role of Water and Energy Resources:
Barry C. Field
David A. Storey
Cleve B. Willis
University of Massachusetts

DISCUSSANTS: John E. Edinger - J.E. Edinger, Inc.
Frank K. Moore - Cornell University
William Shipman - Bowdoin College
Richard J. Goettle - Brookhaven National Laboratory

GENERAL DISCUSSION

Background Reading
Workshop Section 3

5:00-7:00 DINNER

EVENING MEETING OF INTERDISCIPLINARY WORKING GROUPS

7:00-10:00 Meetings

GROUP I	Social Problems and Public Issues -Research Questions- Moderator - <u>Richard Brooks</u> University of Rhode Island
GROUP II	Technological Problems, Issues and Uncertainties in Water-Energy-Economic Development Relationships -Research Questions- Moderator - <u>Paul D. Uttormark</u> , Director, Water Resources Center University of Maine
GROUP III	Research management Process -Problems, Issues and Strategies- Moderator - <u>Gordon L. Byers</u> , Director, Water Resources Research Center University of New Hampshire

Background Reading - Workbook Sections 2,3,4

Friday, October 28, 1977

DESIGNING RESEARCH PROGRAM

8:00-9:00 Breakfast

9:00-10:30

SESSION IV

DEVELOPING REGIONAL RESEARCH AGENDA

Moderator - Edward Kaplan

Written reports by Working Groups I, II, and III

DISCUSSION

10:30-10:45 Coffee Break

10:45-12:30 Research Needs Identification Groups

A. Social Science Research Needs, Priorities-Methodologies

Economics, Law, Sociology, Political Science)

Moderator: Mark Lapping, Univ. of Vermont

Recorder: Max Gowen, NERBC

Backus	Ertel	Morell	Weiner
Beauregard	Field	Schwartz	White
Brooks	Mahayni	Storey	Willis

B. Engineering, Natural Sciences Research Needs, Priorities - Methodologies

Moderator: Lewis D. Conta, Univ. of Rhode Isl.

Recorder: Ann Wessel, NERBC

Barstow	Conta	Klotz	Munson
Bedrosian	Edinger	La Motta	Picha
Bergen	Kaplan	Moore	

C. Identifying a Coordinated Research Management Plan Suitable and Useful for Public Discussion and Decisions

Moderator: A. Ralph Thompson, Univ. of RI

Recorder: Dorothy Yanish, NECWCD

Carlson	Hardy	Water Center Directors
Cooper	Meier	

ALL OTHER WORKSHOP PARTICIPANTS MAY ATTEND THE GROUP OF THEIR CHOICE.

Friday, October 28, 1977

12:30-2:00 Luncheon Break

2:15-4:30

SESSION V

CARRYING OUT THE RESEARCH STRATEGY (Jefferson Room)

Moderator: Edward Kaplan, BNL

Reports by Research Needs Identification Group A,B & C
Discussion

Summation - Peter M. Meier, BNL

Follow Up Steps - Rolf Hardy, NECWCD

Closing Remarks - Alan Cassell, NECWCD

PROBLEM ASSESSMENT

Thursday, October 27

5:00-10:00 pm

Interdisciplinary Working Groups

- GENERAL PURPOSE: The objective of these working groups is to recommend problems and questions which need to be explored in order to arrive at scientifically based decisions.
- METHOD: The working groups will discuss in detail written materials and the results of the day's discussions. They should distill these discussions so that a "sense of the group" written statement and recommendations can be presented to the Friday morning session.
- MECHANICS: At the end of the session which should last no later than 10 pm, a short statement (about 5 handwritten pages) should be prepared. A secretary will be available to type these statements which will be reproduced overnight for general distribution at Session IV on Friday morning.

SUGGESTED QUESTIONS TO BE ADDRESSED

GROUP I: Special Problems, Public Issues in Water-Energy-Economic Development Relationships

- * What assumptions can we make about future time dimensions, social change and economics?
- * What are the institutions, current laws and policies? Are they likely to change dramatically or slowly and in what directions? What are the scientific questions derived from these or similar issues?
- * What are the economic and institutional variables that are likely to determine future electric energy needs, water availability and economic development patterns? What are the unknown relationships? How can we define the research subjects?
- * Are social, economic and institutional issues likely to determine energy technologies or are the technological givens likely to determine the direction of decision making for the future? What study questions should be posed?
- * Is water availability at specific sites a significant factor in determining energy facility siting?
- * What don't we know, but should know about these issues to make decisions? What subjects should be researched and how are they interconnected?

GROUP II: Technological and Scientific Problems, Issues and Uncertainties in Water-Energy-Economic Development and Their Relationship

- * Are water resource and environmental considerations realistically reflected in private and public decisions which determine electric energy requirements and the constellation of power generating plants? What are the regional implications? What are the appropriate research topics?
- * What are the factors, their weights and sequence leading to the selection of an electric energy generating facility of a network of facilities of a specified mix of modes (peaking, bulk) fuel factor "water adequacy" within the decision making process? What is known - what is unknown? What research questions should be posed?

GROUP II: (Continued)

- * What are the ecological impacts related to the growth in number, size and changes in composition of electric energy facilities assuming application of latest water input and output technology on specific areas (river basins, coastal zones, etc.)? How do we determine the specifics of New England sites. What research needs to be done?
- * What ecological impacts result from thermal and chemical contamination of fossil fuels, nuclear or hydroelectric generating plants? How can these impacts be controlled with the latest waste treatment technology and at what costs? What control mechanisms, structural or non-structural, are available to minimize ecological impacts? What engineering or natural science research questions should be recommended?
- * Is the quantity and quality of water available in specific sites a factor in internal or external economies of scale (size of plant, number of adjacent plants, fuel transportation or disposal, etc.)? How much do we know? What is the degree of certainty, uncertainty. What are useful research questions? How are they connected?

GROUP IIL: Research Management Process Problems, Issues and Strategies

- * Should research questions related to energy - water - economic development be studied separately or as a system of interactions? What is the best order if the two approaches are to be employed?
- * Is a case study approach adequate or should an assessment of New England's position and likely future be undertaken? Can the two approaches be combined?
- * How far are the issues raised interconnected so that interdisciplinary regional research will be required?
- * What research management implication should be addressed? What are the proper phasings of a research management plan for an interdisciplinary team approach?
- * What alternative management approaches should be used for an academic research approach. How much central research staff--how much decentralized discipline oriented research is appropriate?
- * What techniques can be used for interdisciplinary research management in a university setting? What are the problems?
- * What should be the relationship of a research team, public agencies and the general public over the course of an integrated research effort?

RESEARCH NEEDS IDENTIFICATION GROUPS

Friday, October 28 10:45-noon

GENERAL PURPOSE: The purpose of the research needs groups is to begin identifying topics and subject areas recommended and discussed at the beginning of Session IV in terms of research designs and methodologies.

METHOD: The research areas are to be defined in terms of:

- data availability
- data collection needs
- methodology
- order of importance and sequence
- magnitude of effort and time required
- relationship of sub-topics and methodologies

MECHANICS: Each group will be supplied with a reporter to take notes. The recorder will be available to assist the moderator (or any designee for each group) to give a brief (5 minute) report at the beginning of Session V. The luncheon period could be used for preparation.

SUGGESTED QUESTIONS

It is difficult to anticipate the nature of these specific discussions and questions. Nevertheless, the individual issue papers make some specific recommendations which can serve as points of departure. In addition, the following general questions might be addressed.

GROUP A: Social Science Research Needs, Priorities and Methodologies

- * Can the elasticity (substitutability) in quantity of water used by water utilization processes of electric power plants be determined? What are the factor costs of electric energy production that determine these elasticities? Can changes in the relationship of fuel costs, capital costs, labor costs to water utilization costs alter the mix of production inputs significantly? Moreover, can such changes alter the configuration, size and type of plant to be constructed? What are appropriate research techniques?
- * To what extent can the decision making processes in planning and management of electric energy facilities and water resources utilization be adequately coordinated? How can "adequacy" be researched?
- * To what extent will an increase or decrease of economic costs of water through location decisions or through technological applications influence overall electric energy costs? Are such water cost changes likely to be significant in altering New England's relative energy cost levels vis a vis other areas of the country? If so, will there be a marked effect on the industrial structure and growth of the region between now and 1990? Can such an effect be isolated, predicted and quantified?
- * To what extent are different social science methodologies to study regional problems compatible? Are the data adequate for quantitative analysis and modeling? Can historical analyses be used? What should be the level of effort and coordination?
- * What data is needed? What data is missing? How can it be collected and stored?

GROUP B: Engineering, Natural Science Research Needs, Priorities and Methodologies

- * How should engineering design criteria for different electric energy modes be developed to assure adequate availability?
- * Is size of plant or close proximity of power plant locations important in energy production costs? How can objective criteria be developed taking account of water availability (quantity and quality) and alternate water use?

GROUP B: (Continued)

- * What research techniques are to be applied for water conservation technologies in electric power plants in areas of high population use?
- * Is hydro technology for small dams feasible in the context of New England? What research methods should be used to determine feasibility?
- * What "cooling" techniques can be developed and what research methodology is appropriate to determine effects on water for alternate uses?

GROUP C: Identifying a Coordinated Research Management Plan Suitable and Useful for Public Discussions and Decisions Within the New England Region

- * What relationships should be established among the different interested institutions participating in such a regional research project?
- * What should be the scope of the effort in terms of disciplines, man-years, and the balance between central staff/university based investigators?
- * How should responsibility and authority be allocated among institutions' principal investigators and research team members, if a team effort is required?
- * How should the budget be allocated among research components?
- * What research coordination techniques should be used?
- * What should be the size, time period and phasing of such a research study? How should publications be handled?
- * Should a public advisory group be established? If so, at what point in the process and who should participate? How should it be serviced?

APPENDIX C

LIST OF PARTICIPANTS

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REGIONAL WORKSHOP

on

ELECTRIC ENERGY, WATER AVAILABILITY AND ECONOMIC DEVELOPMENT

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APPENDIX D

SELECTED MAJOR REGIONAL INSTITUTIONS
(As of November 1977)

APPENDIX D: SELECTED MAJOR REGIONAL INSTITUTIONS

(As of November 1977)

PUBLIC INSTITUTIONS

New England Governors Conference

The Conference is comprised of six New England Governors who elect a new leader annually. They meet five times a year to consider stands on proposed federal and state legislation, hear reports from the various regional agencies, and issue directives on agency activities.

New England Interstate Water Pollution Control Commission (includes New York)

Classify interstate waters. Advises on and promotes water pollution control legislation at the state and federal level. Advises and coordinates the planning for construction of municipal and industrial waste treatment facilities on interstate streams. Sponsors training courses for waste treatment plant operators. Sponsors research and conferences on matters of water pollution control.

New England Regional Commission (NERCOM)

Regional planning and study, funding of regional demonstration projects, and supplementing grant funds from other federal agencies. The Commission's activities are focused on economic development, transportation and energy planning. The six state governors are members of NERCOM together with a federal co-chairman appointed by the President. From a federal perspective, it is an agency of the Department of Commerce.

Environmental Protection Agency - New England Regional Office

The E.P.A. was created in 1970 to control and abate pollution in the areas of air, water, solid waste, pesticides, noise and radiation. Some of the E.P.A.'s authority is contained in the original Presidential Executive Order; Congress subsequently increased this authority with various legislation. The E.P.A. administers these laws through its headquarters in Washington, DC and ten regional offices. Each regional office is staffed by pollution control specialists and headed by a regional administrator.

New England River Basins Commission

NERBC publishes reports on regional and local priorities for federal and state water resource projects, has done surveys on flood control and flood management, power plant siting, and special recommendations to New England states on management of water resource. NERBC consists of a federal co-chairman appointed by the President and a variety of state and federal regional agencies. NERBC has organizational ties at the federal level to the Water Resources Council.

Federal Regional Council

The FRC of New England was organized by Executive Order of the President and is comprised of the regional heads of 15 major federal agencies and commissions.

The 15 member agencies are:

1. Department of Health, Education, and Welfare (HEW)
2. Housing and Urban Development (HUD)
3. Department of Labor (DOL)
4. Department of Transportation (DOT)
5. Department of Interior (DOI)
6. Department of Commerce (DOC)
7. Civil Service Commission (CSC)
8. Community Service Administration (CSA)
9. The Corps of Engineers (DOD)
10. Law Enforcement Assistance Administration (LEAA)
11. Environmental Protection Agency (EPA)
12. The Federal Energy Administration (FEA)
13. The New England Regional Commission (NERC)
14. The New England River Basins Commission (NERBC)
15. Department of Agriculture (DOA)

The objectives are to improve communications and working relations among federal, state, regional and local units of government; greater federal interagency program coordination; coordinating federal efforts in response to unique situations such as energy shortages, military base closings, disasters, and other regional concerns. Their ongoing programs include areas such as energy, natural resources, transportation, socio-economic impacts, human resources, and inter-governmental assistance.

New England Staff for Coordinated Air Use Management (NESCAUM)

Promotes the region-wide interchange of data on air quality and determining and identifying actual and potential multistate air pollution problems.

New England Radiological Health Compact

Develops comprehensive policies, plans, and programs for the evaluation, determination and control of hazards associated with the use of ionizing radiation; provides mutual aid and assistance in radiological health matters including nuclear incidents.

New England Congressional Caucus

All members of House of Representatives from New England states meet to discuss issues of importance to New England and to provide legislation in the best interests of New England funding; the New England Council pays for research; the director is paid through congressional funds.

Caucus of New England State Legislatures

The Caucus is a bipartisan organization which investigates problems common to the six New England states and makes common policy positions. It is open to all 1405 elected members of the six New England legislatures. Its 24-member executive committee consists of the highest ranking elected Senator, Speaker, Senate Minority Leader and House Minority Leader of each of the six participating states.

Massachusetts Siting Council

The council is essentially a Massachusetts state institution which currently assists other states with assessments for power plant location throughout the region.

Federal Reserve Bank of Boston

Apart from its regulatory and monetary policy function the bank undertakes research in a variety of New England issues including economic development, energy and other resource subjects.

U.S. Army Corps of Engineers (North Atlantic Division)

Created by Congress, the Corps has duties to protect the navigable waters of the United States. The North Atlantic Division has regional responsibilities for a variety of water related management, planning and construction activities (including hydropower).

PRIVATE INSTITUTIONS

New England Council for Economic Development

Provides assistance and direction to interstate conferences and compact organizations. Supports federal and state legislation designed to promote regional economic development. Active in developing regional projects such as solar energy and all energy systems, plus developing seminars for state officials.

New England Energy Policy Council/Center for Energy Policy

The NEEPC is a private council that is composed of 36 people from various sectors of the economy, both energy related and non-energy related. They meet to discuss and form solutions to the unique energy problems found in New England. Their funding comes from various foundations, corporations, and contracts from federal agencies. The Center for Energy Policy researches issues of concern to the council.

New England Power Pool (NEPOOL/NEPLAN)

The NEPOOL and NEPLAN organizations, primarily supported by the investor owned Electric Energy Utilities, coordinates the exchange and planning of electric energy on a regional basis.