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PRELIMINARY ANALYSIS
OF THE STUDY OF A
NUCLEAR ENERGY CENTER
AT GREEN RIVER, UTAH

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ABSTRACT

The planning phase for the study of a conceptualized Regional Nuclear Energy Center (NEC) at Green River, Utah to serve a four state area is discussed and an outline of the proposed study is presented. It is assumed that the more technical issues of a NEC have already been studied in detail for generic sites and that this study will address the site specific impacts of a NEC at a representative site. The emphasis will be on the institutional, legal, political, sociological, economic and environmental impacts of a NEC. An assessment is made of the willingness and ability of related public and private entities to participate in the study. These include local, state and regional government agencies, colleges and universities, research organizations, private firms and consultants, and relevant federal agencies in Utah and the region.

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1.0 INTRODUCTION

A Nuclear Energy Center (NEC) is a clustering of a large number of nuclear powered electric generating plants in a localized area where certain benefits of "togetherness" may be realized. The concept of a NEC has been proposed as an option for meeting future energy demands while mitigating some of the potential problems involved in nuclear power generation. The ERDA "Brief on a Cooperative Study of a Regional Nuclear Energy Center", November 1976, and the NRC study "Nuclear Energy Center Site Survey, 1975", (NECSS - 75), NUREG-0001, January 1976, have indicated that the NEC concept is technically feasible and that the major technical problems associated with the NEC concept, such as heat dissipation, are considered amenable to resolution.

The Department of Energy (DOE) is interested in further study of the NEC concept. The more difficult problems appear to be institutional in nature, and involve the areas of land and water use, the roles of various levels of government in planning and regulation, and the taxation and revenue distribution from the Center itself and its associated transmission facilities.

The State of Utah, with considerable reserves of both coal and uranium is considering its role as a possible energy supplier to other more populous states. In attempting to plan for future energy development, the State of Utah is interested in studying the concept of a NEC at Green River, Utah, and evaluating the social, institutional, economic and environmental impacts of such a center, without any precommitment to the implementation of a NEC within the state.

Utah is a sparsely populated state which is growing rapidly, and in which the internal demand for energy is expanding much faster than the national average. The projected electric power demand for the Utah Power and Light service area, however, would probably not be able to accomodate the 12,500 MW(e) proposed for a 10 unit NEC at the Green River site. Thus, if a NEC as large as this were built at Green River, it would imply that the State of Utah would become a major exporter of electrical power to the surrounding states, particularly California. Therefore, the State wishes to investigate the impacts of 12,500 MW(e) of nuclear generating capacity and evaluate these impacts which may result from the development of a NEC in Utah.

The Department of Energy has proposed that nuclear energy centers consisting of a cluster of large scale nuclear powered electrical generating plants in close proximity to one another, merit analysis as an option in future nuclear energy development. The issue of merit of the nuclear energy center concept, or indeed, of nuclear power itself is one which is of importance to the nation and will be studied on the national level. The purpose of this study will be to objectively analyze the potential impacts of a Nuclear Energy Center in Utah, and produce answers to basic questions dealing with costs and benefits incurred and received within the State of Utah and the region which may be served by a NEC. The purpose of this report is to describe the results of the preliminary planning phase of the study which has identified issues, assessed constraints, and determined a proposed approach.

1.1 BACKGROUND - UTAH STUDY

As a follow-up study to NECSS-75, DOE, through the Western Interstate Nuclear Board (WINB, now the Western Interstate Energy Board, WIEB) contracted with Dames & Moore, Inc. to perform a rough screening of the eleven western states to identify possible NEC sites. This study resulted in the report "Preliminary Assessment of Nuclear Energy Centers and Energy Systems Complexes in the Western U.S.", ORNL/Sub. 7272/1, February 1978, which named Green River Utah, along with seven other locations in the west as potential NEC sites. This study was based on ten siting issues or criteria for the analysis of site locations. The issues of primary importance were population density, land and water availability, seismic design, and transmission. The report was circulated to all the western states along with a request for expressions of interest in further site specific studies from any state containing favorably identified sites. Governor Scott Matheson of Utah, at the prompting of his energy advisory group, the Energy Conservation and Development Council, responded with a favorable expression of interest. Further discussions with officials of DOE and WINB led to the decision of the Energy Conservation and Development Council to pursue the study through its staff organization, the Utah Energy Office. Governor Matheson withheld final approval of this action pending the results of a public hearing at the prime site for the study, Green River, Utah. The citizens attending the meeting overwhelmingly approved such a study with the qualification that the local citizens be kept informed and involved in the process through an ongoing program of public participation such as a local citizens advisory board. This was in keeping with Governor Matheson's objectives and the goals expressed by officials of DOE. Upon receiving the results of this hearing,

the Energy Conservation and Development Council passed a resolution supporting the study of the impacts of a Nuclear Energy Center at Green River, Utah to be performed by the State of Utah under the direction and management of the Council, by and through the Utah Energy Office staff. No commitment was made to the implementation of such a NEC by the Council or the State of Utah, the U.S. Department of Energy, or any other participant in the study.

1.2 OBJECTIVES.

The proposed study is designed to analyze the impacts of a Nuclear Energy Center and determine their effect on the State of Utah and also the surrounding states. The NEC must be consistent with all federal and state environmental standards and regulatory criteria as a precondition to further analysis. The study would provide the data base necessary to guide the Utah Energy Conservation and Development Council in developing a general state energy siting policy, and a specific policy on the Nuclear Energy Center. The study will be designed to answer the following key questions about the Nuclear Energy Center and its associated transmission requirements:

1. Identify and define the major features and technical design parameters such as the site location, number of plants, plant size and location, heat rejection technology, manpower requirements, water utilization, and transmission requirements which would determine the impacts of the Center.
2. Identify and define the environmental impacts of the Center and how they would affect the State and the practical licensibility of the Center.
3. Identify and define the socio-economic impacts of the Center and how they would affect the State and the regional service area compared to other energy development scenarios.
4. Identify and define the institutional impacts of the Center and how these impacts would affect both state and local governments.
5. Identify and define methods of mitigating the negative impacts with such a center.
6. Disseminate information obtained from the study to the public and obtain necessary feedback about the NEC concept.
7. Identify and define the impact of a NEC on other potential energy developments in the State.

8. Identify and define appropriate key local, state and regional issues which would most likely have the greatest effect on the development of a Nuclear Energy Center in Utah.

9. Identify and define the regional interfacing and cooperation which would be necessary for the development of a NEC in Utah.

10. Provide the necessary data base for the formulation of a state policy position on development of a NEC in Utah.

11. Provide DOE with additional information on the viability of the NEC concept as a siting option.

12. Provide additional information on the NEC in a situation where a large percent of the power would be exported from the state.

1.3 STUDY AREA

The primary proposed siting area for a NEC is that around Green River, Utah and in relative proximity to the Green River. The map on the following page outlines the study area and also that of the Paradox Basin waste disposal study area. These areas are both within the Colorado Plateau, a region rich in resources of uranium, coal, oil shale, oil impregnated sands, oil and natural gas. The terrain near Green River is desert range eroded with shallow canyons.

STATE OF UTAH

1.4 USE OF STUDY RESULTS

The information generated during the study will be utilized by the Utah Energy Conservation and Development Council to formulate policy recommendations and if appropriate, recommendations for legislation regarding the development of nuclear energy in Utah. The results of the study will also be useful to other states in the prospective service area and to the Department of Energy for future planning of the concept of Nuclear Energy Centers. Section 63-53-4 of the Utah Code requires that the State Energy Conservation and Development Council develop and recommend energy policy to the Governor and to the Legislature.

In addition to other policy development projects, the Energy Conservation and Development Council is in the process of preparing a state energy facility siting policy and a state policy on the exportation of electrical power. In order to facilitate development of an energy facility siting policy which is acceptable to the public, state government, federal government, and local government, the Energy Council has directed the Utah Energy Office to study the concept of a Nuclear Energy Center at Green River, Utah. The study will be managed by the staff of the Energy Office and will be carried out by state agencies and private subcontractors, with the invited cooperation of the Western Interstate Energy Board, Utah utilities, and the utilities and state agencies of adjoining states. The agencies and subcontractors responsible for study will report orally and in writing on a regular basis to the members of the Energy Council.

1.5 APPROACH

The study will address the principal issues of siting a Nuclear Energy Center in Utah and produce the data and methodologies required to aid in the formulation of state policy on such a NEC. Initial studies performed by a subcontractor will establish site location and general site design parameters which will serve as input to the impact analysis and policy formulation aspects of the study. The emphasis will be on Utah specific issues related to a NEC. Previous studies on nuclear reactor siting, NEC assessments, and nuclear reactor design will be used as part of the data base and will be supplemented by Utah specific data as required.

The project will be organized into three study elements. The first element will be devoted to siting methodology and the NEC design. The second element will include the data collection required for project assessment. The third element will include public dissemination of study findings, analysis of findings, and development of policy by the Utah Energy Conservation and Development Council and other state agencies.

(1) SITING METHODOLOGY AND NEC DESIGN:

A subcontractor has been engaged to help in the design of a detailed work plan for the screening and selection of a site, the description of a representative site layout, and the compilation of the specific technical parameters which will influence off-site impacts. This effort is being aided and overseen by an Advisory Committee consisting of members of the Energy Council, private citizens, and representatives of utility, government, and environmental interests.

(2) DATA COLLECTION

The Utah Energy Office is in the process of identifying potential subcontractors for the implementation of the various study tasks described in sections to follow. These subcontractors will for the most part, be familiar with the area and have special expertise within the state or the region. This data collection will serve as input to the assessment and policy making phase to follow.

(3) ANALYSIS OF FINDINGS AND POLICY DEVELOPMENT

The State of Utah has given prime responsibility to the Utah Energy Conservation and Development Council to prepare, for gubernatorial and legislative review, policy positions relating to the desirability or undesirability of a nuclear energy center development within the state.

Section 63-53-4 of the Utah Code requires that the State Energy Conservation and Development Council develop and recommend energy policy to the Governor and to the Legislature. In addition to other ongoing policy development projects, the Energy Conservation and Development Council is charged with the preparation of a state energy facility siting policy and an exportation policy specifically concerning coal resources and electricity. This decision-making process will dovetail with the nuclear energy study.

In order to facilitate development of an energy facility siting policy which is acceptable to the public, state government, federal government, and local government the Energy Council has created a Task Force on Energy Facility Siting. The task force is composed of all members of the Energy Council, seven local government officials representing each of the state's seven multi-county association of governments, five state department heads, a representative appointed by the

Secretary of Interior, and the top official within Utah from the Bureau of Land Management, Forest Service, National Park Service, and the Bureau of Reclamation. Since September 1977, the task force has met on a regular basis to prequalify potential energy facility sites in order to expedite the siting of facilities in areas tentatively found to be environmentally, socially, and legally acceptable, thus avoiding some of the undue delays and public conflicts over development issues. It is expected that the Energy Council will be called upon to perform a similar prequalification assessment of the Green River study site.

The State of Utah will not independently decide the fate of the Green River nuclear center regardless of its eventual enthusiasm for or antipathy against the center. A complex set of decisions made by and advocacies advanced by the state, federal and local governments, and a variety of private interests and utilities will eventually determine whether or not the nuclear center is implemented. In order for the state to be as effective as possible in advocating whatever position it arrives at on the center, it will be necessary to understand the entire decision-making process for its implementation. Consequently, a component of the study will be the delineation of the decisions which must be made prior to implementation of the center and by whom they must be made. The Energy Council can then identify the decisions and strategies that should be developed to most effectively promote its own interests.

An important element of the study, though not listed as a study task, is the dissemination of information and results of the study to the public and obtaining a feedback of opinions and concerns. This will be managed by the Utah Energy Office throughout the study period.

Every effort will be made to maintain open communication with the public and to monitor the results of that communication. A "before and after" consensus taken by a professional polling organization is being considered.

The study manager will interact closely with a number of state, local and federal agencies. Draft information reports will be submitted to the Southeastern Utah Association of Governments who will be requested to review and comment on each report. Draft reports on impact evaluations will be submitted to interested state and local agencies responsible for wildlife, land, water and resource management.

Where appropriate, federal and state agencies will be requested to prepare analysis and policy position papers covering their area of responsibility. For example, the National Parks Service will be provided a draft of the demographic report and requested to evaluate the effect of that population upon use patterns of Arches National Monument, Canyonlands, Capitol Reef and other national parks, monuments, or recreation areas in Southeastern Utah. In the same manner the state or district BLM office will be asked to perform an evaluation of the relationships between their land management responsibilities, goals, programs, and plans and the construction of a nuclear energy center on which is now federally administered land.

Part of the study's interaction with other agencies will be a pre-qualification procedure.

The prequalification process will be initiated by identifying governmental agencies having authority to issue the permits, rights of way and other approvals necessary for the development of a nuclear power plant.

Appropriate draft reports will be submitted to the agencies for review, and an opportunity will be offered for these governmental agencies to request additional information or clarification where the data is not sufficiently detailed or is unclear. The agencies will be requested to indicate potential problem areas, or areas of conflict. Finally, each agency will be requested to state an opinion on whether or not the proposed site will or will not likely be approved relative to the agency's authority when later subjected to the full regulatory requirements of that government agency. A prequalification response may not be obtainable from all agencies but sufficient opinions about the site should be generated to indicate if any major institutional or regulatory problems exist.

Due to the large size (12,500 MW) of the proposed NEC, there will be significant regional problems to be addressed. Preliminary contacts have been made with the California Energy Office, the Nevada Department of Energy, the Western Systems Coordinating Council, and the Western Interstate Energy Board, as well as several utilities and cooperative power associations in the region. The study will involve a significant commitment to the determination of regional institutional, organizational, or environmental impediments to the development of a NEC in Utah.

1.6 STUDY PROCEDURES

James M. Byrne from the Utah Energy Office will serve as the manager of the study. The manager's role will require active participation in the study and not merely occasional assessment of progress. The manager will coordinate the efforts of federal, state and local agencies, research personnel at local universities and subcontractors involved in the study.

Funds will be administered by the Utah Energy Office. Most decisions including the selection of subcontractors, the obligating of funds, and the scheduling of work and expenditures will be made by the Energy Office.

A request for proposal has been prepared by the Energy Office and a subcontractor identified to aid in the development of a detailed work statement to outline the study. The Advisory Committee will review this work statement with the subcontractor and the study manager and approve the approach before study operations begin.

It is anticipated that the subcontractor will be retained to provide technical management assistance for the study. As data needs are prescribed by the subcontractor or the Energy Office, federal, state and local agencies, education institutions and in some cases other subcontractors will be used to provide data for input to the study. The subcontractor will provide technical direction to all agencies and subcontractors collecting data to assure that the data are applicable to standards, rules and regulations put forth by NRC and EPA for the siting of nuclear power plants. The subcontractor consultant will also work with the Energy Office, agencies and other subcontractors to interpolate and extrapolate data where necessary. The subcontractor will be required to provide written and oral progress reports to the Advisory Committee as it monitors the process and to the Utah Energy Council.

1.7 STUDY TASKS

The following study tasks will be carried out in order to determine the impacts of a Nuclear Energy Center in Utah and facilitate future energy siting policy and planning. It is recognized that many facets of these study tasks are interrelated. Overall correlation of these tasks will be accomplished by the Utah Energy Office, its technical management assistance subcontractor and the Advisory Committee for the study. On each of these study tasks, available literature has been researched to avoid duplication of effort and make optimal use of available resources. In some cases, review of existing data with application to Utah will be all that is required, while in other cases new data and methodology will be necessary to adequately address particular issues.

2.0 SITE LOCATION & DESIGN

The purpose of this study is not to design a Nuclear Energy Center near Green River, Utah, but rather to assess the effects on the State and the region if such a center were to be designed, constructed, licensed, and operated. In order to determine these effects, however, a logical assessment of probable design parameters must be made in order to define the scope of the impacts of a NEC. The purpose of this section of the study is to describe a possible generic design of a NEC, define its probable inputs and outputs, and deliver to the following sections, a data base for impact assessment and policy formulation.

2.1 SITE LOCATION

The preliminary screening study conducted by Dames & Moore for the Western Interstate Energy Board and the Department of Energy has identified Green River, Utah as a potential site for a Nuclear Energy Center. This was based on a very rough screening of the eleven western states and on Green River being nominated by the State of Utah as a potential site. A further site screening should be done based on seismic, geotechnic, and population considerations, and on land and water availability. This will be done to determine a representative site for further studies addressing the impacts of the NEC. This screening will also identify possible alternate sites within Utah.

First, a review of the available geologic and seismologic literature of the region will be carried out with a cursory review of remote-sensing imagery and a brief aerial or ground field reconnaissance. Emphasis will be placed on identifying subregions that: (1) contain extensive well-stratified formations of at least early quaternary or pliocene age, (2) are relatively free of lineations implying recent fault movement, (3) have experienced relatively few small earthquakes, and (4) are at least thirty miles from potential sources of large earthquakes. Population and land and water availability will also be considered in identifying subregions of interest for site location. Several subregions will be identified, and further screening will take place based on a thorough analysis of imagery and reconnaissance geologic mapping, to identify representative sites of approximately twenty-five square miles.

The output of this screening will be to come up with a prime site and at least one potential alternative site in which there is a fair level of confidence that they are feasible from a geologic, seismic, and foundation engineering viewpoint.

The majority of land in the Green River area is federal land administered by the Bureau of Land Management with interspersed sections of state owned land. Land requirements will be determined and the land acquisition constraints and methodology will be assessed by working with the BLM and with the State Land Board. Any problems with land acquisition will be identified and possible mitigations assessed.

A detailed analysis of the Dames and Moore study, "Preliminary Assessment of Nuclear Energy Centers and Energy Systems Complexes in the Western - U.S.". (ORNL/Sub-7272/1) has been made and discussed with the Advisory Committee for the NEC study and with personnel from the Utah Geological and Mineral Survey, the Utah Division of Water Resources, various other state agencies, and the Utah Consortium for Energy Research and Education (UCERE), which is performing the "Utah/Great Basin Energy Facility Siting Study". The Dames and Moore study was a rough screening of the eleven western states from which Green River, Utah emerged as a one of eight possible NEC sites. This screening study was comprehensive for the scale of that project and it nominated potential areas based on data pertinent to that scale. While this study showed that the Green River area might contain a favorable site it is felt that in order to justify this assessment to Utah State Government Agencies, the Governor, the Legislature and to the people of Utah, a rough screening of the state should be made to identify possible alternates to the Green River area, or indeed, to determine if Green River would be the only possible site. This study could be done in conjunction with the UCERE which is already screening the western part of the state. Seismic considerations and water availability would, of course, be central to the screening. A parallel study of the cooling water needs for such

a center would be input to this screening process. If evaporative cooling was used exclusively, the approximately 200,000 acre feet of water per year required would probably limit the site exclusively to the Green River area. If, however, the technology advances in wet/dry cooling in recent years would allow for perhaps a 10% wet/90% dry cooling mix without undue economic penalty then other potential sites might be realized. Since the prime focus of the study is to be on the Green River area, this preliminary site screening would be carried out at a low level of effort in order to make available to the decision making process, the broad range of background information required.

The focus of the siting study will be to locate representative site and potential alternate to be used for impact and policy evaluation. This will be accomplished by a team of individuals from NUS Corporation, Fugro Incorporated, and the Utah Geological and Mineral Survey, with input from federal, state and local agencies. NRC and EPA siting criteria will be used along with state and local concerns. While site screening is a major part of any nuclear power plant development, it must be recognized that in this conceptual NEC study, neither the funds nor the necessity exist for an in-depth site analysis. The aim must be to identify a reasonable representative site, and an alternate site for comparison purposes, which do not contain obvious impediments to potential development.

2.2 GENERAL CENTER LAYOUT & DESIGN

In order to properly evaluate the impacts of a potential Nuclear Energy Center in Utah, the general conceptual layout must be designated and a multitude of technical parameters defined. This does not mean that a complete PSAR must be written and a reactor type selected, but rather that generic reactor parameters must be spelled out in some detail in order to facilitate the collection of data required for a variety of socio-economic and environmental impact studies. Among these requirements are radiological emissions and meteorology, safeguards and security requirements, cooling tower emission, heat island effect, and weather modification, average and peak manpower requirements during construction and operation, and site specific construction details and problems. In addition, the possibility of modified or advanced construction techniques as a result of the clustering of these nuclear generating plants should be addressed. An effort will be made to identify any non-linear costs or benefits to be realized by clustered versus dispersed reactor siting.

Once a site location has been established a rough conceptual layout of the site can be defined. This would include general location of nuclear reactor power plants, fuel storage areas, radioactive waste storage and/or disposal areas, water storage and processing areas, and cooling tower placement. With this general layout, an assessment will be made, based on existing literature and known operating condition, of the waste heat produced, radiological emissions expected, visual impacts, and on site transportation requirements. The average and peak manpower requirements will be determined for construction and operation of the facility. A central service area would be defined

which would provide construction and operation services to the various reactor locations.

Again, this would be a low level of effort conceptual design to serve as input to other sections of the study. The input data required will be obtained from the rather ample existing literature available on these subjects. Detailed planning for the site layout and conceptual design is being pursued.

2.3 SITE SPECIFIC TRANSPORTATION

The construction of nuclear powered electric generating plants requires the transportation of large equipment, supplies, and pre-fabricated reactor parts. Green River Utah is served by both rail and interstate highway links. A study of the adequacy of this transportation system to such heavy equipment as reactor steam generators, and whether reactor pressure vessels could be prefabricated and brought in, or would have to be fabricated on site, is an important element. Also, the transportation requirements in the fuel cycle and waste storage or disposal should be studied and potential problems identified.

The majority of nuclear reactors built in the United States to date have been located in coastal regions or on large waterways where barge transportation of prefabricated reactor pressure vessels was possible. These pressure vessels are too large for conventional rail or truck transportation. A few boiling water reactor (BWR) pressure vessels have been fabricated on site. Most BWR vessels and all PWR (pressurized water reactor) vessels have been prefabricated in large shops remote from the reactor site. The HTGR, with its concrete pressure vessel is fabricated on site. In a NEC where a relatively large number of pressure vessels would be needed at one site, on site fabrication and heat treatment becomes much more feasible. This issue will be studied only in as much as it might seriously affect the economic or technical viability of a NEC in Utah.

Any specific problems with the transportation of reactor fuel, spent fuel, or radioactive waste will be identified to determine transportation impacts.

2.4 WATER UTILIZATION

Utah is the second most arid state in the Union and therefore the issue of water utilization of a large nuclear energy complex is of paramount importance to the State. Water is probably the ultimate limit to growth in the development of energy resources in Utah. Therefore a key element in the study of a Nuclear Energy Center in Utah must be that of water storage, consumption, and utilization.

It is recognized that, physically there is sufficient water in the Green River to meet the cooling requirements for a 12,500 MW(e) NEC. However, in a water poor region such as Utah, any large use of water will preclude the development of other water uses in the future. A NEC of this capacity could use perhaps 200,000 acre feet or more of water per year with the use of wet cooling towers to reject waste heat. Cooling with a combination of wet/dry towers could cut this usage to as low as 10% of this amount. The issue of heat rejection technology and the technical and economic trade-offs will be addressed in considerable detail.

The design of wet/dry cooling towers has received considerable new attention in the last several years due to increased water usage and concern over future water supplies. Recent studies will be evaluated and the effect of new technologies such as ammonia cycles on the economics of wet/dry cooling will be determined in order to better evaluate the water requirements and trade-offs for the NEC.

The Green River has been proposed for inclusion into the Wild and Scenic River Act. Some structures on the river would be necessary to withdraw the river water to whatever pumps, pipes, canals, or delivery system is required for the NEC. Some impoundment whether on or

off stream, would also be required. An assessment of the probable design of these water delivery elements will be made in order to provide input to the study of possible conflicts with water use for the NEC.

Other questions regarding the acquisition of cooling water will be addressed in the environmental impacts section. What effect will this large quantity of water use have on the water quality of the already highly saline Colorado River? What will be the effect on water use for other industrial and energy development applications? Since these users can easily afford to buy out agricultural water rights, what will be the net effect on agricultural uses. What institutional difficulties can be expected to arise from the fact that much of the water storage on the Green River was developed with Federal funds under Congressional appropriations specifying agricultural use for the water? To what extent does this use of the Colorado River water conflict with other desired uses such as the Central Utah Project? What will be the effect on endangered species in the Colorado River System?

Planning meetings have been held with the Utah State Division of Water Resources and the Division of Water Rights to discuss the implementation of the water use sections of the study. The Division of Water Resources has submitted a work statement outlining a proposed scope of work and man hours required for a water availability/constraint analysis for major energy facilities on the Colorado River System.

2.5 WASTE HEAT UTILIZATION

The Nuclear Energy Center would produce up to 25,000 MW of waste heat which must be somehow utilized or rejected to the atmosphere. As the cost of energy is rapidly increasing and the availability of new energy sources is decreasing, it becomes increasingly prudent to investigate the possibility of co-located industries or agriculture which could make use of this tremendous energy waste.

The development of co-located industries or intensive agricultural or aquacultural endeavors large enough to effectively use 25,000 MW of heat would greatly affect the impact of a NEC. The manpower required for operation of such enterprises could exceed that of the center itself. Therefore, an assessment will be made of the probable economic potential for such developments, the possible mix of technologies involved, and the parameters such as manpower requirements etc., which would be necessary to determine the impacts to the area, region and State. In addition, the likelihood and impacts of industries which might locate in the area because of availability of electric power will be determined.

Discussions have been held with consultants and personnel of the Department of Mechanical Engineering at the University of Utah to determine possible approaches and allocation of funds to perform this task. It is probable that this will be done as a literature search and report by a graduate student in the Mechanical Engineering Dept. under the direction of a consultant in geothermal heat utilization.

2.6 RADIOLOGICAL EMISSIONS AND WASTE DISPOSAL

The radiological emissions from nuclear power plants are well controlled and heavily regulated. This results in radioactivity released by an operating nuclear power plant (1000 MW) actually contributing a very small percent of that received from natural background radiation, to the most exposed individual. The public perception of nuclear power plants, however, contains a large element of concern over radioactive emissions. Therefore, the radioactive emissions from a NEC will be assessed along with the meteorology at the site in order to determine radiation exposures to construction and operating personnel, and to the local population.

The issue of radioactive waste and spent fuel disposal will be addressed. The present moratorium on commercial reprocessing places this option for spent fuel management outside the scope of this study. Other spent fuel management options, including local and away from reactor storage, will be considered. A study being conducted by Battelle Memorial Institute is currently assessing the bedded salt formations in the Paradox Basin near Green River, as a possible waste/spent fuel storage medium. The results of this study will be reviewed for possible implication to waste storage for a Green River NEC.

Planning discussions have been held with personnel from the Utah State Bureau Radiation and Occupational Health and from Ford, Bacon & Davis Utah, Inc. concerning the development of this section of the study. Increased emphasis has been placed on this section due to the increased public concern in Utah brought on by the recent controversy regarding radioactive fallout from nuclear weapons testing at the Nevada Test Site.

3.0 DEMAND, LOADCENTERS, AND TRANSMISSION

The projection of electric energy demand for Utah, the Intermountain Region, and the California market is necessary to determine the need for a NEC in Utah and to identify the potential loadcenters for the power produced. A general description of the transmission network design for the distribution of their power is required in order to assess the impacts on the State and the region of a NEC.

3.1 POWER DEMAND AND NEED FOR A NEC

Power demand projection for Utah and for the western region will be obtained and analyzed for the period of 1995 to 2015. Existing demand projection data from Utah Power & Light Co., and the Western States Coordinating Council will be taken as a base case. In addition, potential reductions in projected demand through future developments in conservation or alternative energy supplies will be studied. This data will serve as input to determine the potential market for the power and the need for a NEC.

In conjunction with a project being performed by the Utah Consortium for Energy Research and Education, an investigation will be made of the demand projections for Utah, the Intermountain Region, and the California market areas. This data will come from utility company projections based on increases in population, new industries, and increased per capita energy demand. This project will be carried out in order to determine the possible need for a NEC in Utah and to identify the markets for the power generated by a NEC.

For the capacity level considered, 12,500 MW, it will be necessary to identify the regional load centers to which the energy is to be delivered and to project the levels of demand in each of these and the portion of that demand to be satisfied by the Green River nuclear cluster. Methodologies for independently projecting future

electricity demands are presently under development. It is fair to say that none presently available are entirely satisfactory. The difficulty derives from the facts that electrical energy is utilized in many different residential, industrial, and commercial applications and that in each of these the quantity of electricity demanded depends not only on the total level of activity in each application, but also on the unit price at which electricity can be delivered. Alternative energy sources can be substituted for electricity and in many industrial applications non-energy inputs can be substituted within limits for energy inputs of any sort. A careful attempt to incorporate these considerations--the price elasticity of demand for electricity--must be incorporated in both total energy demand projections and projections of the portion of total demand which is likely to be satisfied from any Green River nuclear center configuration.

This task is still further complicated by the general problem of uncertainty concerning future technological developments in both the production and consumption of energy and of electricity in particular. It is entirely plausible that presently unforeseen technological developments could so markedly alter either the supply or demand conditions in the electrical energy market that the most careful projections will be rendered wholly inadequate. Scenarios including such developments should be considered for incorporation as Alternative Futures in the study.

3.2 POTENTIAL LOAD CENTERS

Previously cited criteria indicate that up to three-fourths of the electric power generated by a NEC in Utah might be used outside of the State. Preliminary assessments have been made for the potential load-centers for this power with southern California emerging as the most likely consumer. Planning personnel at Pacific Gas & Electric, San Diego Gas & Electric, and five southern California municipals through their association with the Intermountain Power Project, have been contacted and preliminary discussions regarding the study assessment of load centers have been held. The NEC study will address these power use and load center issues without setting up any formal organization of power users from the conceptualized Nuclear Energy Center. Contacts have also been made with the Western Systems Coordinating Council regarding electrical demand forecasting and power wheeling problems and constraints. The Utah Consortium for Energy Research and Education (UCERE) is also addressing transmission concerns in their "Utah Great Basin Energy Facility Siting Study". Meetings have been held with the UCERE principals to determine interfaces and possibilities for pooled resources and shared responsibilities on some of the pertinent load center and distribution issues.

Another issue which will be addressed is the possible inability of certain load centers (localities, states, regions) to participate in the development of a NEC due to legal restrictions placed on it by its governing entity. (i.e. The possibility of California law prohibiting affiliation with nuclear power plants in or outside the state.)

3.3 TRANSMISSION

A key issue in the development of a Nuclear Energy Center in Utah, particularly since in all likelihood a majority of the power will be transmitted out of state, is the location and impact of the necessary transmission corridors, and a transmission system design. The most likely purchaser of NEC power would be Southern California. The most direct routes for transmission of power to Southern California lie through an area of National Parks and other areas of high scenic quality. The designation of potential power transmission corridors will become a very central issue in the feasibility of a Nuclear Energy Center in Utah. Potential routes and the environmental and archeological impacts of these routes must be studied and the potential problems identified. In addition, the issue of transmission reliability and the degree of transmission route redundancy required for the generation of this much power so remote from the regional load centers it serves, will be assessed.

The economic cost of this energy delivery system will be determined. Included as part of the cost of energy delivery analysis, but conveniently separable for analytical purposes, is the consideration of various questions relating to the transmission lines required to deliver Green River nuclear center electricity to market centers. It will be necessary to identify possible power line routes analyze transmission capacities, construction issues, transmission technology (a.c. vs. d.c. selection, line loss, etc.). The purposes here will be to investigate the cost implications of overcoming the spatial separation of market areas and the Green River nuclear center and to provide inputs into impact analysis of the construction and operation of the transmission lines.

Contacts have been made with the Nevada Department of Energy, the Bureau of Land Management and the Intermountain Power Project on transmission routes and probable geographic, institutional, environmental, and legal obstacles to transmission line development. Potential bottlenecks for transmission such as Clark County Nevada have been identified. Representatives of the Nevada DOE, the California Energy Commission, Utah Power and Light, Southern California Edison (Kaiparowitz), Los Angeles Department of Water and Power (IPP), Pacific Gas and Electric, and the Intermountain Consumer Power Association have agreed to participate in the transmission planning task. This may be handled as part of the Regional Planning and Impact section of the study.

4.0 IMPACTS ASSESSMENT

An assessment of the various impacts of a Nuclear Energy Center upon Utah and the other states in the region will be a major task of this study and will serve as the major input to the formulation of state policy on the NEC.

4.1 ECONOMIC/DEMOGRAPHIC IMPACT

The economic and demographic impacts of a Nuclear Energy Center would be large regardless of the location, but in a sparsely populated area such as Green River, Utah, the effects will be sharply magnified. An important study element, therefore, will be the development of a clear picture of the economic and demographic impacts on the Green River Area, the Grand, Emery, and Carbon County Region, and on the State of Utah, of the construction and operation of a large nuclear energy complex. Also the impacts to other areas of the state and the region from the construction of transmission lines should be addressed.

The major factors influencing the overall effect of the development include population, public services, employment, housing, per capita income and local tax base. Using economic impact modeling capabilities already developed in Utah, projections of total increments to population, employment, income, school age population, and demand for housing will be derived for each of the power plant configurations. Using this data as a base, population characteristics and distribution and subsequent governmental service demands will be forecast for both the long term (5 to 20 years) and the short term (one to five years).

Existing population is generally a good indicator of the capability of an area to absorb the impact of project-related population. Historically, serious problems have occurred when annual growth rates reach 5 percent or more for a period of years. Due to the lack of significant population centers within 50 miles of the project area and the large population impact, the possible need for a new town will be studied. The ability of the existing communities and municipalities to accommodate the population impacts will be assessed.

To produce answers to basic economic impact questions the study will identify the types and magnitudes of economic benefits to be derived from the nuclear energy center development and identify the recipients, both individuals and governments, of the benefits. A variety of economic costs will also result from such a development. The most significant costs will be to provide for public services including capital stocks such as sewer systems, streets, sidewalks, culinary water systems, and schools. Other public services, including recreation, public health services, police and fire protection, social services and governmental administration will also be required. An effort will be made to quantify service demands and develop a cash flow analysis and revenue comparison for each development configuration.

The focus of this analysis will be on questions relating to costs and benefits incurred and received within the State of Utah and especially within the substate area of the project itself.

A different type of economic disbenefits (primarily higher prices, taxes, competition for housing and public services, etc.) will be identified in order to assess the economic costs which the areas' indigenous population will be required to bear if the development project occurs.

Planning meetings have been held with personnel from the State Planning Coordinator's Office (SPCO) and the Bureau of Economic and Business Research (BEBR) of the University of Utah to determine sources of the necessary data base and available computer models for economic/demographic forecasting. The existing models for population growth, economic activity, and tax revenue generation which will most likely be used are the "Utah Process Economic and Demographic Impact Model" (UPED) and the "Utah Process Land Use and Tax Base Model" (UPLAND). These models are both available through the SPCO and the BEBR.

4.2 SOCIAL-CULTURAL IMPACT

The social-cultural impacts of the Nuclear Energy Center will also be large. The population base in the region is small and would provide very little of the necessary work force. Also the high level of technical skills required of both the construction work force and the operations personnel will require importation of workers from outside the region. A major development, such as the nuclear center can be expected to alter the social-cultural system through both its economic implications for the indigenous population and the influx of in-migrants from areas with different values, traditions, etc. The small number of residents which provide the social base can be expected to be greatly outnumbered by the influx of construction tradesmen and their families. The major impacts on the social and cultural fiber, and on traditions of the community will be identified as well as the impacts on the political structure.

The Energy Council will not attempt to determine if the social-cultural impacts are considered to be acceptable or not. Rather the study findings will be reported to the local and regional government agencies and to local residents. Public meetings in the impact area will be held in order for the local government agencies and residents to communicate their opinions about impacts which would occur if the center is developed. The Southeastern Utah Association of Governments will be able to assist in the process.

4.3 ENVIRONMENTAL IMPACT

With construction of a Nuclear Energy Center, the physical environment of the Green River area and of the State can be expected to experience impacts from two sources: (1) the construction and operation of the nuclear power plants, associated facilities, and transmission lines, and (2) the population increase and secondary economic activity associated with the construction and operation of the plants. Careful analysis of the physical impacts of both these sources on the area's air, land and water will be carried out. The output of the economic-demographic impact analysis will be incorporated as input into the analysis of the environmental impacts of the population increase and secondary economic activity.

The findings of the environmental analysis will be used to evaluate the probable effect of the nuclear energy center on the region's ecology and to assess the opportunity to mitigate those effects considered to be undesirable. The study will identify the likelihood of the nuclear plants to disrupt both terrestrial and aquatic ecosystems.

TERRESTRIAL AND AQUATIC ECOLOGY IMPACT

Special emphasis will be placed on foreseen impacts upon rare or threatened plants or animals, and their habitat. If endangered species are identified in the area, the study effort will include a preliminary assessment to determine if the site area is a critical habitat area for the identified species.

Public law provides that ecosystems in which threatened or endangered species exist be conserved. Regarding compliance with these laws, reservoirs, holding ponds, transmission corridors and storage and waste areas need to be evaluated along with the plant facilities. The study will sum the impacts

to indicate the cumulative environmental/biological effects which can be expected from the development of a nuclear energy center.

WATER QUALITY

The impacts of a nuclear energy center on both surface and ground water will be evaluated. Water quality will be considered in terms of discharge loads, thermal pollution, water withdrawal and return flow, and the effect upon salinity levels as they exist and are to be changed by expanded consumptive use of water for cooling purposes. The policy issues regarding utilization of Utah's scarce water resources for power plant cooling purposes are discussed in section 5.3. However, information in addition to water utilization trade-offs, specifically concerning the salinity of surface water systems in the Colorado River and the Green River is necessary before allocation of Colorado River Basin water for a nuclear power plant can be supported by policy makers in Utah.

In conjunction with a project being performed by the Utah Consortium for Energy Research and Education, an investigation will be made of the restrictions imposed for maintaining existing salt concentrations in river systems to determine if the effect of the nuclear center would violate those restrictions with or without expanding salt removal activities.

The groundwater analysis will be designed to determine if contamination of groundwater or surface water by waste ponds or run-off can be prevented or minimized to the state's satisfaction.

ATMOSPHERIC IMPACTS

An effort will be made to determine what impacts will accrue to the atmosphere. Of particular concern will be the heat release effect on the micro-climate and the emission of low level radioactive emissions into the air. The Utah Bureau of Environmental Health will determine if

the nuclear energy center complex will violate state or federal air quality standards.

Effects of airborne plant emissions include safety effects and ecological effects. Terrain, dispersion characteristics of the area and distance from population centers are likely to be the most important criteria for evaluation especially in the evaluation of the potential effect of any radioactivity release due to an accident or malfunction.

Safety related problems in the form of icing and fogging can occur from cooling tower plumes during cold weather. However, this effect generally occurs at distances less than .5 miles. Due to the large scale of a nuclear energy center, an assessment, however, will be made to determine potential fogging problems which may result in more distant locations.

ALTERNATIVE LAND USES

The environmental impact analysis will include review of land management plans developed or being prepared by federal and local governmental agencies to determine if those plans exclude or can accomodate a nuclear energy center and the activites and facilities necessarily associated with a nuclear energy center. Meetings will be held with representatives of any governmental agencies whose land management or zoning plans could be affected by the development of a nuclear energy center in the Green River area.

An inventory of all existing land properties and current uses will be developed. The basic purpose of the inventory will be to determine what existing economic or recreational activities must cease as well as what potential activities or development options in the immediate site vicinity will be lost as a result of nuclear power plant construction in the area.

In view of the strong opposition by the national environmental movement to similar projects in southern Utah (Kaiparowits, IPP-Salt Wash)

which contributed in no small measure to their demise, an analysis of the perceived remoteness or proximity of the Green River site to the National Parks and Monuments in Southern Utah by these organizations would be an important issue in determining the probability of dramatic nationwide opposition to the Nuclear Energy Center. Consequently, the study will evaluate the site in relationship to areas of potential concern to interest groups. Utah officials who will formulate a position regarding the desirability or undesirability of a nuclear energy center in Utah should be aware of the potential impact or relationship of a nuclear energy center upon other important resources or activities in the region. The study will identify and assess the potential impact or relationship of the three nuclear configurations in the Green River area with:

- Nationally or State Designated Historic Landmarks
- Wildlife Management Areas/Game Preserves
- National Parks, Monuments, and Recreation Areas
- Wild/Scenic/Recreational Riverways
- Proposed Wilderness Areas
- Recreational or Historic Trails
- Archeological Sites
- Areas Identified as Scientifically or Naturally Unique

The environmental investigation will also identify the effect of the nuclear energy center upon the aesthetics of the region. The investigation will determine from what areas, accessible to the public, will the nuclear energy center be visible. The concern is that no highway or road overlooks or other important vistas be destroyed or adversely affected by the plant itself or the cooling tower plumes. If such vistas are found to be affected the possibility of mitigation will be determined.

Compliance requirements of the Wild and Scenic Rivers Act, the National Park Service Enabling Act, the National Wilderness Preservation Act, the Historic Preservation Act, the National Trails Act, the Federal Land Policy Act and any other federal laws or regulations which may be applicable will be reviewed to ascertain relevant requirements. The potential for compliance or noncompliance of the nuclear plant configurations will then be ascertained.

4.4 INSTITUTIONAL IMPACTS

The study will develop an assessment of the ability of the local and regional governmental agencies and institutions to provide services, to regulate, and to otherwise anticipate, plan for, and guide the societal aspects of the NEC development. The issues of taxes, tax revenues, and the distribution of those revenues will be assessed. Possible imbalances in taxation burden and benefit receipt locally, statewide, and regionally will be determined as well as possible imbalances between the indigenous population and the in-migrants as a result of NEC development. The possible need for legislative action and tax law changes will be assessed.

The study will also focus on possible solutions or innovative arrangements to mitigate and minimize the institutional impacts of a NEC. The State of Utah has already addressed the issue of front end financing for energy related community impacts. The adequacy of existing State laws relating to this issue will be assessed.

Meetings have been held with representatives of the Utah Department of Community Affairs to determine existing efforts in planning for energy development impacts. The Governor's Tax Revision Committee is currently looking at the tax revenue and front end financing issues attached to energy development. Issues such as revenue distribution between counties which may receive substantial revenue from energy development but not substantial impacts and its neighboring counties which may receive little revenue and substantial impacts, are being studied for possible legislative requirements. The NEC study should be able to provide significant inputs to energy impact planning in Utah.

4.5 SAFETY/RADIOLOGICAL IMPACTS

An assessment will be made of the potential radiological hazards and radiological safety issues in order to determine the impacts on the area, region, and state. Radiological dose rates will be determined for each of the above classifications. Public dissemination of this information must be open and forthright.

The radiological effects from the nuclear generating plants and from any radioactive waste and spent fuel storage or disposal will be assessed. Radiological exposures to construction and operating personnel and to the general public will be determined and the potential health effects researched in order to assess the radiological impacts from operation of a NEC. Existing studies on the risks of potential accidents will be researched and the information disseminated to the public.

Public concern has recently been raised about the long term health effects of nuclear weapons testing and the associated fallout of radioactive materials in Utah during the period 1952 to 1963. Areas of southwestern Utah downwind from the Nevada test site are thought to have received substantial doses of radioactive fallout from which the long term health effects are still largely unknown. The publicity associated with the fallout issue has raised the public consciousness about radiological health issues and, therefore, the associated concerns about nuclear power plants, or radioactive waste disposal in Utah. Because of this recent increased concern, the radiological issues involved with the study of a NEC in Utah must receive very careful attention. The public must receive adequate information to allow them to understand the difference between radioactive fallout from nuclear weapons testing and the carefully controlled releases from nuclear power plants. Meetings have been

held with state radiological health personnel regarding the necessary data to be gathered and the methods of disseminating that data to the public. The concerns of people downwind of Green River in Colorado should also be addressed. It is felt that public interaction will be a very significant part of this study element.

4.6 TRANSPORTATION IMPACTS

Traffic patterns during both construction and operation may significantly disturb existing traffic flows or transportation networks in the southeast portion of Utah. The impacts which will be evaluated include time delays, congestion and safety problems. The transportation of materials and nuclear fuel is extremely important. An evaluation will be made to determine the possibility of railroad delivery for materials. The study will also assess the potential safety hazards associated with the nuclear fuel or spent fuel transportation which is expected to occur on Utah's highways.

The State Department of Transportation will assess the non-nuclear transportation impacts while the radiological impacts will be handled in Section 4.5.

4.7 TRANSMISSION IMPACTS

The transmission network which could reliably transmit 12,500 MW from the Green River area to distant load centers would have substantial impacts on the State of Utah and surrounding states. These impacts will effect the planning and policy decisions required for a NEC. For the most part these impacts will be handled within the individual sections of this study (i.e. environmental impacts, etc.), but an overview of transmission issues will be necessary to make sure that all elements of the transmission network (capacity, reliability, etc.) are covered.

The regional nature of the transmission network required for a NEC would also necessitate the evaluation of the institutional, legal, and regulatory aspects of this regional power wheeling. This will be carried out as part of the transmission impacts assessment, but has broader implications in terms of overall determination of NEC policy. Preliminary contacts within the region have been made to determine the necessary participants in an assessment of regional impacts and constraints. These would include, at a minimum, representatives of the Public Service Commissions and Energy Offices of Utah and the surrounding states, utilities, public power associations, the Western Systems Coordinating Council, and local Associations of Government.

5.0 POLICY ASSESSMENT

The overall purpose of the study is to provide an information and analysis base upon which the State of Utah can formulate and effectively articulate a position regarding the desirability or undesirability of a nuclear energy center development in Utah. The findings of the study will also be very useful in evaluating the merits of the notion of a nuclear energy center and will identify any major local, state, or regional obstacles which may exist for implementation of such a center.

To enable the state to determine the desirability or undesirability of a nuclear energy center a number of issues must be evaluated and policy positions on those issues developed. Some of these issues will be identified during the study but the most important issues which the study will be designed to address include:

1. Do the citizens of Utah, and surrounding states, perceive that a nuclear energy center poses health and safety threats, and if so, are they willing to accept the development of a NEC.
2. Are the residents of the Green River region willing to experience the cultural, sociological impacts which will be created by development of the center in order to obtain employment opportunities and other benefits which the center would produce.
3. Is the state willing to forego other potential developments which development of the center may preclude due to the inadequacy of the necessary resource base. The allocation of water, land resources, manpower, air resources and nuclear fuel are all important resources, the commitment of which could render the remaining resource in the region inadequate to sustain other potential activities or developments. Thus, a basic issue is

whether or not the state is willing to support allocation of these resources to a nuclear center development.

4. Are there other means of producing electricity which may provide better or more important benefits to the state or to the region.
5. Are Utah and adjacent states willing to accomodate the environmental impacts from such a center or is it willing to take the measures or commit the resource necessary to mitigate those impacts.
6. Are there regional problems involved in the wheeling of large amounts of electric power which will impact future policy decisions regarding a NEC.
7. Are there positive benefits of the NEC concept which outweigh any potential negative impacts in a reasonable analysis.

In order to make the above determinations, substantial data is necessary on the conceptual nuclear energy center configuration to be analyzed including the resource inputs which would have to be committed to the center and the environmental, economic, sociological and cultural impact which such a center will generate. Earlier sections of this study proposal more fully describe the data requirements, the policy issues requiring resolution and the decision-making process for policy determination. Following is a more detailed discussion of the process the study will pursue to resolve some of the issues not already discussed.

5.1 ECONOMIC VIABILITY

The nuclear power industry is beset with large uncertainties in the fuel cycle, in regulatory criteria, and in the storage or disposal of radioactive wastes. These uncertainties make it difficult to determine the future cost of nuclear power generation. Nevertheless, an attempt will be made to determine the cost of power generated from a NEC during the 1995 to 2015 period and compare it to the cost of dispersed nuclear plants and to the cost of coal fired power generation in Utah. The projected costs of nuclear power generation in dispersed reactor sites will be determined and any construction or operational cost savings realized by the Nuclear Energy Center, identified elsewhere in the study, will be applied. The cost of electric energy within the State of Utah and the western region is an important factor in the future growth of the state and the region and, therefore, an important element to serve as input to the policy development process.

5.2 POTENTIAL LICENSIBILITY

Recent difficulties and delays in the licensing of nuclear power plants raise the question of potential licensibility of a Nuclear Energy Center. What are the practical and political obstacles to licensibility? What will be the additional licensing liability or advantages acquired through the clustering of nuclear power plants in a Nuclear Energy Center? What are the Utah specific concerns or obstacles to licensing? A qualitative assessment of these problems will be attempted by reviewing them with federal licensing agencies such as NRC and EPA. There is a good probability that by the middle 1980's, when the licensing process for such a NEC would likely have to begin, many of the uncertainties in the licensing process will have been resolved one way or the other. At this point we can only attempt to assess, predict, or "crystal ball" the licensing conditions for a NEC and attempt to identify any particular licensing problems for a NEC or specifically a NEC in Utah.

5.3 WATER ALLOCATION POLICY

As with any enterprise, the development of a nuclear energy center can be successful only if the required productive inputs such as water, fuel and manpower are available in adequate quantities and at acceptable prices. The cost and availability of these inputs is largely determined by the market except that the availability of the required amount of water for the Nuclear Energy Center is primarily a political allocation issue.

It is recognized that, physically, there is sufficient water in the Green River area to meet the cooling requirements of a 12,500 megawatt nuclear energy center even with 100% water cooling configurations. However, the use of this resource, either through the allocation of presently unallocated water or through the marketing of rights to the use of currently appropriated water, will preclude other major developments in the region by rendering the remaining resource base inadequate for other potential developments.

A major component of the study will consist of an effort to determine the desirability from the State's point of view of this utilization of the water. An adequate effort will require a comparative analysis of the economic and societal benefits of the use of water for agriculture, for coal fired generating plants, nuclear electric generating plants, oil shale operations, coal gasification plants, urban use, and for other possible industrial uses. An effort will be made to have the State Board of Water Resources determine a desirable water allotment pattern among those major water uses.

Such a process will establish a policy base for the Governor and the State Engineer to determine if Utah is willing to allocate to the NEC the amounts of water required for its operation.

5.4 ALTERNATE TECHNOLOGY FOR ELECTRICITY GENERATION

Within the State of Utah there are presently seventy-three operational power plants with a total generating capacity of 2,286 megawatts. Of that capacity 1,652 megawatts are coal fired and 198 MW are hydro-electric. The remaining capacity is in peaking petroleum fired units and eight relatively old natural gas-fired generating plants.

Utah has approximately 23.4 billion tons of remaining identified coal reserves which is sufficient to produce all the electricity required in Utah for hundreds of years. However, there are factors which indicate that nuclear power generation may become preferable in the near future. The study will identify and evaluate these indicators. One of the most important factors will be economics of power generation. State government in Utah has an interest in maintaining low power rates for its citizens and the cost of building and operating nuclear reactors may become more economical in Utah than are coal fired power plants.

Coal fired power plants also have serious air pollution problems. This is very important in Utah because of the large number of Class I air sheds in the southern part of the state. The net advantages and disadvantages of additional sulfur dioxide, particulates, oxides and other coal combustion related air pollution versus the low radiation emissions from both types of plants will be evaluated.

Coal fired power plants use less water per kilowatt generated than do conventional nuclear power plants. In Utah water is a scarce and precious commodity. Thus the study will attempt to determine if there are appropriate reasons to allocate water for nuclear generating stations where the benefit of that water consumption appears to be greater in coal fired plants.

The question of fuel reliability will also be addressed. The coal strike of 1978 clearly illustrated the potential reliability problem when dependence on a single power plant fuel source exists. The study will research existing literature relevant to that issue to determine if a coal/nuclear fuel mix has clear advantages over a single fuel source and if so what is the most desirable mix. This will be assessed from both a state and regional point of view.

5.5 NEC POLICY

The net input from the impact assessments, public input, and the previously stated policy issues will facilitate the formulation of a policy on the development of a nuclear energy center in Utah. This effort will attempt to tie together all elements of the study in order to produce a logical conclusion.

The Utah Energy Conservation and Development Council will be involved throughout the study in reviewing project results, requesting information, and analyzing impacts of the NEC. The formulation of a policy on the NEC, therefore, will be an ongoing process of careful reviewing and interaction with the study participants rather than a "one shot" review and decision at the end of the study. The public input, based on careful dissemination of all study results, will be an important element in the final decision making process. Mechanisms for regional participation and review will also be incorporated into the study implementation. The study results and reports will be circulated to states in the western region through the Western Interstate Energy Board/WINB for review and comment.

Possible obstacles to the development of a NEC in Utah which may be identified by the study will be examined and potential means of mitigating these obstacles will be analyzed. If this examination reveals any "fatal flaws" they will be documented. The Energy Council will then make recommendations to the Governor and the Legislature for ultimate formulation of a state policy on the development of a nuclear energy center in Utah.

6.0 STUDY PLANNING

The planning of the study of a nuclear energy center in Utah will be a continuing process throughout the study, rather than a one shot "cast in concrete" approach. This report describes the results of the preliminary planning phase of the study which has identified issues, assessed constraints, and determined a proposed approach. This preliminary planning has been carried out by the staff of the Utah Energy Office with assistance and direction from the Advisory Committee for the NEC study. Overall direction of the study approach is provided by the Utah Energy Conservation and Development Council which is charged with energy policy development for the State of Utah. The Energy Office is presently engaged in the development of more detailed study work plans.

Conserted efforts have also been made to establish the interfaces for cooperation with the Utah Consortium for Energy Research and Education (UCERE) which is conducting the Utah/Great Basin Energy Facility Siting Study. The Utah Energy Office and the UCERE will be addressing many of the same issues in these two studies and a cooperative effort on certain study elements, such as siting criteria and socio-economic impacts will be of benefit to the end product of both endeavors. Some problems exist, due to the time lag between the two studies. The Great Basin study was started in September, 1978, while the NEC study is still in the planning phase. Increases in this time lag will make it more difficult to establish effective cooperation.

It is hoped that the preliminary planning effort will result in the implementation of a detailed study of a nuclear energy center in Utah.

6.1 PLANNING RESULTS - UTAH

The majority of impacts of the development of a NEC in Utah will be upon the State and the people of Utah, while the benefits may accrue to a much larger regional area. The planning for the NEC study has addressed both concerns. The Utah specific impact studies will be managed and performed, by and large, by Utah State agencies, local offices of the federal agencies, Utah universities, or by consultants who are familiar with the social, economic, and environmental conditions which exist within the State.

The Utah Energy Conservation and Development Council is the overseeing board for the NEC study. The Council will review major planning and study results. As a subcommittee to the Council, an advisory panel has been formed to closely follow the study development and assist in the formulation of approach. The membership of the panel consists of two members of the Energy Council, a representative of local government interests, a representative of Utah utilities, a technical representative from the University of Utah, an environmentalist, and a representative of the State Office of the Bureau of Land Management.

Other state agencies have been involved in the planning effort. Meetings have been held with personnel from the State Division of Water Resources and the Division of Water Rights to discuss the requirements for the water allocation and availability sections of the study. The Division of Water Resources has submitted a study plan and determination of man hours required to address these important water issues from a state perspective. The Division of Wildlife Resources has also performed an analysis of study requirements and has committed several regional personnel to the project. The State Department of Transportation will address the local transportation issues, but the important concerns of the transportation of heavy reactor components such as reactor

pressure vessels or steam generators will be allocated to a consultant more familiar with these specific transportation problems. The Utah Bureau of Air Quality and the Bureau of Radiation and Occupational Health will be involved in the plume modeling from the cooling towers and the evaluation of radiological emissions from a NEC. The Utah Geological and Mineral Survey will be involved in the seismic and siting work and has already begun a statewide seismic data gathering project in conjunction with Fugro Inc. The State Offices of the Bureau of Land Management and the National Park Service will also contribute to the pertinent study land use and recreation sections.

6.2 PLANNING RESULTS - REGIONAL

The regional impacts of a NEC will also be studied, and will require a regional perspective in their development. John Watson, Executive Director of the Western Interstate Energy Board (WIEB), has expressed interest in assisting with the regional aspects of the study such as transmission, load centers, state and federal legal considerations, and multi-state utility coordination. The WIEB will be requested at its next board meeting to approve the participation of the WIEB in the regional aspects of the Utah NEC study.

Numerous preliminary contacts have been made with various state agencies and utilities within the region to assess interest in participating in the study. Frank Hahn, Deputy Director of the California Energy Commission stated that his office would have to await the completion of their current electrical demand study (due in about two months) to assess their interest in or commitment to the study. Noel Clark, Director of the Nevada Department of Energy, has expressed interest in being involved in the transmission and load center assessment segments of the study. The Nevada DOE is also interested in the energy park concept in their own state. Of special interest in the load center and transmission aspects of the study are Southern California Edison (SCE) and the Los Angeles Department of Water and Power (LADWAP). SCE was heavily involved in the development of the now canceled Kaiparowitz coal fired power plant and LADWAP is the largest partner and technical manager of the 3000 MW(e) coal fired Intermountain Power Project in Utah. Both of these projects have important impacts on the transmission studies for a NEC in Utah. Discussion with Dave Smith, Chief of Generation Planning at SCE indicated interest in participating in the Utah NEC study in a planning and data resource capacity. The Kaiparowitz transmission studies would be of use to the NEC project.

Contacts were also made with Robert C. Burt, Assistant Chief Engineer, Design and Construction Division, who is in charge of nuclear projects at LADWAP. Mr. Burt indicated that LADWAP would be interested in the study of a NEC in the 1995 to 2015 time frame and also that they would be quite willing to share transmission studies that have been done recently (and are continuing) for the Intermountain Power Project (IPP). The Salt Wash site for the IPP is quite close to Green River, Utah and much of the transmission corridor data would be directly applicable to a Green River NEC. The potential involvement of these and other utilities in any eventual development at Green River would be addressed during the course of the study. The Western System Coordinating Council (WSCC) has been contacted for electrical demand projections. Dennis E. Eyre, Administrative Manager of WSCC, has expressed willingness to provide data and advice for the study, but would have to get approval from his governing board for official participation in the study. The Intermountain Consumer Power Association is concerned about possible electric power supplies for 1995 and beyond. Joseph C. Fackrell, Executive Director of ICPA, would like to be involved in any regional demand assessments and in any planning for potential developers and consumers of the power from a NEC.

It is anticipated that working through the Western Interstate Energy Board a task force of state, federal, utility, and citizen interests would be formed to assist in the assessment of the regional impacts of, and constraints to the potential development of a NEC in Utah.